

Stomatološki vjesnik

Stomatological review



Stomatološki vjesnik 2026; 15 (1)

STOMATOLOŠKI VJESNIK / STOMATOLOGICAL REVIEW

ISSN 2233-1794 (online) UDK 616.31

Izdavač / Publisher:

Stomatološki fakultet sa Klinikama Univerziteta u Sarajevu / Faculty of Dentistry with Clinics, University of Sarajevo
Udruženje stomatologa u Federaciji BiH/ Association of Dentists in the Federation of BiH

ČLANOVI UREĐIVAČKOG ODBORA / EDITORIAL BOARD:

Glavni urednik / Editor in chief: Mirjana Gojkov Vukelić

Sekretar uređivačkog odbora / Secretary of editorial board: Selma Zukić

Članovi / Members: Nina Marković, Mediha Selimović Dragaš, Selma Zukić, Vildana Džemidžić, Sanela Strujić Porović, Alma Konjodžić, Sanja Hadžić, Sadeta Šečić, Sedin Kobašlija, Verica Pavlić, Nikola Stojanović.

MEĐUNARODNI UREĐIVAČKI ODBOR / INTERNATIONAL EDITORIAL BOARD: Anwar Barakat Bataineh (Irbid, Jordan), Jasenka Živko-Babić (Zagreb, Hrvatska), Andrija Petar Bošnjak (Rijeka, Hrvatska), Hrvoje Brkić (Zagreb, Hrvatska), Dolores Biočina Lukenda (Split, Hrvatska), Davor Katanec (Zagreb, Hrvatska), Šahza Hatibović Koffman (London Ontario Kanada), Mladen Kuftinec (USA), Darko Macan (Zagreb, Hrvatska), Berislav Perić (Zagreb, Hrvatska), Tore Solheim (Oslo, Norveška), Dragoslav Stamenković (Beograd, Srbija), Marin Vodanović (Zagreb, Hrvatska), Dobrila Lazareva (Skoplje, Makedonija)

Lektor za engleski jezik / English language editor: Nermana Bičakčić

Tehničko uređenje / Technical editor: prof. dr. sci. Elmedin Bajrić

Dizajn naslovnice / Cover page design: Lana Malić

KONTAKT / CONTACT:

Stomatološki vjesnik
Stomatološki fakultet sa klinikama
Bolnička 4a, 71000 Sarajevo
Bosna i Hercegovina

Telefon: + 387(33)443269
e-mail: glavni_urednik@stomatoloskivjesnik.ba
Web: www.stomatoloskivjesnik.ba

TRANSAKCIJSKI RACUN / TRANSFER ACCOUNT:

33386902296551066 UniCredit Bank dd

Printed on acid free paper



Svrha i cilj:

Stomatološki vjesnik je neprofitni naučno-stručni časopis koji publicira originalne naučne radove, prikaze slučajeva, pisma uredniku, savremene perspektive, editorijale, preliminarne komunikacije u oblasti stomatologije i drugih biomedicinskih nauka. Radovi su na engleskom jeziku. Radovi se mogu koristiti u edukacijske svrhe bez predhodnog odobrenja, a uz obavezno navođenje izvora. Korištenje cijelih ili dijelova članaka u komercijalne svrhe nije dozvoljeno bez predhodnog pismenog odobrenja izdavača.

Časopis je "open access", što znači da je kompletan sadržaj dostupan bez posebnog plaćanja svim korisnicima ili njihovim institucijama. Korisnicima je dozvoljeno da čitaju, preuzimaju, kopiraju, ispisuju, pretražuju ili povezuju cijele tekstove članaka objavljenih u časopisu bez traženja prethodne saglasnosti izdavača. Autorska prava posjeduje izdavač.

Aim and Scope:

Stomatološki vjesnik / Stomatological review is a non-profit scientific journal that publishes original articles, case reports, letters to the editors, current perspectives, editorials, fast-track articles in a field of dentistry and other bio-medical sciences. Papers are in English. All manuscripts undergo the peer review process before can be accepted for publishing in Stomatološki vjesnik/ Stomatological review. Papers can be used for educational purposes without prior consent only with adequate citation of the sources. Using whole or parts of articles for commercial purposes is not permitted without prior written permission of the publisher.

This is an open access journal which means that all content is freely available without charge to the user or his/her institution. Users are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles in this journal without asking prior permission from the publisher or the author. This is in accordance with the BOAI definition of open access. Copyright owns the publisher.

Časopis Stomatološki vjesnik je oslobođen poreza na promet prema mišljenju Federalnog ministarstva obrazovanja, nauke, kulture i sporta br: 04-15-661/2002.

Journal Stomatological review is tax exempt according to the opinion of the Federal Ministry of Education Science Culture and Sports no: 04-15-661/2002.

Indexed in: ICV 2021 = 72.91 ICV 2022 = 77.14 (Index Copernicus International), DOAJ (Directory of Open Access Journal), EZB (Elektronische Zeitschriftenbibliothek), SJIF (Scientific Journal Impact Factor Value 7.669)

Stomatološki vjesnik

CONTENTS

ORIGINAL SCIENTIFIC ARTICLES

PROFESSIONAL CHALLENGES FOR DENTISTS: PATIENT COMPLAINTS AND LEGAL SECURITY

Vedran Jakupović, Zerina Sačak Memišević, Amer Ovčina 2

PATIENTS' ATTITUDES, EXPERIENCES AND AWARENESS REGARDING ENDODONTIC THERAPY

Mirna Pašić, Alma Konjhodžić, Madžida Halilović Mehinović,
Adna Begović, Aida Džanković, Samra Korać, Irmina Tahmiščija 12

PREDICTING OCCLUSAL VERTICAL DIMENSION USING FACIAL ANTHROPOMETRY: DEVELOPMENT OF POPULATION-SPECIFIC REGRESSION MODELS

Lejla Berhamović, Emir Berhamović, Alma Kamber, Amela Đonlagić, Alma Gavranović-Glamoč..... 21

ASSOCIATION BETWEEN TEMPOROMANDIBULAR DYSFUNCTION AND PARAFUNCTIONAL ORAL HABITS IN STUDENTS

Una Šehović, Amela Đonlagić, Alma Kamber, Lejla Berhamović, Emir Berhamović, Sanela Strujić-Porović..... 33

ASSOCIATION BETWEEN THE THREE-DIMENSIONAL INDEX AND PANORAMIC ANGULAR PARAMETERS (α AND θ ANGLES) IN IMPACTED MAXILLARY CANINES

Azra Jelesković, Vildana Džemidžić, Alisa Tiro, Maida Mehadžić,
Tamara Topalović Starović, Lejla Redžepagić Vražalica..... 41

REVIEW ARTICLES

ORAL MANIFESTATIONS OF NICOTINE POUCH USE: CURRENT KNOWLEDGE

Tijana Adamović, Verica Pavlić, Valentina Veselinović, Nataša Trtić, Ognjenka Janković, Adriana Arbutina,
Irena Kuzmanović Radman, Renata Josipović, Jana Ilić, Jovana Lovrić, Mirjana Gojkov Vukelić 48

THE IMPORTANCE OF IMPLEMENTING IMMUNOHISTOCHEMICAL METHODS IN THE DIFFERENTIAL DIAGNOSIS OF ODONTOGENIC KERATOCYST AND AMELOBLASTOMA

Anela Hardaga-Muzurović, Amina Vejselović..... 57

PROFESSIONAL PAPER

INFLUENCE OF SNUS ON THE ORAL MUCOSA OF CHILDREN

Šejla Pošković, Hanela Gojak..... 63

ABSTRACTS

10th DENTAL CONGRESS OF BOSNIA AND HERZEGOVINA WITH INTERNATIONAL PARTICIPATION

- May 2026, Mostar, Bosnia and Herzegovina 66

INVITED LECTURES 66

ORAL PRESENTATIONS 82

POSTER PRESENTATIONS 108

INSTRUCTIONS FOR THE AUTHORS 125

PROFESSIONAL CHALLENGES FOR DENTISTS: PATIENT COMPLAINTS AND LEGAL SECURITY

Vedran Jakupović^{*1}, Zerina Sačak Memišević², Amer Ovčina¹

¹Department of Community Healthcare, Faculty of Health Studies, University of Sarajevo, 71000 Sarajevo, Bosnia and Herzegovina

²Department of Orthodontics, Faculty of Dentistry with Dental Clinical Center, University of Sarajevo, 71000 Sarajevo, Bosnia and Herzegovina

*Corresponding author

Vedran Jakupović, PhD
Department of Community Healthcare,
Faculty of Health Studies,
University of Sarajevo
71000 Sarajevo, Bosnia and Herzegovina
E-mail:
vedranjakupovic@gmail.com

DOI 10.69559/issn.2233-1794.2026.15.1.1

ABSTRACT

The aim of this study was to assess the frequency of patient complaints, and dentists' perceptions of legal protection in Bosnia and Herzegovina. A total of 171 dentists participated, employed in both the public (21.5%) and private sector (78.5%), with varying years of professional experience. Data were collected using an anonymous structured questionnaire addressing record-keeping practices, the use of informed consent, experiences with complaints and lawsuits, and perceptions of legal security and exposure to violence.

Results show that 80.4% of dentists report maintaining proper documentation, while only 16.8% routinely obtain written informed consent. Negative experiences with patient complaints were reported by 60.7% of respondents, yet only 7.5% had been involved in legal proceedings. Most conflicts (61.7%) were resolved informally through settlement. The highest proportion of complaints concerned prosthodontics (71%), followed by restorative dentistry (15%) and oral surgery (9.3%).

More than half of dentists (56.1%) do not feel adequately protected by law, and 69.2% do not know which institution to contact in the event of a patient lawsuit. Verbal violence was reported by 66.4% and physical violence by 1.9% of respondents. Multivariate analysis showed that dentists exposed to violence were significantly less likely to feel legally protected (OR = 9.62, $p = 0.031$), independent of gender and years of experience.

Dentists in the private sector were more likely to resolve complaints through settlement (OR = 1.65, $p < 0.001$), while prosthodontists experienced the highest number of complaints and exhibited the strongest preference for settlements (OR = 2.63, $p = 0.03$).

Keywords: Dentistry, Patient complaints, Legal protection, Informed consent.

Introduction

Healthcare has traditionally been considered one of the noblest professions, as it inherently carries responsibility for the health, well-being, and dignity of individuals. Dentistry, as an integral part of the healthcare system, has experienced significant development in recent decades—not only in terms of technical innovations, new materials, and technologies, but also through the gradual establishment of ethical and legal standards that define the boundaries and responsibilities of professional practice. The modern dentist is no longer merely a clinician addressing oral health issues, but also a professional operating within clearly defined moral and legal obligations [1,2].

In daily practice, a dentist's focus is usually on the patient's needs, the successful execution of therapeutic procedures, and achieving functional and aesthetic outcomes. However, in this dedication to the patient, the legal aspects of practice may sometimes be overlooked—until situations arise that require reference to legal provisions. It is in these instances that insufficient knowledge of the legal framework can lead to serious consequences, both professional and personal [3-5].

Every dental procedure carries a certain degree of risk, and the outcome of treatment largely depends on the dentist's expertise, experience, and judgment. When complications, patient dissatisfaction, or adverse outcomes occur, the dentist may face allegations of professional error or negligence. Therefore, a thorough understanding of medico-legal aspects—including informed consent, proper medical documentation, data confidentiality, and adherence to professional boundaries—is an essential component of responsible practice.

Law and ethics constitute inseparable elements of professional responsibility. While legal regulations establish formal boundaries and sanctions, ethics guide behavior through moral values, integrity, and respect for human dignity. Fundamental principles include respect for patient autonomy, beneficence, non-maleficence, and justice [6].

The modern healthcare context, characterized by commercialization, rapid technological advancement, and increasing patient awareness of their rights, further complicates the traditional doctor-patient relationship. The former model, based solely on trust and professional authority, is now largely regulated by legal and administrative mechanisms. The growing number of complaints, lawsuits, and legal actions against healthcare professionals, including dentists, highlights the need for a deeper understanding of the legal and ethical obligations inherent in contemporary practice [7].

Patient rights and the rights of dentists in Bosnia and Herzegovina are regulated by the Law on Dental Practice of the Federation of BiH and the Law on Health Care of the Republic of Srpska. These laws define the principles, measures, organization, and implementation of dental practice, the responsibilities for public oral health, as well as the rights and obligations in providing and utilizing dental care. These laws also stipulate supervision of dental practice within the territory of the Federation of BiH (Article 1 of the Law on Dental Practice of FBiH) [8].

Within this context, education in medical law, professional ethics, and dental jurisprudence has become an indispensable part of modern dental education and continuous professional development. Responsible and ethically grounded practice forms the foundation of long-term professional integrity and the reputation of any healthcare profession [9-10].

Efforts to meet patient expectations can sometimes lead to neglect of legal procedures and prescribed standards, which may result in complications, inspections, financial penalties, or proceedings before professional chambers and courts. However, in practice, compromises are often reached, and agreements are made to resolve arising issues. The frequency of such situations in Bosnia and Herzegovina was analyzed through a survey conducted in the BiH territory.

The aim of this study is to examine the level of knowledge and awareness regarding certain legal aspects of dental practice and to emphasize the importance of their application in the daily work of dentists as an inseparable part of modern, safe, and responsible dental professionalism.

Materials and Methods

This study aimed to assess the frequency of patient complaints and lawsuits in dental practice, as well as dentists' knowledge regarding medical record keeping, informed consent, experiences with complaints and legal proceedings, and perceptions of legal protection.

A total of 171 dentists from public and private sectors participated, selected via random sampling across different professional experience groups (<5, 5–15, >15 years). Participation was voluntary, anonymous, and uncompensated. All participants were informed about the study's purpose.

Data were collected using a structured questionnaire with two sections; General (demographics: gender, years of experience, type of practice) and Specific (record keeping, informed consent, complaint frequency and type, legal experiences, patient awareness, and verbal or physical aggression). Questions were mainly closed-ended, with a few open-ended for qualitative comments. The survey was conducted online and/or on paper from February to May 2025, taking 5–10 minutes to complete. Consent was implied by completing the questionnaire.

Data Analysis

Descriptive statistics were applied. Chi-square tests were used to compare observed versus expected frequencies; Fisher's exact test was applied when appropriate. Univariate logistic regression and, where possible, multivariate logistic regression were performed, controlling for gender and years of experience. Results are presented as odds ratios (OR) with 95% confidence intervals (CI) and p-values; $p < 0.05$ was considered significant.

Results

Table 1. provides a descriptive overview of the study variables.

Male dentists were 1.12 times (12%) more likely to have been involved in a legal proceeding, 1.18 times (18%) more likely to know which institution to contact in case of patient complaints, and 1.25 times (25%) more likely to conclude that

complaints and lawsuits negatively affected practice reviews compared to female dentists. Female dentists maintained records more accurately, were more likely to feel unprotected by the law, and experienced verbal and physical aggression more frequently than male dentists (Table 2, Figure 1). These differences were not statistically significant.

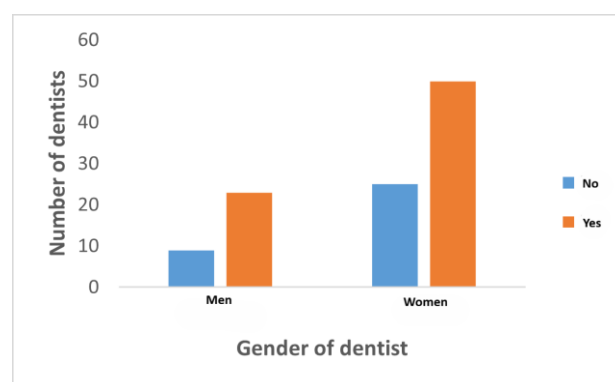


Figure 1. Experience of verbal or physical assault by gender

Additionally, using both univariate and multivariate analyses, we observed that dentists who had experienced verbal or physical aggression were nine times less likely to consider themselves legally protected compared to those who had not experienced such incidents, independent of gender and years of professional experience (OR = 9.62, $p = 0.031$, CI: 1.24–74.8) (Table 2, Figure 2).

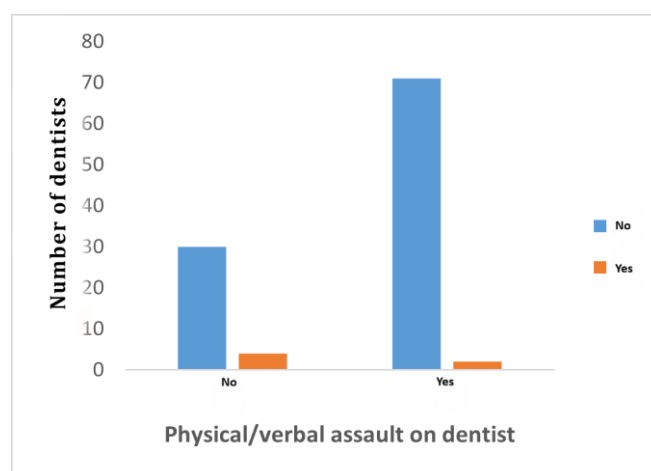


Figure 2. Perceived legal protection by history of verbal/physical assault

Table 1. Description of variables

Variable	%	Variable	%
Gender		Have complaints or lawsuits negatively affected your practice's reviews?	
Male	29.9	Yes	10.3
Female	70.1	No	89.7
Sector		In which field of dentistry do you receive the most complaints?	
Public	21.5	Restorative	15.0
Private	78.5	Implantology	0.9
Years of professional experience		Oral surgery	9.3
0-5	54.2	Periodontology	0.9
5-10	12.1	Orthodontics	2.8
10-15	20.6	Prosthetics	71.0
15-20	10.3		
>20	2.8		
Do you properly maintain dental records and charts in your practice?		Do you consider yourself adequately protected by law as a dentist?	
Yes	80.4	Yes	5.6
No	19.6	No	56.1
Does the patient in your practice sign informed consent for interventions?		I don't know	38.3
Yes	16.8	Do you consider that patients are informed and aware of their rights?	
Only for certain procedures	44.9	Yes	22.4
No	39.3	No	40.2
Have you experienced negative situations with patients, complaints or disputes?		I don't know	37.4
Yes	60.7	Do you consider that patients are aware of their obligations?	
No	39.3	Yes	13.1
Do you try to resolve patient complaints through settlement?		No	40.2
Yes	61.7	I don't know	37.4
No	38.3	Do you know which institution to contact in case of a patient lawsuit?	
Have you ever been involved in a legal proceeding with a patient?		Yes	30.8
Yes	7.5	No	69.2
No	92.5	Have you ever experienced verbal or physical aggression from a dissatisfied patient?	
		Yes	31.8
		Verbal	66.4
		Physical	1.9

Table 2. Univariate analysis of various dental outcomes by gender

Outcome	Male vs. Female Dentists		
	OR	CI	p
1. Do you properly maintain dental records and charts in your practice? (ref: Yes)	0.87	0.44, 1.74	0.70
2. Does the patient in your practice sign informed consent for interventions?	0.91	0.50, 1.64	0.83
3. Have you ever experienced difficult interactions with patients, such as complaints or disputes? (ref: No)	0.93	0.51, 1.96	0.81
4. Do you try to resolve patient complaints through settlements?	1.00	0.57, 1.89	0.99
5. Have you ever been involved in a legal proceeding with a patient? (ref: No)	1.21	0.35, 4.18	0.75
6. Have complaints or lawsuits negatively affected your practice's reviews? (ref: No)	1.25	0.54, 2.80	0.63
7. In which field of dentistry? Prosthetics vs. others (ref: Other)	0.94	0.38, 2.36	0.90
8. Do you consider yourself adequately protected by law as a dentist? (ref: Yes)	0.85	0.15, 4.86	0.85
9. Do you consider that patients are informed and aware of their rights? (ref: Yes)	0.80	0.37, 1.71	0.54
10. Do you consider that patients are aware of their obligations? (ref: Yes)	0.95	0.39, 2.29	0.91
11. Do you know which institution to contact in case of a patient lawsuit? (ref: Yes)	1.18	0.64, 2.15	0.61
12. Have you ever experienced verbal or physical aggression from a dissatisfied patient? (ref: No)	0.84	0.44, 1.62	0.66

Dentists who consider themselves adequately protected by law are 1.91 times (91%) more likely to have over 5 years of professional experience compared to dentists with shorter experience who do not consider themselves legally protected (Table 3). This difference is statistically significant (OR = 1.91, CI: 1.26–2.92) (Table 3).

Dentists in the private sector are 1.65 times (65%) more likely to attempt resolving patient complaints through settlements compared to dentists in the public sector (OR = 1.65, CI: 0.25–2.18, $p < 0.001$).

Dentists in the private sector are 2.58 times less likely to know which institution to contact in case of patient complaints or lawsuits compared to dentists in the public sector (OR = 2.58, CI: 1.00–6.69, $p = 0.05$), although none of the public sector dentists considered themselves adequately protected by law (Table 4).

Specialists in prosthodontics are 4.77 times more likely to be employed in the private sector compared to dentists from other specialties (OR = 4.77, CI: 1.80–12.64, $p = 0.002$), and they are 1.54 times (54%) more likely to consider that their patients are not aware of their rights compared to dentists from other specialties (OR = 1.54, CI: 0.43–0.98, $p = 0.01$). Additionally, prosthodontists are 2.63 times more likely to attempt resolving patient complaints through settlements compared to their colleagues from other specialties (OR = 2.63, CI: 1.17–6.19, $p = 0.03$) (Table 5).

Dentists who have experienced difficult situations with patients, such as complaints or grievances, receive seven times poorer practice reviews (OR = 7.17, $p = 0.047$, CI: 0.87–58.9) and are 6.56 times more likely to attempt resolving complaints through settlements (OR = 6.56, $p < 0.001$, CI: 2.73–15.79), independent of gender and years of professional experience.

Table 3. Univariate analysis of various outcomes according to dentists' years of professional experience

Outcome	More than 5 years vs. less than 5 years of professional experience		
	OR	CI	p
1. Female vs. male gender	1.32	0.80, 2.18	0.29
2. Employment in private vs. public sector (ref: public)	1.46	0.97, 2.21	0.16
3. Do you properly maintain dental records and charts in your practice? (ref: Yes)	1.75	0.86, 3.55	0.07
4. Does the patient in your practice sign informed consent for interventions? (ref: Yes)			
5. Have you ever experienced difficult interactions with patients, such as complaints or disputes? (ref: No)	0.68	0.43, 1.09	0.09
6. Do you try to resolve patient complaints through settlements? (ref: Yes)	1.70	0.75, 1.82	0.55
7. Have you ever been involved in a legal proceeding with a patient? (ref: No)	1.09	0.53, 2.23	0.80
8. Have complaints or lawsuits negatively affected your practice's reviews? (ref: Yes)	1.22	0.68, 2.18	0.75
9. In which field of dentistry? Prosthetics vs. other (ref: Other)	0.86	0.37, 1.99	0.99
10. Do you consider yourself adequately protected by law as a dentist? (ref: No)	1.91	1.26, 2.92	0.05
11. Do you consider that patients are informed and aware of their rights? (ref: Yes)	1.00	0.66, 1.52	0.99
12. Do you consider that patients are aware of their obligations? (ref: Yes)	1.50	0.95, 2.36	0.16
13. Do you know which institution to contact in case of patient complaints or lawsuits? (ref: Yes)	1.19	0.78, 1.28	0.53
14. Have you ever experienced verbal or physical aggression from a dissatisfied patient? (ref: No)	0.84	0.44, 1.62	0.66

Table 4. Univariate analysis of various dental outcomes by private and public sector

Outcome	Private vs. Public Sector		
	OR	CI	p
1. Gender			
2. Years of professional experience (ref: <5 years)			
3. Do you properly maintain dental records and charts in your practice? (ref: Yes)	1.02	0.82, 1.26	0.88
4. Does the patient in your practice sign informed consent for interventions?			
5. Have you ever experienced difficult interactions with patients, such as complaints or disputes? (ref: No)	0.86	0.69, 1.07	0.16
6. Do you try to resolve patient complaints through settlements? (ref: No)	1.65	0.25, 2.18	<0.001
7. Have you ever been involved in a legal proceeding with a patient? (ref: No)	0.89	0.67, 1.18	0.50
8. Have complaints or lawsuits negatively affected your practice's reviews? (ref: Yes)	1.18	0.95, 1.46	0.25
9. Do you consider yourself adequately protected by law as a dentist?*	-	-	-
10. Do you consider that patients are informed and aware of their rights? (ref: Yes)	0.88	0.67, 1.16	0.31
11. Do you consider that patients are aware of their obligations? (ref: Yes)	1.11	0.87, 1.41	0.46
12. Do you know which institution to contact in case of patient complaints or lawsuits? (ref: Yes)	2.58	1.00, 6.69	0.05
13. Have you ever experienced verbal or physical aggression from a dissatisfied patient? (ref: No)	0.94	0.34, 2.50	0.88

Table 5. Univariate analysis of various dental outcomes by dentist specialty

Outcome	Prosthetics vs. other dental specialties		
	OR	CI	p
1. Are you employed in the private or public sector? (ref: public)	4.77	1.80, 12.64	0.002
2. Years of professional experience	1.00	0.88, 1.33	0.83
3. Do you properly maintain dental records and charts in your practice? (ref: Yes)	0.79	0.63, .98	0.08
4. Does the patient in your practice sign informed consent for interventions? (ref: Yes)	1.00	0.78, 1.29	0.99
5. Have you ever experienced difficult interactions with patients, such as complaints or disputes? (ref: No)	0.90	0.69, 1.17	0.43
6. Do you try to resolve patient complaints through settlements? (ref: No)	2.63	1.17, 6.19	0.03
7. Have you ever been involved in a legal proceeding with a patient? (ref: No)	1.15	0.66, 1.99	0.69
8. Have complaints or lawsuits negatively affected your practice's reviews or marketing? (ref: Yes)	1.17	0.86, 1.60	0.50
9. Do you consider yourself adequately protected by law as a dentist?	0.94	0.52, 1.67	0.81
10. Do you consider that patients are informed and aware of their rights? (ref: No)	1.54	1.02, 2.34	0.01
11. Do you consider that patients are aware of their obligations? (ref: Yes)	1.00	0.76, 1.44	0.97
12. Do you know which institution to contact in case of patient complaints or lawsuits? (ref: Yes)	0.91	0.69, 1.21	0.65
13. Have you ever experienced verbal or physical aggression from a dissatisfied patient? (ref: No)	1.00	0.78, 1.32	0.86

Discussion

In modern dentistry, the doctor–patient relationship is gaining increasing importance, particularly in the context of adhering to professional standards, legal regulations, and ethical principles. Patients today have higher expectations regarding the quality of service, information, and transparency of treatment procedures, which further obliges dentists to consistently and properly apply legal and ethical norms. At the same time, healthcare systems in many countries are undergoing changes and adaptations, so requirements regarding documentation, informed consent, and the protection of patients' rights vary depending on local legislation and institutional frameworks.

Therefore, it is important to understand how dentists manage situations involving misunderstandings, complaints, or patient dissatisfaction. In practice, a balance must be struck between professional responsibility and the practical realities of daily work, as well as between the desire to accommodate the patient and the obligation to follow prescribed procedures. While in countries with clearly defined regulatory mechanisms and strong control systems such situations less frequently result in formal proceedings, in settings with less stringent regulations, there is a greater need for informal agreements and adjustments to circumstances [2].

Under these conditions, it is particularly relevant to examine dentists' attitudes, the frequency of situations leading to misunderstandings, and the level of knowledge regarding procedures and institutions involved in complaint resolution.

In attempts to meet patient demands, some respondents reported occasional deviations from formal procedures, most commonly regarding the maintenance of medical records, obtaining informed consent, or compliance with prescribed administrative steps. These findings are consistent with the literature, which emphasizes that patient pressure, limited time, and high expectations can influence the quality of communication and adherence to legal standards in everyday dental practice [2,4].

The results of this study indicate that dentists in Bosnia and Herzegovina relatively frequently encounter patient complaints, although the number of legal proceedings remains low. While most surveyed dentists strive to operate within the legislative framework, the survey data show that a certain number of professionals rely on informal agreements in situations of misunderstanding or complaints. Such an approach often arises from the desire to avoid lengthy administrative procedures and from the belief that problems are more efficiently resolved through direct communication between patient and dentist. Similar tendencies have been observed in other studies, which indicate that many dentists prefer informal complaint resolution to preserve the patient relationship and avoid negative consequences for professional reputation [9].

Research from other countries shows that clear legal frameworks, continuous education in ethics and jurisprudence, and strong regulatory institutions significantly reduce the risk of professional errors and disputes [10–15].

Interestingly, the majority of dentists reported formally maintaining patient records (80.4%), yet signed informed consent is still not a routine practice—only 16.8% of respondents use it for all procedures. This suggests a potential gap between legal requirements and daily practice. Previous studies indicate that properly maintained documentation and the availability of signed consent significantly reduce dentists' legal vulnerability and serve as key evidence in case of disputes [16–20].

More than half of the respondents (60.7%) reported experiencing some form of complaint or grievance, consistent with trends described in the literature, which note an increase in patient dissatisfaction and expectations regarding service quality and communication. However, only 7.5% of respondents reported involvement in a legal proceeding, suggesting that most conflicts remain at the level of internal complaints or are resolved through informal agreements between the dentist and the patient.

The reasons for legal disputes were diverse, including: lawsuits filed by dentists for non-payment of certain procedures, patient dissatisfaction with skeletal dentures, negligent treatment, aesthetic issues with prosthetic work, functional deficiencies following the fabrication of fixed prosthetic work on implants, and dissatisfaction with removable dentures.

The results showed that 50% of cases were resolved through settlements, 11.2% in favor of the dentist and their practice, while the remaining 50% did not enter formal legal proceedings. These data indicate that many disputes are resolved outside formal court processes.

Analysis of the areas of dentistry most frequently associated with complaints and complications revealed that 71% of complaints were related to prosthetics, including patient dissatisfaction with prosthetic work such as bridges, dentures, and crowns; 9.3% of complaints originated in oral surgery (e.g., complications following tooth extractions); and 15% of complaints were related to restorative dentistry and endodontics, including tooth restorations and root canal treatment. The remaining percentage was associated with implantology, orthodontics, and periodontology, which showed a lower frequency of complaints compared to prosthetics.

Similarly, other authors report that prosthetic procedures are among the most common causes of complaints and legal actions, largely due to the subjective assessment of treatment success and the high risk of dissatisfaction. Yüce & Yurt, in a 2025 study, emphasize that prosthetic procedures—due to their complexity, lengthy treatment, cost, and high patient expectations—are “particularly high-risk” for dissatisfaction and lawsuits [21].

A retrospective study conducted in Iran analyzing 450 patient complaints found that the most frequent complaints concerned prosthetic treatments (such as crowns, bridges, etc.) (20.4%), followed by implantology and tooth extractions [22].

Moreover, older studies from Scandinavian countries show that prosthetics is the discipline with the highest number of complaints. For example, *Malpractice reports in prosthodontics in Sweden* noted that bridges, complete and partial dentures, and individual crowns were the most frequent procedures leading to complaints [23].

The results of our study indicate that most complaints are attempted to be resolved through settlements (61.7%), reflecting dentists' willingness to avoid legal proceedings, but at the same time raising questions about the duration, quality, and formality of the complaint resolution process. This approach is common in other countries, where settlements are considered more efficient, faster, and less stressful for both parties [24].

Another important finding is the perception of insufficient legal protection—more than half of respondents (56.1%) do not consider themselves adequately protected as dentists, which may be related to the fragmented healthcare regulations in Bosnia and Herzegovina and insufficient knowledge about rights and procedures. This is further evidenced by the fact that 69.2% of respondents do not know which institution to contact in the event of a patient lawsuit.

Verbal aggression is also alarmingly frequent (66.4%), which aligns with global reports of increasing aggressive behavior of patients toward healthcare workers, particularly in systems where trust between patient and provider is weakened or where there is insufficient regulation protecting healthcare professionals.

Analysis of the results reveals differences in the perception of professional risks, legal protection, and complaint management among dentists based on gender, years of experience, employment sector, and area of specialization. Although most of these differences are statistically non-significant, a number of dentists are unfamiliar with protective procedures, indicating that education and standardization would be beneficial. Similar findings have been reported in studies from other countries [9, 17–19].

Regarding gender differences, male dentists were slightly more likely to be involved in legal proceedings (12%), more often knew which institution to contact in case of patient complaints (18%), and more frequently perceived that complaints and lawsuits had affected their professional reviews (25%). Female dentists, on the other hand, demonstrated more consistent record-keeping, were more likely to feel inadequately protected by law, and were more frequently exposed to physical or verbal aggression (Table 2, Graph 1). Although these differences were not statistically significant, they reflect gender patterns in professional experience within dentistry and highlight the need for better systemic protection and support, especially for women in the profession.

Multivariate analysis further confirmed the impact of experiencing physical or verbal aggression on perceived legal security. Dentists who had experienced such incidents were nine times less likely to consider themselves legally protected compared to colleagues without such experiences (OR = 9.62, $p = 0.031$), independent of gender and years of experience (Table 2, Graph 2). This represents one of the most significant findings of the study, demonstrating that personal experiences with aggression have a strong and lasting effect on the professional sense of security.

Work experience also plays a significant role. Dentists with more than five years of experience were almost twice as likely to feel adequately protected by law (OR = 1.91, CI: 1.26–2.92). Similarly, more experienced dentists were slightly more likely to perceive that patients are not sufficiently aware of their obligations, although this difference was not statistically significant (Table 3). These trends suggest that experience contributes to greater legal knowledge but also to a heightened awareness of the imbalance between professional and patient responsibilities.

The results also show clear differences between the private and public sectors. Dentists in private practices reported that patients were 0.86 times less likely to file complaints compared to patients in public institutions, which may reflect differences in expectations, approach, or organization of care. However, private sector dentists were 1.65 times more likely to attempt to resolve complaints through settlements ($p < 0.001$), indicating a more practical and direct approach to patient retention (Table 4).

Notably, prosthodontics specialists stand out. Prosthodontists are 4.77 times more likely to be employed in the private sector and 2.63 times more likely to prefer resolving complaints through settlements ($p = 0.03$) compared to colleagues in other areas of dentistry (Table 5). This may reflect the nature of prosthetic procedures, which are often more complex, costly, and subject to subjective patient expectations.

Dentists who had negative experiences in the form of complaints or grievances received seven times worse professional reviews (OR = 7.17, $p = 0.047$) and were 6.56 times more likely to attempt to resolve situations through settlements ($p < 0.001$). This finding confirms the assumption that conflict situations with patients have both reputational and professional consequences, further emphasizing the need for preventive mechanisms, proper documentation, communication training, and formal legal support.

Conclusion

The results of this study suggest that there is room for improvement in the application of legal obligations in everyday dental practice in Bosnia and Herzegovina.

Although most dentists report maintaining proper documentation, the use of informed consent remains infrequent, increasing professional and legal risk, particularly in complex therapeutic procedures. Patient complaints are relatively common, while legal proceedings are rare, and conflicts are most often resolved through informal settlements, indicating a tendency to avoid lengthy and formal procedures. The highest number of complaints pertains to prosthodontics, reflecting the complexity of prosthetic treatment and high patient expectations.

Notably, dentists who have experienced verbal or physical aggression report significantly lower perceptions of legal and professional security compared to colleagues without such experiences, highlighting the strong and lasting impact of personal experiences with aggression on professional confidence.

Furthermore, insufficient awareness among dentists regarding competent institutions and protective mechanisms contributes to the perception of legal insecurity. These findings underscore the need to strengthen education in medical law and ethics, standardize administrative procedures, improve complaint resolution processes, and enhance institutional support, with the aim of increasing

dentists' legal security and the overall quality of dental care.

Conflicts of interest: The authors declare no conflicts of interest.

Authors' contributions: Conceptualization: Vedran Jakupović VJ, Zerina Sačak Memišević ZSM; Methodology: VJ, ZSM, Amer Ovčina AO; Investigation: VJ, ZSM; Data curation AO; Formal analysis: VJ; Validation: VJ; Visualization: VJ; Project administration: VJ.

References

1. Beauchamp TL, Childress JF. Principles of Biomedical Ethics. Oxford University Press; 2019.
2. Ozar DT, Sokol DJ. Dental Ethics at Chairside: Professional Obligations and Practical Applications. Georgetown University Press; 2018.
3. López-Nicolás M, Falcón M, Pérez-Carceles MD, Osuna E, Luna A. Informed consent in dental malpractice claims. A retrospective study. *International Dental Journal*. 2007;57(3):168-172.
4. Bhadauria US, Dasar PL, Sandesh N, Mishra P, Godha S. Medico-legal aspect of dental practice. *Clujul Medical*. 2018;91(3):255-258. [PMC](#)
5. Savić Pavičin I, Jonjić A, Maretić I, Dumančić J, Zymber Česhko A. Maintenance of Dental Records and Forensic Odontology Awareness: A Survey of Croatian Dentists with Implications for Dental Education. *Dent J*. 2021;9(4):37.
6. Pervez Z, Hussain M, Naz F, Iqbal M. Ethical relationship in the dentist-patient interaction. *Journal of Forensic & Legal Medicine*. 2021;87:102-123.
7. Nash DA. Ethics in dentistry: review and critique of Principles of Ethics and Code of Professional Conduct. *J Am Dent Assoc*. 1984 Oct;109(4):597-603. doi: 10.14219/jada.archive.1984.0131. PMID: 6384327.
8. Zakon o stomatološkoj djelatnosti Federacije Bosne i Hercegovine, "Službene novine FBiH", br. 40/13.
9. Muralidharan S, Pendyala G, Gandhage D, Sachan S. Knowledge of Dental Ethics and Jurisprudence Among Dental Practitioners in Pune: A Questionnaire Survey. *Cureus*. 2022 Nov 14;14(11):e31503. doi:10.7759/cureus.31503
10. Ehsan A, Raza A. Ethical Practices in Dentistry: Call for Bioethics Education and Collective Action. *Pak J Med Sci*. 2025;41(3):641-642. doi:10.12669/pjms.41.3.11907
11. Coburn DG, Monaghan AM, Gibbons AJ. Risk management. *Br Dent J*. 2004 Sep 11;197(5):225.
12. Hrudey SE, Leiss W. Risk management and precaution: insights on the cautious use of evidence. *Environ Health Perspect*. 2003 Oct;111(13):1577-81.
13. Perea-Perez B, Santiago-Saez A, Garcia-Marin F, Labajo-Gonzalez E, Villa-Vigil A. Patient safety in dentistry: Dental care risk management plan. *Med Oral Patol Oral Cir Bucal*. 2011;(Epub ahead of print).
14. Graskemper JP. A new perspective on dental malpractice: practice enhancement through risk management. *J Am Dent Assoc*. 2002 Jun;133(6):752-7.
15. Hay LJ. Risk management: the top 10 mistakes dentists make. *Dent Assist*. 2007 Sep-Oct;76(5):36, 8, 45.

16. Savić Pavičin I, Jonjić A, Maretić I, Dumančić J, Zymber Česhko A. Maintenance of Dental Records and Forensic Odontology Awareness: A Survey of Croatian Dentists with Implications for Dental Education. *Dent J (Basel)*. 2021 Mar 25;9(4):37.
17. Jerrold L. Litigation, legislation, and ethics: Inferences, presumptions, and certainties. *Am J Orthod Dentofacial Orthop*. 2003 Feb;123(2):194-5.
18. Jerrold L. Litigation, legislation, and ethics. Alchemy in orthodontics. *Am J Orthod Dentofacial Orthop*. 2002 Nov;122(5):573-4.
19. Filker PJ, Muckey EJ, Kelner SM, Kodish- Stav J. Taking a quality assurance program from paper to electronic health records: one dental school's experience. *J Dent Educ*. 2009 Sep;73(9):1095-101.
20. Brkić H. Forenzična stomatologija. Zagreb: Školska knjiga 2000.
21. Yüce, E., & Kacdioğlu Yurt, S. (2025). Two decades of dental malpractice litigations in Türkiye: a retrospective matched cohort study analyzing legal and clinical outcomes. *BMC Oral Health*, 25, 487. <https://doi.org/10.1186/s12903-025-05838-1>
22. Tabrizi, R., Taheri, H., Forouzes, M. et al. (2025). Complaint trends of dental malpractice in Tehran, Iran: a retrospective study (2016—2022). *The Saudi Dental Journal*, 37, 44.
23. René N, Owall B. Dental malpractice in Sweden. *J Law Ethics Dent*. 1991;4:16-31. PMID: 1816351.
24. Nassar D, Tagger-Green N, Tal H, Nemcovsky C, Mijiritsky E, Beitlitum I, Barnea E, Kolerman R. The Incidence and Nature of Claims against Dentists Related to Periodontal Treatment in Israel during the Years 2005-2019. *Int J Environ Res Public Health*. 2021 Apr 14;18(8):4153.

PATIENTS' ATTITUDES, EXPERIENCES AND AWARENESS REGARDING ENDODONTIC THERAPY

Mirna Pašić*, Alma Konjhodžić, Madžida Halilović
Mehinović, Adna Begović, Aida Džanković, Samra
Korać, Irmina Tahmiščija

Department of Dental Pathology with Endodontics, Faculty of Dentistry,
University of Sarajevo, Bosnia and Herzegovina

*Corresponding author

Mirna Pašić, DMD
Department of Dental Pathology
with Endodontics Faculty of
Dentistry, University of Sarajevo
Bolnička 4a, 71000 Sarajevo
Bosnia and Herzegovina
Phone: +38761161714
E-mail: mirnapasic@sf.unsa.ba

DOI 10.69559/issn.2233-1794.2026.15.1.2

ABSTRACT

Objectives: The aim of this study is to evaluate patients' awareness and the key factors affecting decisions on tooth preservation.

Material and methods: This study was conducted through an anonymous survey of 237 patients who visited the Department and Clinic for Dental Pathology and Endodontics at the Faculty of Dentistry, University of Sarajevo. Participant were informed about the purpose of the research and informed consent was obtained from each participant. General demographic data on gender, age and education were collected, followed by their attitudes, experiences and knowledge regarding endodontic treatment.

Results: A total of 236 valid responses were analyzed. The majority of respondents (53.2%) assessed their knowledge as „moderate/average“ and also cited 'the dentist' as their primary source of information (81.8%). Our survey revealed that respondents distinguish a broader spectrum of symptoms that indicate the need for root canal treatment (RCT) rather than just spontaneous toothache. In terms of treatment outcomes, majority (86%) recognized RCT as an effective tooth-saving method. Local anesthesia was highly demanded, with 56.2% of patients exclusively insisting on a pain-free procedure. In selecting a dental clinic, respondents primarily value clinical expertise and experience (68.6%), followed by staff friendliness and service quality (44.9%) while financial costs did not affect the priority of tooth preservation for the majority of patients (50.9%).

Conclusion: Our research demonstrates significant progress in patient awareness and perception of endodontic therapy. Furthermore, as dental knowledge is more accessible than ever, patients must be educated to view the dentist as their primary and most reliable resource. Ultimately, establishing mutual trust between the patient and the dentist remains the foundation of successful therapy.

Keywords: root canal treatment, patient awareness, public perception, dental anxiety, questionnaire.

Introduction

Endodontics is a branch of dentistry primarily aimed to preserve the natural dentition, which patients nowadays consider as a priority. Root canal treatment is no longer regarded as a temporary solution preceding tooth extraction, but rather as a long-term investment in oral health. Despite the fact that patients today are well-informed regarding the endodontic process through available information sources, dental anxiety still persists. Furthermore, since root canal treatment often requires multiple appointments depending on the diagnosis and treatment progression, it remains a key reason why patients postpone treatment. From a clinical perspective, a patient's decision to undergo endodontic treatment is further influenced by socioeconomic status, educational background, oral health awareness and financial means. Since successful treatment not only depends on clinician's expertise but also on the quality of patient-dentist communication, understanding and trust, evaluating public perception toward endodontic therapy is essential. The aim of this study is to evaluate patients' awareness and the key factors affecting decisions on tooth preservation. The ultimate goal is to provide clinical guidelines for improved, personalized patient-dentist communication.

Patients and Methods

This study was conducted through an anonymous survey of 237 patients who visited the Department and Clinic for Dental Pathology and Endodontics at the Faculty of Dentistry, University of Sarajevo. Participant were informed about the purpose of the research and informed consent was obtained from each participant. General demographic data on gender, age and education were collected, followed by their attitudes, experiences and knowledge regarding endodontic treatment.

Data analysis was performed using descriptive statistics such as frequencies and percentages.

Results

This study was conducted through an anonymous survey. Although 237 patients initially participated, one did not provide consent, resulting in 236 valid responses. The final sample included 64.4% females and 35.6% males. In terms of education levels, 65.7% of respondents held a higher education degree, while 34.3% had completed secondary education.

The majority of respondents (53.2%) rated their knowledge as „moderate/average“, while 17.4% reported high and 29.4% minimal knowledge (Figure 1). The primary source of information for the 81.8% of respondents was the dentist, friends and family experiences or recommendations for 28% of the participants, and internet for 20.3%. Social media at 3% and traditional media at 0.4% had a minimal impact (Table 1). More than half of the participants (53.6%) selected a combination of all listed symptoms as indicators for RCT. However, pain or sensitivity upon biting and chewing was reported by 34.9% of the participants, spontaneous pain by 24.3% and tooth crown color change by 12.3%. Minimal values of 0.4% were recorded for both the options that the profession decides and the need for a 3D OPG scan (Table 2). The majority of respondents (86%) believe that 'a treated tooth can last for many years', 7.7% remained undecided, 6% considered RCT as a temporary solution before extraction, and 1.3% preferred immediate extraction followed by implant or bridge placement (Table 3). Regarding financial factors, 50.9% of respondents stated they are 'willing to pay whatever is necessary to preserve a natural tooth', 33.8% would prioritize saving the tooth but would consider alternative payment options, 10.7% could be driven to choose extraction by high costs, and 6.8% would only undergo the treatment if it were free through health insurance (Table 4). Pain during or after the procedure was the leading cause of concern for 51.3% of respondents, followed by fear of therapy failure leading to tooth loss (44.3%) and the duration of the therapy process (27.4%). Radiation exposure from multiple RVG images was

the least prevalent concern (3.5%) (Table 5). In terms of the use of local anesthesia during RCT 56.2% of respondents exclusively demand local anesthesia, 26% would request anesthesia only in cases of unbearable pain, and 11.1% have no specific position and defer the decision to their dentist, whereas only 8.5% actively avoid local anesthesia unless it becomes absolutely necessary (Table 6). The majority of respondents (67.7%) considered it a normal reaction to feel mild sensitivity or pain on pressure a few days after a

successfully completed RCT, 26% remained undecided and 6.3% interpreted post-operative pain as a sign of therapeutic failure (Figure 2). In terms of dental practice selection criteria, 72.3% of the respondents prioritized the clinician's expertise and experience, 48.9% the friendliness of the staff combined with service quality, and 29.8% patient recommendations, while the practice's location (23.4%) and economic affordability (17.0%) had the lowest impact on their decision (Table 7).

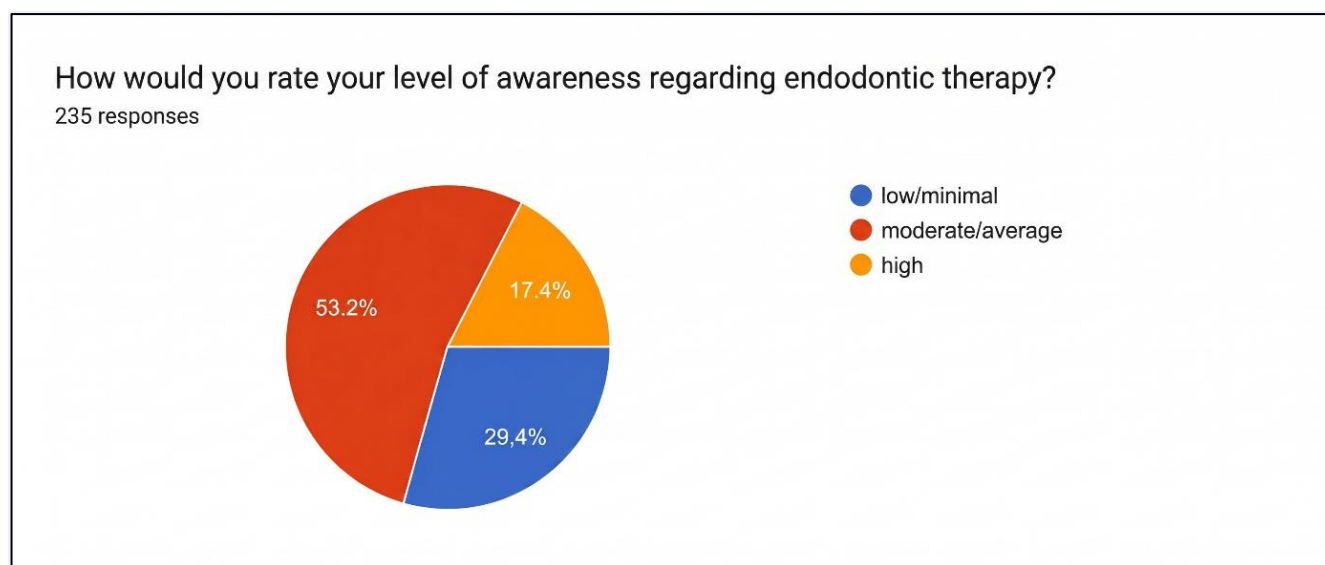


Figure 1. Responses for patient awareness regarding endodontic therapy – predominantly rated as moderate/average

Table 1. Patients' main sources of dental informations: reliance on professional advice outranks online research

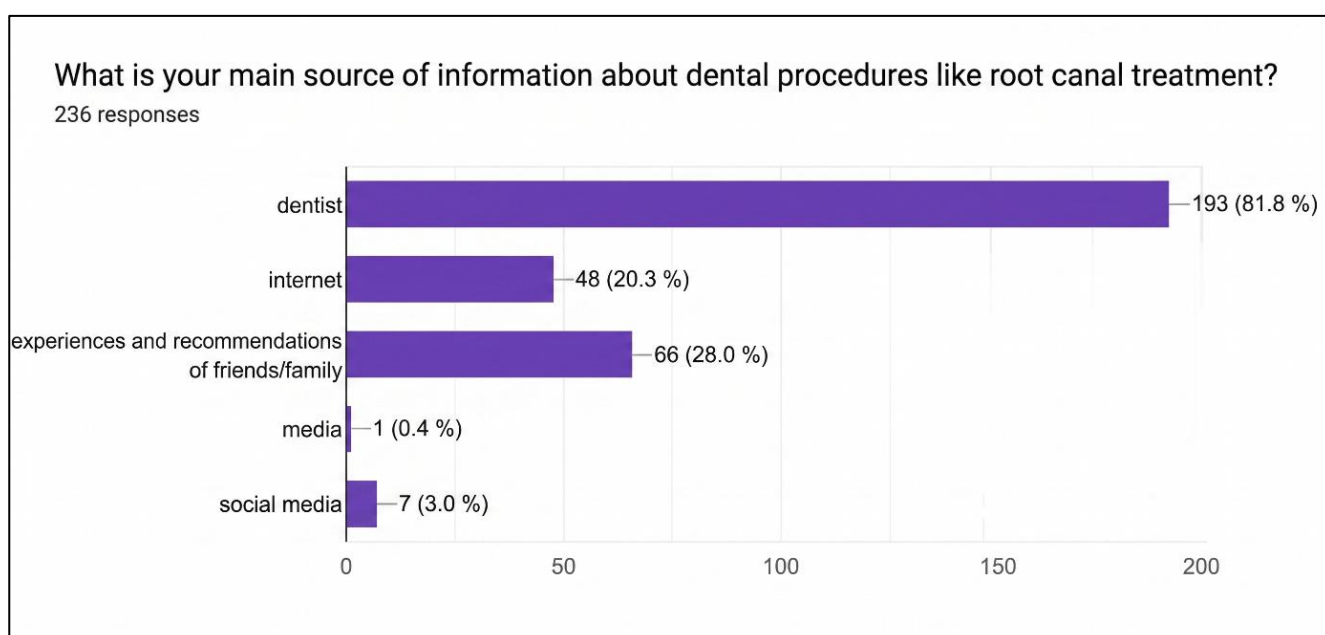


Table 2. Data regarding patients' perception of symptoms that indicate the need for RCT – over half respondents recognize all combined symptoms

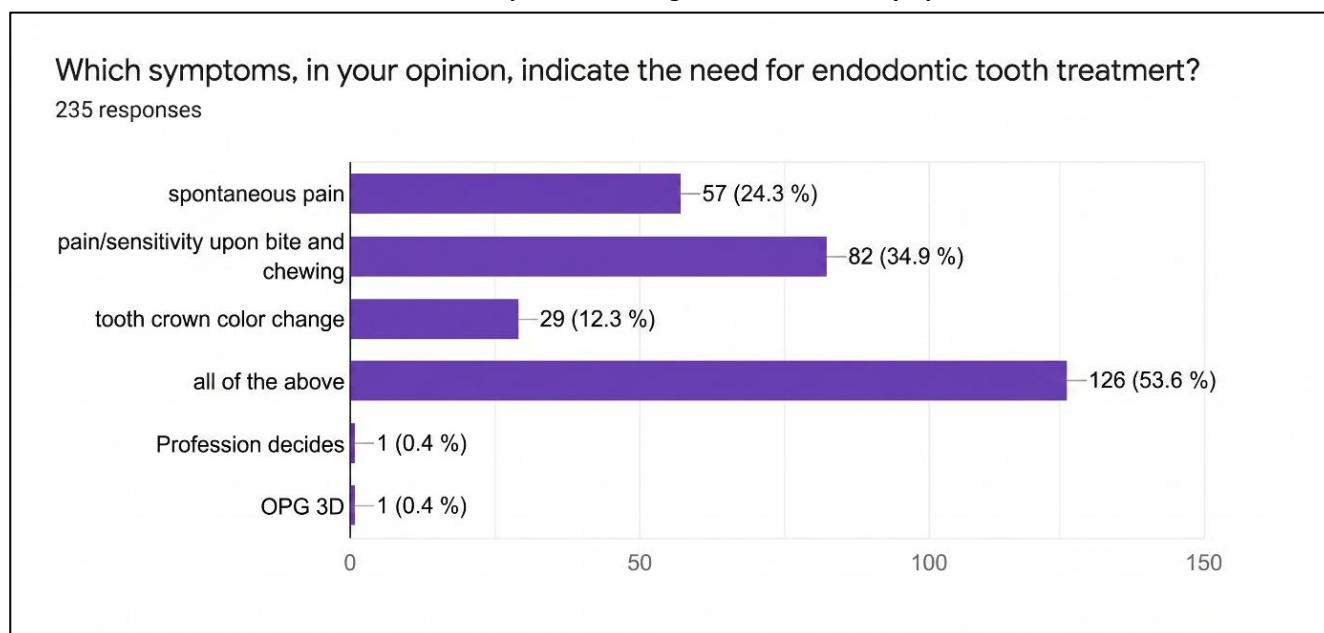


Table 3. Patients' perception of the long-term efficacy of RCT – the majority recognize it as an effective tooth-saving method

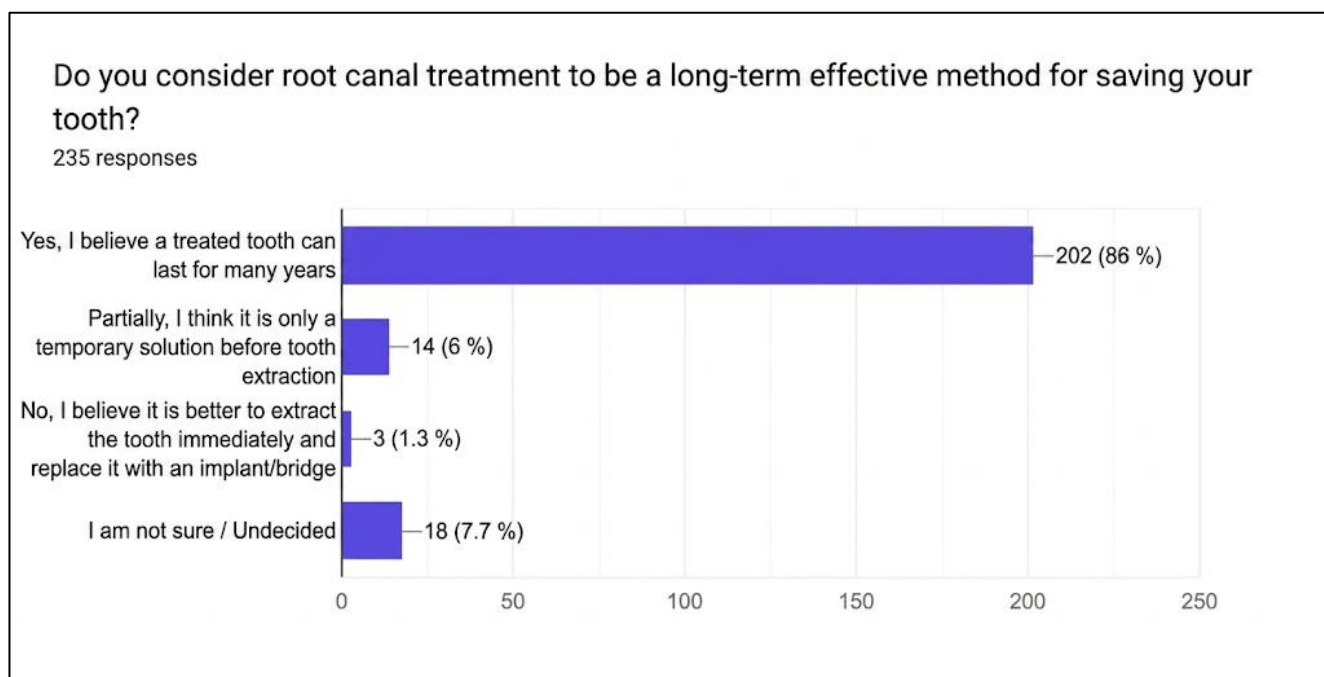


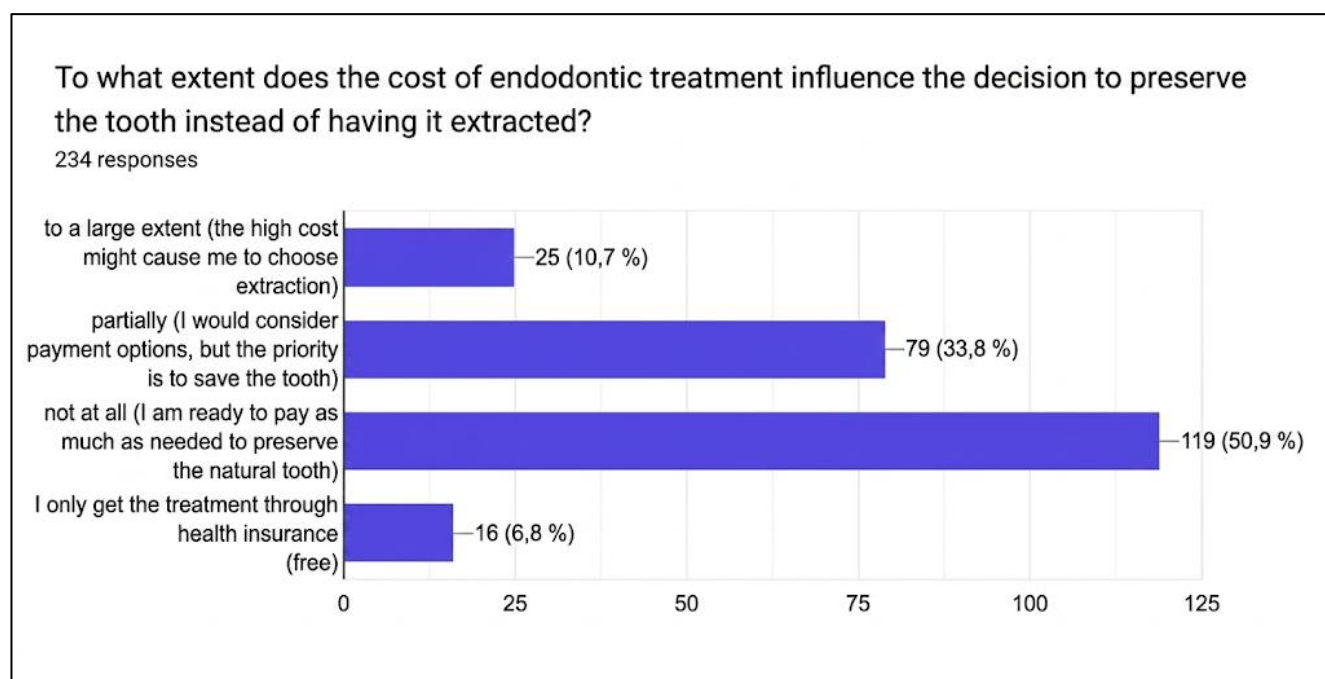
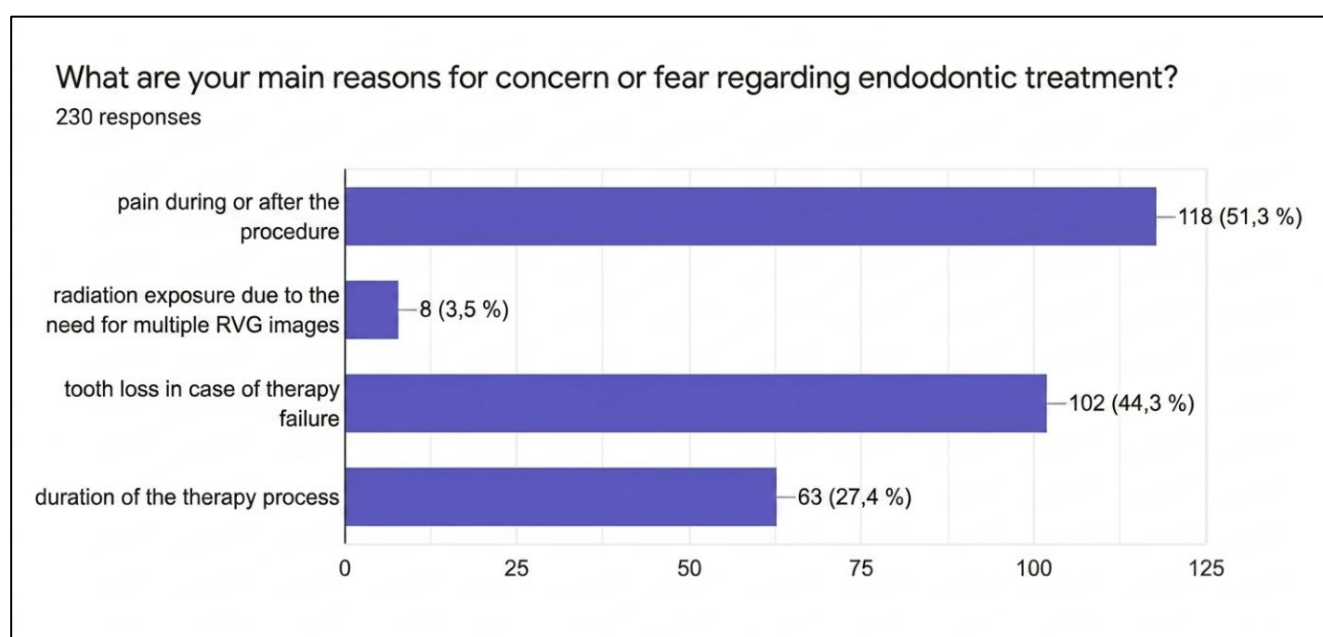
Table 4. Data regarding the financial impact on patients' endodontic decisions – tooth preservation is highly prioritized**Table 5. Procedural pain and potential treatment failure are the primary fears associated with endodontic treatment**

Table 6. Analysis of patients' preferences regarding local anesthesia during RCT – the majority demand a pain-free procedure

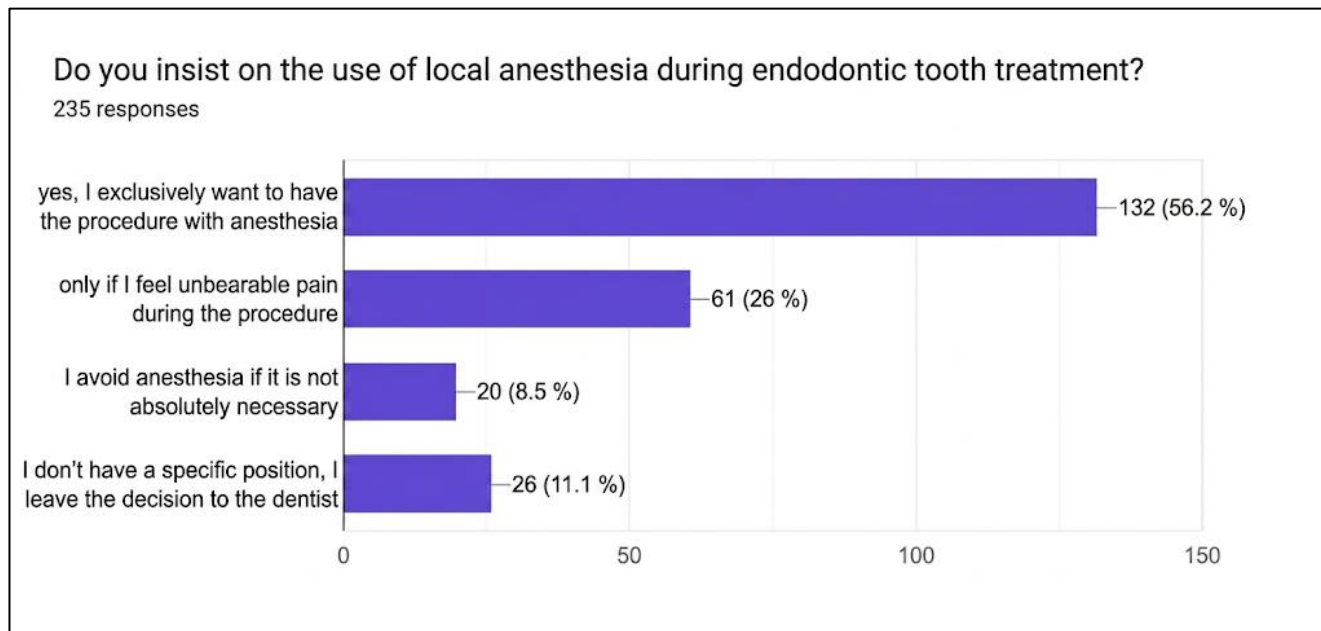


Figure 2. Patients' responses regarding post-operative sensitivity – mild post-operative sensitivity is recognized as a normal reaction

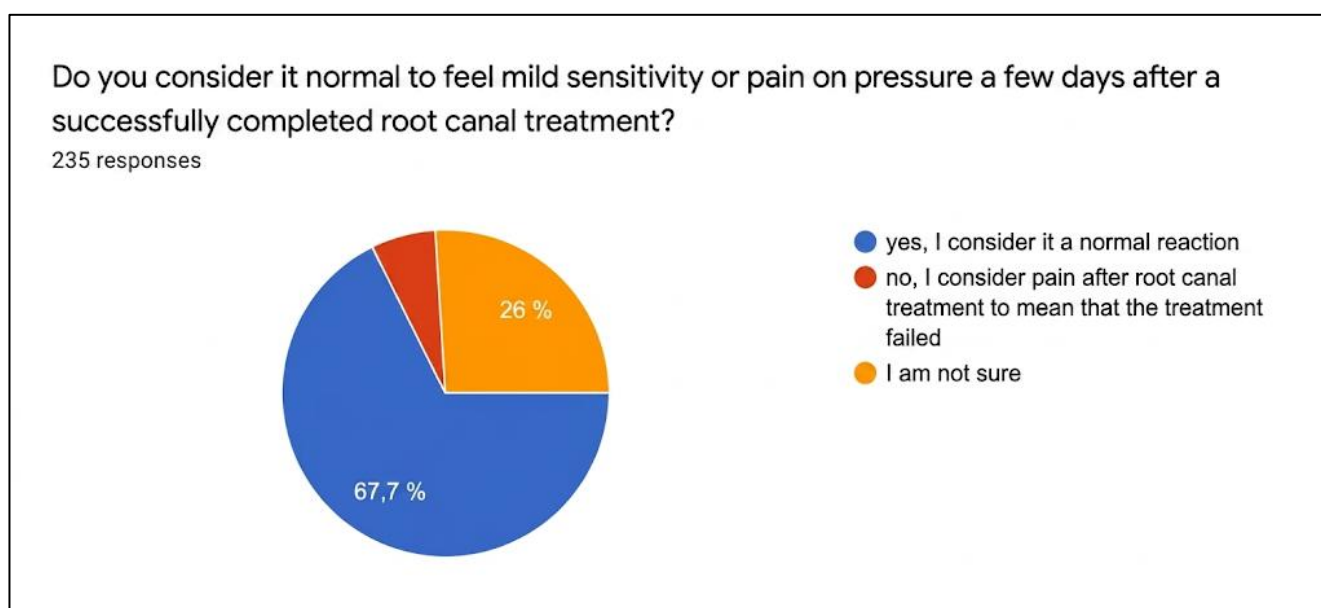
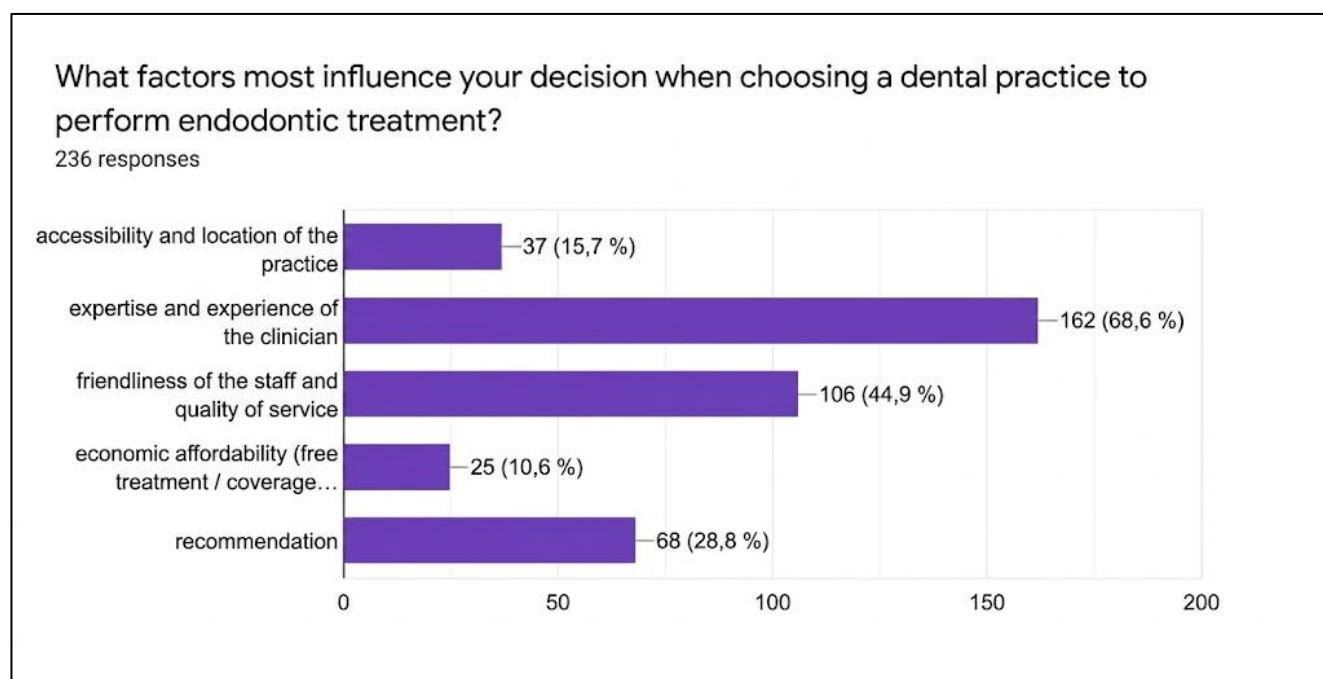


Table 7. Analysis of patients' criteria for choosing a dental practice – the clinician's expertise and experience are leading priorities.



Discussion

When evaluating their own endodontic knowledge within the questionnaire, the majority of respondents in our survey assessed their understanding as 'moderate/average'. Older studies recorded very low levels of awareness, where only 23% to 25.3% of respondents were well-informed about endodontics [1, 2]. However, modern global studies indicate a significant increase, revealing that 61.4% of respondents in Nepal and over 85% in India report basic knowledge [2,3]. These outcomes reflect a notable transition from historical public unawareness toward a well-established, moderate level of understanding.

As their primary source of information respondents cited 'the dentist' but often combined with internet sources and peer recommendations. This contrasts with the past when dentists were the sole source of knowledge [1]. However, recent literature indicates that patients increasingly rely on the internet and mass media [2, 3]. Consequently, patients enter dental practices with a wealth of online information, which is predominantly unverified or misleading.

Although our survey shows the dentist remains a trusted authority, clinicians must often invest additional effort to clear up misunderstandings caused by superficial online information.

Severe, spontaneous toothache was long recognized as the main symptom prompting root canal treatment in 37% to 40.1% of patients [1, 2]. Our survey revealed that respondents distinguish a broader spectrum of symptoms. In addition to spontaneous pain, they very frequently selected 'all of the above', as well as 'pain/sensitivity on biting and chewing' and 'tooth crown discoloration'. These data align with our previous conclusions regarding enhanced patient awareness. Today's patients can identify subtle, non-acute symptoms of endodontic pathology rather than just unbearable pain.

The majority of respondents believe that 'a treated tooth can last for many years', and a significant portion stated they are 'willing to pay whatever is necessary to preserve a natural tooth'. This reflects current global data showing a strong preference for tooth retention; 65% to 76% of patients choose endodontic treatment over

extraction, and 77.2% accept higher financial costs to avoid tooth loss [2, 3]. Consequently, the preservation of natural dentition has become a priority, and endodontics is no longer considered a temporary solution.

The primary concerns cited by patients regarding endodontic procedures is 'pain during and after the treatment' and 'tooth loss'. Besides pain, respondents also selected 'tooth loss in case of therapy failure' and the 'prolonged nature of the treatment process'. A Nepalese study confirms this, reporting that besides pain (28.7%), treatment length was the greatest patient concern (49.6%) [2]. Likewise, a Pakistani study identified prolonged treatment and multiple visits (22.6%) as a key disadvantage that drove some patients to choose extraction [4]. Despite this persistent fear, patients are aware that modern treatments can and should be painless with the use of anesthetics, thus requesting the procedure 'exclusively under anesthesia'. This contrasts with historical data, where fear of pain was the primary barrier to endodontic care, and 64.1% to 78% of patients perceived the treatment as painful [1, 2]. Considering demographic data, younger respondents (aged 18–29) and female participants frequently report fear, predominantly opting for procedures 'exclusively under anesthesia' and expressing concern regarding the outcome. A Croatian study highlights that fear levels decrease with age, with the highest prevalence of anxiety observed among women between 26 and 35 years of age [5]. Furthermore, a study from Madagascar confirms that younger patients (aged 18–24; 84.2%) and females (86%) show a significantly higher correlation with pain and fear than older or male patients, as younger individuals more frequently exaggerate expected pain [6].

Furthermore, the shift in patient awareness has led to progress, as respondents now consider it normal to experience mild sensitivity or pressure pain following a successfully completed RCT. A study from Madagascar confirms that postoperative inflammatory pain is a normal occurrence that can last up to 7 days [6]. Additionally, a Croatian study highlights a psychological aspect: anxious patients tend to expect significantly more severe pain than they actually experience during and after the procedure [5]. Consequently, knowing that mild post-treatment pain is a 'normal reaction' indicates high patient knowledge, which probably helps reduce patient anxiety in the clinic.

In selecting a dental clinic, respondents primarily value clinical expertise and experience, followed by staff friendliness and service quality. This matches a growing global trend of patient awareness regarding specialties, with recent data showing that 72% to 88.9% of patients prefer an endodontist over a general dentist for root canal therapy [1, 2, 3]. Ultimately, patients understand the procedural complexity and intentionally seek the most experienced clinicians.

Conclusion

In conclusion, our research demonstrates significant progress in patient awareness and perception of endodontic therapy. Furthermore, as dental knowledge is more accessible than ever, patients must be educated to view the dentist as their primary, most reliable resource. Ultimately, establishing mutual trust between the patient and the dentist remains the foundation of successful therapy.

References

1. Ahamed ZH, Alwakeel A, Alrshedan A, Altimsah F. Knowledge and awareness of root canal therapy for population in Saudi Arabia: A questionnaire-based study. *Int J Med Sci Clin Invent*. 2018 Feb;5(02):3560-4.
2. Gautam S, Thapa A, Joshi R, Joshi B, Karmacharya A. Knowledge, awareness and expectations of root canal treatment: Patients' perspective. *Nepal Med Coll J*. 2022 Dec;24(4):363-8.
3. Iyer AA, Nair R, Gupta P, Tavane PN, Pawar P. Dental patient's knowledge, awareness and attitude towards root canal treatment: A survey based research. *Int J Recent Sci Res*. 2018 Jan;9(1E):23214-8.
4. Saqib M, Jouhar R, Masood S, Saeed S, Hemani A, Zehra SA, Warraich ZZ. Decision-making of patients towards treatment modalities of failed root canal therapy. *Gandhara Med Dent Sci*. 2023 Jan;10(1):37-40.
5. Perković I, Perić M, Romić Knežević M, Jukić Krmek S. The level of anxiety and pain perception of endodontic patients. *Acta Stomatol Croat*. 2014 Dec;48(4):258-67.
6. Andrianjafinoro TH. Psychological impact of post-operative endodontic pain. *IJO Int J Health Sci Nurs*. 2023 Dec;6(12):1-5.

PREDICTING OCCLUSAL VERTICAL DIMENSION USING FACIAL ANTHROPOMETRY: DEVELOPMENT OF POPULATION-SPECIFIC REGRESSION MODELS

Lejla Berhamović*, Emir Berhamović, Alma Kamber, Amela Donlagić, Alma Gavranović-Glamoč

Department of Prosthodontics and Dental Implantology, Faculty of Dentistry, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

*Corresponding author

Lejla Berhamović
Faculty of Dentistry, University of Sarajevo
Bolnička 4A, Sarajevo, Bosnia and Herzegovina
Phone: 38761431901
E-mail: berhamovic.lejla@gmail.com

DOI 10.69559/issn.2233-1794.2026.15.1.3

ABSTRACT

Background: Determination of the occlusal vertical dimension, (OVD), remains one of the key challenges in prosthodontics, due to the lack of a universally accepted and sufficiently accurate method. Anthropometric approaches have been proposed as a simple and objective way to estimate OVD, although their applicability may vary across different populations.

Objective: To evaluate whether selected facial anthropometric dimensions can serve as reliable predictors of OVD and to develop regression models for estimating the nasion-menton distance in a sample of the Bosnia and Herzegovina population.

Materials and Methods: This descriptive-analytical cross-sectional study included 60 subjects aged 20–45 years with preserved occlusal relationships and normal facial morphology. A total of 30 anthropometric parameters were measured using standardized techniques. Reliability was assessed using intraclass correlation coefficients. Simple linear regression was used to assess individual predictors, while multiple regression analysis (stepwise method) was applied to develop two models based on the presence or absence of intraoral landmarks.

Results: All analyzed variables showed statistically significant associations with the nasion-menton distance ($p < 0.001$), with the strongest correlations observed for bizygomatic width ($r = 0.947$), nasion-incision ($r = 0.895$), and nasion-gingival papilla tip ($r = 0.891$). Both regression models showed high predictive accuracy ($R^2 = 0.958$ and $R^2 = 0.950$), with better performance when intraoral landmarks were included.

Conclusion: Selected facial anthropometric parameters can estimate the occlusal vertical dimension with high accuracy. Regression models provide a reliable approach for clinical estimation, particularly when intraoral landmarks are available.

Keywords: occlusal vertical dimension; anthropometry; facial measurements; regression analysis

Introduction

Occlusal vertical dimension (OVD) is defined as the height of the face in the inter-cuspal position of the mandible and is commonly assessed as the distance between two midline facial reference points [1].

OVD is not a static parameter, as it may change under the influence of various clinical and biological factors, including occlusal wear, loss of posterior teeth, alterations of the occlusal surfaces of prosthetic restorations, and progressive resorption of edentulous ridges beneath dentures [2,3].

Establishing OVD represents a critical step in determining maxillomandibular relationships. In most prosthetic rehabilitation procedures, the primary therapeutic goal is to restore a physiological OVD, as this ensures optimal function, acceptable aesthetics, and biological stability [4]. Accurate determination of the original OVD facilitates patient adaptation to prosthetic restorations and contributes to overall treatment satisfaction [5,6].

Due to its considerable clinical importance, OVD has been extensively investigated for nearly a century [7]. Nevertheless, accurately defining its optimal value remains challenging, making it one of the most debated topics in prosthodontics.

Although numerous methods for determining OVD have been proposed, based on functional, morphological, anthropometric, or combined parameters, they all have inherent limitations, and none has demonstrated complete accuracy or universal applicability in clinical practice [8]. Current evidence demonstrates considerable variability in the results obtained with different methods, indicating the absence of a widely accepted clinical consensus [9-12].

Therefore, the use of multiple complementary approaches is recommended in clinical practice to improve the reliability of OVD assessment [13,14].

Among these approaches, anthropometric methods are particularly important, as they enable the estimation of OVD based on measurable and relatively stable morphological relationships [15]. These methods are objective and can be applied using direct facial measurements, as well as modern two-dimensional [16, 17] and three-dimensional digital techniques [18]. Despite advances in digital technology, direct facial anthropometry remains a reliable, widely used method due to its simplicity, reproducibility, and minimal technical requirements [19].

However, the application of anthropometric parameters requires caution when extrapolating results across different populations, since facial dimensions are influenced by factors such as sex, age, ethnicity, and geographic characteristics [20, 21].

Therefore, validation of these parameters within specific populations is essential. Data regarding the relationship between OVD and facial dimensions in the population of Bosnia and Herzegovina remain limited, which highlights the need for further research in this field.

Objective

The objective of this study was to evaluate whether selected facial anthropometric dimensions can serve as reliable predictors of occlusal vertical dimension and to develop regression models for its estimation in a sample of the Bosnia and Herzegovina population.

Materials and Methods

In this descriptive-analytical cross-sectional study, 60 subjects of both sexes, aged between 20 and 45 years, were included. The study was conducted at the Department of Prosthodontics, Faculty of Dentistry, University of Sarajevo, with the approval of the institutional Ethics Committee (No. 09-874-4/2012) and in accordance with the principles of the Declaration of Helsinki. All participants provided written informed consent.

The sample was formed based on predefined inclusion and exclusion criteria. The study included citizens of Bosnia and Herzegovina with an average facial width (Facial index 85%–89.99% according to Banister's classification), natural dentition, Class I canine and molar relationships, and preserved occlusal vertical dimension (OVD). One restoration per quadrant (crown, inlay, or on-lay) was allowed, as well as minor rotations or inclinations not involving the maxillary central incisors. Participants were required to have intact incisal edges of the maxillary central incisors, without differences in their vertical position, and to present no signs of interdental papilla loss between these teeth.

Individuals with a history of orthodontic treatment, skeletal discrepancies, temporomandibular disorders, orthognathic or aesthetic facial surgery, craniofacial trauma, congenital or acquired maxillofacial defects, prosthetic restorations, marked facial asymmetry, or a midline diastema were excluded from the study.

A total of 16 anatomical or geometrically derived landmarks were used in the study (8 midline and 8 bilateral points). Their locations were defined according to the standardized nomenclature proposed by Caple and Stephan [22], or are well established in clinical practice.

Landmarks were identified by inspection and, when necessary, palpation. Facial landmarks were marked with a non-toxic pencil, while intraoral and periocular landmarks were assessed visually. A total of 26 distances between predefined landmarks were evaluated. As four variables were measured under both open (OE) and closed eye (CE) conditions, the final number of anthropometric parameters included in the analysis was 30.

Distances measured in the facial midline included nasion–menton, nasion–sub-nasale, nasion–gingival papilla tip, nasion–incision, glabella–sub-nasale, sub-nasale–interpupillary line, sub-nasale–stomion superius, sub-nasale–incision, and supra-mentale–menton.

Transverse distances between paired bilateral landmarks included zygion_R–zygion_L, e exocanthion_R–endocanthion_L, –alare_L, crista philtri_R–crista philtri_L, gonion_R–gonion_L, pupil center–pupil center_L.

Distances located on one side of the face were measured bilaterally and included exocanthion_R–endocanthion_R, exocanthion_L, –tragus facial groove_L–tragus facial groove_L.

Distances involving a midline and a lateral landmark were also evaluated, including subnasal and exocanthion–incision measurements. These were recorded bilaterally under both eye conditions (OE and CE).

Most variables were measured using a digital caliper with straight arms, with a resolution of 0.01 mm and a measuring range of 0–150 mm (Emil Lux GmbH & Co. KG, Wermelskirchen, Germany). Bizygomatic and bigonial widths were evaluated using a digital caliper with curved arms, with a measuring range of 0–203.2 mm and an accuracy of 0.254 mm (Digital outside diameter caliper 35-OD8, iGaging DigiCal, San Clemente, California, USA). Interpupillary distance was measured using a digital pupillometer (Digital PD Ruler PDM 30H, Traversal (CN) LLC, Hangzhou, Zhejiang, China). All measuring instruments were disinfected using an antimicrobial agent (Zeta 3 Wipes, Zhermack SpA, Badia Polesine (RO), Italy) before and after use on each participant. All measurements were performed by a single trained examiner.

During the measurements, participants were seated upright, with the head positioned such that the Frankfort horizontal plane and the interpupillary line were parallel to the floor.

For interpupillary distance assessment, both the participant and the examiner were seated upright facing each other, with their eyes at the same level.

The inter-cuspal position served as the reference for most measurements, with the lips in light contact. When intraoral landmarks were used, participants retracted their lips to facilitate the proper positioning of the measuring instrument. Measurements of sub-nasale-stomion superius and sub-nasale-incision were performed with the mouth open during continuous pronunciation of the vowel "i".

During most measurements, the participant's gaze was directed straight ahead. Measurements involving periocular landmarks were performed either with the participant looking upwards or with the eyes closed.

All measurements, except interpupillary distance, were contact and non-compressive, with intentional soft tissue compression applied when measuring bizygomatic and bi-gonial widths until bony resistance was reached.

Each variable was measured twice during the same session, and the mean value was used as the reference. For interpupillary distance, the mean of three measurements was used, in accordance with the manufacturer's instructions for the digital pupillometer.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics (version 21, IBM Corp). Descriptive statistics included means with 95% confidence intervals, standard deviations, minimum and maximum values, as well as absolute and percentage frequencies. Differences between mean values were analyzed using the paired samples t-test, with a significance level set at 5%.

Prediction of the dependent variable (nasion-menton distance) was initially performed using simple linear regression. Subsequently, based on clinical criteria, two multiple linear regression models were developed using a stepwise method: the first model was intended for individuals with preserved intraoral landmarks (incision and gingival papilla tip), while the second model was constructed for individuals in whom these landmarks were not preserved.

The reliability of repeated measurements was assessed using intraclass correlation coefficients ICC(3,1) and ICC(3,2), based on a two-way mixed-effects model with a consistency criterion. The normality of the mean values of the two measurements was tested using the Shapiro-Wilk test.

Assumptions of the regression models were evaluated by residual analysis, including assessment of the normality of residuals (Shapiro-Wilk test). Multicollinearity was assessed post hoc by calculating variance inflation factor (VIF) values for predictor variables in the final stepwise regression models.

Results

A total of 60 subjects were included in the study, with equal distribution of males and females. The mean age of the participants was 25.35 ± 5.59 years. The mean facial index was $87.00 \pm 1.60\%$, with a range from 85.05% to 89.92%.

High intra-rater reliability between the two measurements was confirmed by intraclass correlation coefficients, with ICC (3,1) values ranging from 0.972 to 0.998 and ICC (3,2) values from 0.986 to 0.999. The Shapiro-Wilk test confirmed that the differences between the two measurements for most distances satisfied the assumption of approximate normality ($p > 0.05$).

Descriptive values of the dimensions measured in this study are presented in Table 1.

Analysis of differences between the mean values of the nasion-menton distance and all other evaluated dimensions showed that all tested measurements were statistically significantly different in relation to the nasion-menton distance (paired samples t-test, $p < 0.001$; 95% confidence level).

Comparison of the mean values of bilateral dimensions did not reveal statistically significant differences between the left and right sides of the face, except for the exocanthion_R-endocanthion_L and exocanthion_L-endocanthion_R distances, where a statistically significant difference was observed (paired samples t-test, $p = 0.004$; 95% confidence level).

Values of the simple linear regression models used to assess the predictive ability of the analyzed dimensions for the nasion-menton distance are presented in Table 2. All variables demonstrated statistically significant regression coefficients ($p < 0.001$). The strongest correlation was found for zygion_R-zygion_L ($r = 0.947$), followed by nasion-incision ($r = 0.895$) and nasion-gingival papilla tip ($r = 0.891$). The highest value of the regression coefficient b was observed for the exocanthion_R-endocanthion_R dimension ($b = 1.852$).

Table 1. Descriptive statistics of the measured dimensions (mm)

	n	Mean	Std.Dev.	Minimum	Maximum
zygion _R –zygion _L	60	133.230	7.133	120.800	150.000
nasion–menton	60	115.914	6.625	102.900	131.500
glabella–subnasale	60	64.832	4.563	54.740	77.750
nasion–subnasale	60	51.956	3.810	43.160	63.525
subnasale–exocanthion _{L(OE)}	60	73.082	4.104	66.195	86.535
subnasale–exocanthion _{L(CE)}	60	69.661	4.290	60.870	81.280
subnasale–exocanthion _{R(OE)}	60	73.615	4.401	66.495	88.005
subnasale–exocanthion _{R(CE)}	60	70.023	4.792	61.630	82.795
subnasale–interpupillary line	60	49.940	3.690	41.810	64.045
supramentale–menton	60	27.363	2.524	22.765	33.955
exocanthion _R –exocanthion _L	60	94.542	4.845	83.310	109.335
exocanthion _R –endocanthion _L	60	63.838	3.606	55.725	74.440
exocanthion _R –endocanthion _R	60	32.033	1.638	27.340	36.285
exocanthion _L –endocanthion _L	60	32.056	1.765	27.115	36.915
exocanthion _L –endocanthion _R	60	64.217	3.733	54.970	75.265
endocanthion _R –endocanthion _L	60	31.528	2.441	26.580	36.940
alare _R –alare _L	60	35.063	2.901	29.780	42.135
crista philtri _R –crista philtri _L	60	13.317	2.154	9.825	16.985
gonion _R –gonion _L	60	108.427	5.668	92.750	120.450
pupil center _R –pupil center _L	60	64.716	3.663	57.433	73.833
nasion–gingival papilla tip	60	69.361	4.359	59.990	81.205
nasion–incision	60	74.620	4.291	64.825	85.675
subnasale–stomion superius	60	21.767	2.440	16.980	27.955
subnasale–incision	60	26.074	2.582	21.115	31.865
exocanthion _{R(OE)} –incision	60	84.920	4.333	78.135	96.700
exocanthion _{R(CE)} –incision	60	80.685	4.400	73.020	91.430
exocanthion _{L(OE)} –incision	60	84.731	4.190	78.230	96.710
exocanthion _{L(CE)} –incision	60	80.582	4.295	73.505	91.465
exocanthion _R –tragus facial groove _R	60	77.886	4.631	68.735	91.930
exocanthion _L –tragus facial groove _L	60	77.584	4.548	67.330	88.925

The assumptions of simple linear regression were tested using residual analysis and were satisfied for all models presented in Table 2.

For the construction of the first multiple regression model to estimate the nasion–menton distance in individuals with preserved incision and gingival papilla tip landmarks, a total of 29 anthropometric measurements and the variable sex were included in the initial stepwise procedure. During the selection process, and according to the predefined criteria (Probability-of-F-to-enter ≤ 0.050 ; Probability-of-F-to-remove ≥ 0.100), the model retained five statistically most significant predictors: zygion_R–zygion_L, nasion–gingival papilla tip, supramentale–menton, endocanthion_R–endocanthion_L, and gonion_R–gonion_L.

The first multiple regression model showed a very strong association with the dependent variable ($R=0.979$; $R^2=0.958$; $p<0.001$), as demonstrated in Tables 3 and 4.

All regression coefficients in the first multiple regression model were statistically significant, with the strongest positive contribution from the nasion–gingival papilla tip distance ($b=0.586$). Other statistical parameters of the regression coefficients are presented in Table 5.

The obtained regression equation for predicting the nasion–menton distance in the first multiple regression model is as follows:

$$\text{nasion–menton} = 2.313 + 0.581 X_1 + 0.586 X_2 + 0.453 X_3 - 0.214 X_4 - 0.094 X_5$$

For the construction of the second multiple regression model to estimate the nasion–menton distance in individuals without preserved incision and gingival papilla tip landmarks, all variables from the previous model were included in the initial stepwise procedure, except those based on these specific landmarks.

Table 2. Prediction of the nasion–menton distance by simple linear regression

Variable X Variable Y	Mean	Mean X/Y	r	p	a	b
zygion _R –zygion _L nasion–menton	133.230 115.914	1.149	0.947	<0.001	-1.248	0.879
glabella–subnasale nasion–menton	64.831 115.914	0.559	0.628	<0.001	56.813	0.912
nasion–subnasale nasion–menton	51.956 115.914	0.448	0.781	<0.001	45.383	1.358
subnasale–exocanthion _{L(OE)} / nasion–menton	73.082 115.914	0.630	0.738	<0.001	28.805	1.192
subnasale–exocanthion _{L(CE)} / nasion–menton	69.661 115.914	0.601	0.678	<0.001	43.023	1.046
subnasale–exocanthion _{R(OE)} / nasion–menton	73.615 115.914	0.635	0.760	<0.001	31.685	1.144
subnasale–exocanthion _{R(CE)} / nasion–menton	70.023 115.914	0.604	0.732	<0.001	45.022	1.012
subnasale–interpupillary line nasion–menton	49.940 115.914	0.431	0.623	<0.001	60.060	1.118
supramentale–menton nasion–menton	27.363 115.914	0.236	0.611	<0.001	72.029	1.604
exocanthion _R –exocanthion _L nasion–menton	94.542 115.914	0.816	0.542	<0.001	45.825	0.741
exocanthion _R –endocanthion _L / nasion–menton	63.838 115.914	0.551	0.516	<0.001	55.361	0.949
exocanthion _R –endocanthion _R / nasion–menton	32.033 115.914	0.276	0.458	<0.001	56.580	1.852
exocanthion _L –endocanthion _L nasion–menton	32.056 115.914	0.277	0.474	<0.001	58.907	1.778
exocanthion _L –endocanthion _R nasion–menton	64.217 115.914	0.554	0.514	<0.001	57.390	0.911
endocanthion _R – endocanthion _L /nasion–menton	31.528 115.914	0.272	0.499	<0.001	73.248	1.353
alare _R –alare _L nasion–menton	35.063 115.914	0.302	0.534	<0.001	73.168	1.219
crista philtri _R –crista philtri _L nasion–menton	13.317 115.914	0.115	0.550	<0.001	93.382	1.692
gonion _R –gonion _L nasion–menton	108.427 115.914	0.935	0.550	<0.001	46.218	0.643
pupil center _R –pupil center _L /nasion– menton	64.716 115.914	0.558	0.500	<0.001	57.418	0.904
nasion–gingival papilla tip nasion–menton	69.361 115.914	0.598	0.891	<0.001	22.007	1.354
nasion–incision nasion–menton	74.620 115.914	0.644	0.895	<0.001	12.753	1.382
subnasale–stomion superius nasion–menton	21.767 115.914	0.188	0.675	<0.001	76.039	1.832
subnasale–incision nasion–menton	26.074 115.914	0.225	0.576	<0.001	77.411	1.477
exocanthion _{R(OE)} –incision nasion–menton	84.920 115.914	0.733	0.827	<0.001	8.572	1.264
exocanthion _{R(CE)} –incision nasion–menton	80.685 115.914	0.696	0.790	<0.001	19.970	1.189
exocanthion _{L(OE)} –incision nasion–menton	84.731 115.914	0.731	0.829	<0.001	4.800	1.311
exocanthion _{L(CE)} –incision nasion–menton	80.582 115.914	0.695	0.776	<0.001	19.512	1.196
exocanthion _R –tragus facial groove _R /nasion–menton	77.886 115.914	0.672	0.534	<0.001	56.441	0.764
exocanthion _L –tragus facial groove _L /nasion–menton	77.584 115.914	0.669	0.602	<0.001	47.881	0.877

Table 3. Model summary for the first multiple regression model

R	R Square	Std. Error of the Estimate
0.979	0.958	1.413

Predictors: (Constant), $zygion_R-zygion_L$, nasion–gingival papilla tip, supramentale–menton, endocanthion_R–endocanthion_L, gonion_R–gonion_L

Dependent Variable: nasion–menton

Table 4. Analysis of variance (ANOVA) for the first multiple regression model

	Sum of Squares	df	Mean Square	F	p
Regression	2481.533	5	496.307	248.574	<0.001
Residual	107.817	54	1.997		
Total	2589.350	59			

Predictors: (Constant), $zygion_R-zygion_L$, nasion–gingival papilla tip, supramentale–menton, endocanthion_R–endocanthion_L, gonion_R–gonion_L

Dependent Variable: nasion–menton

Table 5. Regression coefficients for the first multiple regression model

Model	b	Std. Error	t	p
Constant (a)	2.313	3.880	0.596	0.554
X ₁ $zygion_R-zygion_L$	0.581	0.061	9.500	<0.001
X ₂ nasion–gingival papilla tip	0.586	0.078	7.528	<0.001
X ₃ supramentale–menton	0.453	0.094	4.833	<0.001
X ₄ endocanthion _R –endocanthion _L	-0.214	0.093	-2.303	0.025
X ₅ gonion _R –gonion _L	-0.094	0.044	-2.117	0.039

Dependent Variable: nasion–menton

According to the same criteria, the model ultimately retained six statistically most significant predictors: $zygion_R-zygion_L$, sex, exocanthion_R–exocanthion_L, glabella–supra-nasale, supra-mentale–menton, and sub-nasale–stomion superius.

The second multiple regression model showed a very high level of association with the dependent variable ($R=0.974$; $R^2=0.950$; $p<0.001$), as shown in Tables 6 and 7.

All regression coefficients in the second multiple regression model were statistically significant, with the strongest positive contribution from the $zygion_R-zygion_L$ distance ($b=0.818$). Other statistical parameters of the regression coefficients are presented in Table 8.

The obtained regression equation for predicting the nasion–menton distance in the second multiple regression model is as follows:

$$\text{nasion–menton} = -11.982 + 0.818 X_1 - 2.896 X_2 - 0.186 X_3 + 0.241 X_4 + 0.438 X_5 + 0.471 X_6$$

In this model, the variable “sex” was retained as a predictor and was coded as 1 for male participants and 0 for female participants.

Normality of residuals was confirmed by the Shapiro–Wilk test in both multiple regression models (first model: $W=0.992$, $p=0.967$; second model: $W=0.991$, $p=0.938$). The distribution of residuals was symmetric and showed no marked deviations (first model: skewness=-0.018, kurtosis=-0.166; second model: skewness=-0.187, kurtosis=-0.208). Q–Q plots of the residuals demonstrated good agreement with normal distribution in both models, and no multicollinearity was detected, as all VIF values of the predictor variables retained in the final models were below the recommended thresholds.

Table 6. Model summary for the second multiple regression model

R	R Square	Std. Error of the Estimate
0.974	0.950	1.569

Predictors: (Constant), $zygion_R - zygion_L$, sex, $exocanthion_R - exocanthion_L$, glabella–subnasale, supramentale–menton, subnasale–stomion superius

Dependent Variable: nasion–menton

Table 7. Analysis of variance (ANOVA) for the second multiple regression model

	Sum of Squares	df	Mean Square	F	p
Regression	2458.823	6	409.804	166.399	<0.001
Residual	130.527	53	2.463		
Total	2589.350	59			

Predictors: (Constant), $zygion_R - zygion_L$, sex, $exocanthion_R - exocanthion_L$, glabella–subnasale, supramentale–menton, subnasale–stomion superius

Dependent Variable: nasion–menton

Table 8. Regression coefficients for the second multiple regression model

Model	B	Std. Error	t	p
Constant (a)	-11.982	5.797	-2.067	0.044
X ₁ $zygion_R - zygion_L$	0.818	0.067	12.240	<0.001
X ₂ sex	-2.896	0.613	-4.725	<0.001
X ₃ $exocanthion_R - exocanthion_L$	-0.186	0.056	-3.297	0.002
X ₄ glabella–subnasale	0.241	0.059	4.085	<0.001
X ₅ supramentale–menton	0.438	0.107	4.078	<0.001
X ₆ subnasale–stomion superius	0.471	0.126	3.744	<0.001

Dependent Variable: nasion–menton

Discussion

Determining the occlusal vertical dimension (OVD) remains a fundamental and unresolved challenge in contemporary prosthodontics, largely due to the lack of a universally accepted and reliably accurate method. Within this framework, and given the well-documented variability of facial characteristics across populations, the present study aimed to evaluate the predictive value of selected facial anthropometric parameters for estimating OVD in a sample of the Bosnia and Herzegovina population, in accordance with the recommendations of Ouni et al. [23], who emphasized the need to validate anthropometric parameters within each population prior to their clinical application.

The methodology applied in this study, based on direct anthropometry, in combination with a standardized participant selection and precisely defined reference landmarks, ensured a reliable assessment of facial dimensions relevant to OVD determination. The use of high-precision digital

measuring instruments, together with a rigorously controlled measurement protocol and a single calibrated examiner, further enhanced the accuracy and reproducibility of the obtained data. Moreover, the carefully established inclusion criteria minimized variability related to non-physiological occlusal and morphological deviations, thereby providing a valid basis for subsequent statistical analysis and regression model development.

Although OVD is most commonly assessed in clinical practice as the height of the lower third of the face (sub-nasale–menton distance) in the inter-cuspal position of the mandible, the present study adopted the nasion–menton distance as the dependent variable. This methodological choice was based on evidence from previous studies indicating that the nasion–menton distance can be assessed with greater reliability and consistency compared to the subnasale–menton distance [24,25].

According to the results of the present study, the mean nasion–menton distance was 115.914 mm, which is generally comparable to values reported in

regional studies, although certain discrepancies were noted [24,26-28]. The observed differences between populations suggest that the nasion-menton distance exhibits considerable population-specific variability, which may limit the direct application of universal anthropometric predictors in clinical practice. A relatively high standard deviation, as an indicator of variability, together with a wide range of values, reflects considerable interindividual variation in the nasion-menton distance, both in the present study and in regional investigations. This variability highlights pronounced differences among subjects and supports the use of regression models for identifying its predictors.

The results of the regression analysis indicate that the selected anthropometric dimensions demonstrate significant predictive capacity for the nasion-menton distance. Simple linear regression demonstrated statistically significant associations for all analyzed variables ($p < 0.001$). The strongest correlations were observed for bizygomatic width ($r = 0.947$), nasion-incision ($r = 0.895$), and nasion-gingival papilla tip ($r = 0.891$). These findings suggest that certain craniofacial dimensions exhibit a strong linear relationship with the nasion-menton distance. However, no single variable in this study accounted for the full variability of the dependent variable. This highlights the limitations of relying on individual anthropometric measures in the clinical assessment of OVD, as biological systems are inherently complex, multifactorial, and characterized by variability [29].

The findings related to bizygomatic width in the present study are consistent with the results reported by Delić et al. ($r = 0.9217$), who also identified this parameter as the strongest predictor [24], whereas a considerably weaker association was reported by Radović et al. ($r = 0.39$) [26]. These results support the relevance of individual anthropometric parameters. However, the discrepancies observed between studies suggest that their predictive value is not universal but rather influenced by population-specific characteristics.

In this context, multiple regression models provide a more reliable approach than the analysis of individual predictors and are widely used in studies focused on OVD assessment, including those by Kaffaf et al. [30] and Morata et al. [31].

The present study also applied multiple regression analysis to develop clinically applicable models for predicting the nasion-menton distance. Two models were constructed for different clinical situations, depending on the presence or absence of intraoral reference landmarks (gingival papilla tip and incision). This approach was based on the assumption that the presence of these landmarks allows for a more precise estimation of the occlusal vertical dimension, which was confirmed by the present findings.

In the first model, developed for subjects with preserved intraoral landmarks, five significant predictors were retained. The model showed a very high level of association ($R = 0.979$; $R^2 = 0.958$), indicating that it accounts for nearly all variability of the dependent variable. The strongest contribution was observed for the nasion-gingival papilla tip distance, while measurements related to the incision landmark were not significant predictors of OVD. Intercanthal and bigonial widths showed a negative association with the dependent variable.

The second model, developed for individuals without preserved intraoral landmarks, retained six predictors and showed a very high predictive value ($R = 0.974$; $R^2 = 0.950$). In this model, sex was the strongest predictor. Slightly lower R^2 values in the second model suggest reduced precision when key intraoral landmarks are absent, although the model still shows strong clinical applicability.

Sex was a significant predictor only in the second regression model, which can be explained by the variables included in each model. In the first model, the nasion-gingival papilla tip distance represents a direct segment of the nasion-menton distance and closely reflects vertical facial proportions. This reduces the need for additional predictors such as sex. In the second model, where such a predictor is not available, this information is

lacking. In that case, sex becomes a useful predictor, as it reflects general morphological differences between males and females and helps improve the estimation of the nasion–menton distance.

Compared to the results of simple regression analysis, both multiple regression models showed higher predictive accuracy, confirming that estimation of the nasion–menton distance is more reliable when based on the combined effect of multiple craniofacial parameters.

The lack of similar multivariate approaches in the available literature further highlights the contribution of this study, particularly in the context of developing models suited to different clinical situations. At the same time, this limits the possibility of direct comparison with existing studies.

The findings of this study should be considered in light of certain limitations, including the relatively small and population-specific sample. At the same time, clearly defined inclusion criteria and high measurement reliability support the

consistency of the results. A strength of this study is the use of a standardized measurement approach and multivariate analysis, which enabled a more accurate assessment of craniofacial relationships and resulted in models with high predictive value and potential clinical use. However, further studies on larger and more diverse samples, along with external validation, are needed to confirm their wider applicability.

Conclusions

The results of this study suggest that selected facial anthropometric parameters can predict the occlusal vertical dimension with a high degree of accuracy. The developed regression models, particularly those including intraoral landmarks, provide a reliable basis for clinical estimation and highlight the importance of population-specific validation.

Declaration of interest: The authors declare no conflict of interest.

References

1. The Glossary of Prosthodontic Terms 2023: Tenth Edition. *J Prosthet Dent.* 2023 Oct;130(4 Suppl 1):e1-e3.
2. Goldstein G, Goodacre C, MacGregor K. Occlusal Vertical Dimension: Best Evidence Consensus Statement. *J Prosthodont.* 2021 Apr;30(S1):12-19.
3. Abduo J, Lyons K. Clinical considerations for increasing occlusal vertical dimension: a review. *Aust Dent J.* 2012 Mar;57(1):2-10.
4. Yadfout A, El Aoud J, Merzouk N, Slaoui Hasnaoui J. Increasing Vertical Dimension of Occlusion (VDO): Review. *Clin Cosmet Investig Dent.* 2024 May 16;16:135-142. doi: 10.2147/CCIDE.S453704.
5. Fayad MI, Moussa R, Ragheb NA, Ahmed Y, Sultan S, AbdulSalam MR, Ismail HA, Elboraey MO, AbdElaziz MH, Helal MA. Vertical Dimension in Prosthodontics Theory and Practice (Part II): A Comprehensive Review of Vertical Dimension Determination in Prosthodontics From Classical Methods to Digital Innovation. *Cureus.* 2025 Oct 6;17(10):e93987.
6. Poggio CE, Manfredini D. Does increasing vertical dimension of occlusion in centric relation affect muscular activity? An electromyographic study. *J Esthet Restor Dent.* 2024;36(1):231-238.
7. Calamita M, Coachman C, Sesma N, Kois J. Occlusal vertical dimension: treatment planning decisions and management considerations. *Int J Esthet Dent.* 2019;14(2):166-181.
8. Fayad MI. A Literature Review of Vertical Dimension in Prosthodontics Theory and Practice - Part 1: Theoretical Foundations. *Cureus.* 2024 Jun 7;16(6):e61903.
9. Fayad MI, Elboraey MO, Mahmoud II, Shon AA, Fayad NI, Moussa R, Meer RMM. A novel formula for estimating the vertical dimension of occlusion using panoramic radiography. *BMC Oral Health.* 2024 Aug 8;24(1):917.

10. Pissiotis AL, Kamalakidis SN, Kirmanidou Y, Zahari E, Karpouzi R, Michalakis K. EPA Consensus Project Paper: The Vertical Dimension of Occlusion. How to Determine and How to Alter? A Systematic Review. *Eur J Prosthodont Restor Dent*. 2023 Jun 1. doi: 10.1922/EJPRD_2487Pissiotis13.
11. Alhajj MN, Khalifa N, Abduo J, Amran AG, Ismail IA. Determination of occlusal vertical dimension for complete dentures patients: an updated review. *J Oral Rehabil*. 2017 Nov;44(11):896-907.
12. Alhajj MN, Khalifa N, Amran A. Eye-rima oris distance and its relation to the vertical dimension of occlusion measured by two methods: Anthropometric study in a sample of Yemeni dental students. *Eur J Dent*. 2016 Jan-Mar;10(1):29-33.
13. den Haan R, Witter DJ. Occlusal vertical dimension in removable complete dentures. *Ned Tijdschr Tandheelkd*. 2011 Dec;118(12):640-5.
14. Strajnić L, Stanisić-Sinobad D, Marković D, Stojanović L. Cephalometric indicators of the vertical dimension of occlusion. *Coll Antropol*. 2008 Jun;32(2):535-41.
15. Goyal N, Kaurani P, Goyal A, Mangal S, Karuveettil V, Gutjahr G, Janakiram C. Correlation of anthropometric methods with standard method of recording the vertical dimension of occlusion: A systematic review and meta-analysis. *J Prosthet Dent*. 2026 Mar;135(3):528-538.
16. Strajnić L, Perić M, Živković N, Lemić AM, Vučinić N, Miličić B. Comparison of Face Anthropometry and Digital 2D-Face Photogrammetry as Methods for Predicting Vertical Dimension of Occlusion. *Int J Prosthodont*. 2024 Jun 21;(3):282-292.
17. Enkling N, Enkling-Scholl J, Albrecht D, Bornstein MM, Schimmel M. Determination of the occlusal vertical dimension in edentulous patients using lateral cephalograms. *J Oral Rehabil*. 2018 May;45(5):399-405.
18. Srinivasan M, Handel S, Bronzino I, Kamnoedboon P, McKenna G, Leles CR. Comparing analog and 3D measurements of vertical dimension in edentulous subjects. *J Dent*. 2025 Mar;154:105566.
19. Emam NM. Correlation Between Nose-to-Chin Distance and Other Measurements Used to Determine Occlusal Vertical Dimension. *Cureus*. 2024 May 16;16(5):e60443.
20. Zhong H, Tong Q. An Anthropometric Study of the Morphologic Facial Index of Tibetan Youth in Tibet. *J Craniofac Surg*. 2024 Mar-Apr 01;35(2):490-494.
21. Majeed MI, Haralur SB, Khan MF, Al Ahmari MA, Al Shahrani NF, Shaik S. An Anthropometric Study of Cranio-Facial Measurements and Their Correlation with Vertical Dimension of Occlusion among Saudi Arabian Subpopulations. *Open Access Maced J Med Sci*. 2018 Mar 28;6(4):680-686.
22. Caple J, Stephan CN. A standardized nomenclature for craniofacial and facial anthropometry. *Int J Legal Med*. 2016 May;130(3):863-79.
23. Ouni I, Jebali R, Amar S, Mansour L. Correlation between facial measurements and vertical dimension of occlusion among Tunisian populations: An anthropometric study. *J Dent Res Dent Clin Dent Prospects*. 2022 Spring;16(2):87-90.
24. Delić Z, Vukovojac S, Grzić R, Marčić D, Kovac Z, Kovacević D. Evaluation of craniometric methods for determination of vertical dimension of occlusion-Part 2. *Coll Antropol*. 2003;27 (Suppl 1):191-4.
25. Delić Z, Simunović-Soskić M, Perinić-Grzić R, Vukovojac S, Rajić Z, Kuna T, Kuna T. Evaluation of craniometric methods for determination of vertical dimension of occlusion. *Coll Antropol*. 2000;24 (Suppl 1):31-5.
26. Radović Z, Muretić Ž, Njemirovskij V, Gaži-Čoklica V. Kraniofacijalne posebnosti južnodalmatinske populacije. *Acta Stomatol Croat*. 2000;34(4):391-8.

27. Jeremić D, Kocić S, Vulović M, Sazdanović M, Sazdanović P, Jovanović B, et al. Anthropometric study of the facial index in the population of central Serbia. *Arch Biol Sci.* 2013;65(3):1163-8.
28. Grbesa D, Pezerović-Panijan R, Kalaya MN, Gorsić I, Cavčić A, Zura N, Berberović B. Craniofacial characteristics of Croatian and Syrian populations. *Coll Antropol.* 2007;31(4):1121-5.
29. Carr A, Diener C, Baliga NS, Gibbons SM. Use and abuse of correlation analyses in microbial ecology. *ISME J.* 2019 Nov;13(11):2647-2655.
30. Kaffaf MB, Şakar O. Evaluation of various anthropometric measurements for the determination of the occlusal vertical dimension. *J Prosthet Dent.* 2024 Sep;132(3):570-577.
31. Morata C, Pizarro A, Gonzalez H, Frugone-Zambra R. A craniometry-based predictive model to determine occlusal vertical dimension. *J Prosthet Dent.* 2020 Apr;123(4):611-617.

ASSOCIATION BETWEEN TEMPOROMANDIBULAR DYSFUNCTION AND PARAFUNCTIONAL ORAL HABITS IN STUDENTS

Una Šehović¹, Amela Đonlagić², Alma Kamber²,
Lejla Berhamović², Emir Berhamović², Sanela
Strujić-Porović*²

¹Private Dental Office

²Department of Prosthodontics and Dental Implantology, Faculty of Dentistry University of Sarajevo, Bosnia and Herzegovina

*Corresponding author

Sanela Strujić - Porović, PhD
University of Sarajevo -
Department of Prosthodontics
and Dental Implantology,
Faculty of Dentistry University
of Sarajevo
Bolnička 4a, Sarajevo, Bosnia
and Herzegovina
Phone: + 387 33 214 249
e-mail: sstrujic@sf.unsa.ba

DOI 10.69559/issn.2233-1794.2026.15.1.4

ABSTRACT

Objective: To examine the extent to which oral parafunctional habits may influence the development of temporomandibular disorders (TMD) in students.

Subjects and Methods: The sample consisted of students of the Faculty of Dentistry, Faculty of Medicine and Faculty of Architecture of the University of Sarajevo, a total of 183 students. Students received two questionnaires electronically, which are anonymous. The questionnaire related to the presence of symptoms and signs of TMD is the Fonesca anamnestic index. The second questionnaire is a Oral Behaviors Checklist (OBC), additional instruments of axis II of the new Diagnostic Criteria for Temporomandibular Disorders (DC/TMD).

Results: A total of 183 students were included in the research, of which 38 were men and 145 were women. 68 (37,2%) subjects were without TMD while 115 (62,8%) had TMD. The results of the ANOVA test showed that students who had symptoms and signs of TMD had on average a significantly higher score of parafunctional oral habits (OBC) compared to students who did not have TMD. There is a moderately strong positive correlation between the Oral Behaviors Checklist (OBC) and the Fonesco Anamnestic Index (FAI) ($r = 0.430$, $p < 0.001$, $n = 182$).

Conclusion: There is a significant association between parafunctional oral habits (OBC) and TMD symptoms (FAI).

Keywords: temporomandibular joint, parafunctional oral habits, temporomandibular disorders

Introduction

Temporomandibular disorders (TMDs) represent one of the primary causes of non-odontogenic pain in the orofacial region. Recent studies indicate that TMDs constitute a complex group of heterogeneous disorders with a multifactorial etiology, influenced by genetic factors, sex, and age. Symptoms may range from mild to debilitating pain accompanied by functional limitations, negatively affecting quality of life. Research has shown that the prevalence of TMDs is significantly higher in females than in males, which is attributed to several factors, primarily the influence of estrogen on joint structures [1-4].

The most common symptoms and signs of TMD include pain in the temporomandibular joint (TMJ) and associated muscles, myofascial pain, restricted mandibular movements, joint sounds within the TMJ, mandibular deviation and deflection during mouth opening, and headache. Pain may radiate to adjacent structures such as the dental arches, ear region, temporal region, occiput, shoulder girdle, and cervical spine, making diagnosis particularly challenging in some cases. Pain intensity may increase during function or parafunctional activities. In patients with bruxism characterized by tooth clenching, most commonly occurring during sleep, symptoms of pain and jaw stiffness are particularly pronounced in the morning. Restricted mandibular movements may result from intracapsular limitations within the TMJ or from muscular tension. Furthermore, symptoms such as headache, neck and shoulder pain, and hearing impairment are nonspecific for TMD and require differential diagnostic evaluation to exclude other etiologies. The first standardized research diagnostic criteria for TMD were the RDC/TMD [5-10]. Subsequently, the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) were introduced, consisting of two axes: Axis I, which focuses on physical diagnoses of the most common TMDs and pain assessment, and Axis II, which includes questionnaires evaluating behavioral and psychosocial factors that may predispose individuals to the development of these

disorders [11-14]. Studies have also shown that the Fonseca Anamnestic Index, which assesses the presence of TMD symptoms and signs, demonstrates high diagnostic accuracy [15-17]. Bruxism, object biting, lip and cheek biting, mouth breathing, and tongue thrusting between the dental arches are among the most common parafunctional habits found in the population. These habits can lead to muscle overload and hyperactivity, ultimately resulting in pain, tooth wear (abrasion), tooth fractures, periodontal changes, and tooth loss [18-20].

The aim of this study was to investigate the extent to which parafunctional oral habits may influence the development of TMD among students at the University of Sarajevo.

Subjects and Methods

The sample included students from the Faculty of Dentistry, Faculty of Medicine, and Faculty of Architecture at the University of Sarajevo, comprising a total of 183 participants. The students received two anonymous questionnaires electronically and completed them voluntarily after providing informed consent.

The questionnaire assessing the presence of TMD symptoms and signs was the Fonseca Anamnestic Index, which has high diagnostic accuracy. It consists of ten questions with three possible responses: "yes" (10 points), "sometimes" (5 points), and "no" (0 points). By summing the total score, TMD severity can be classified as follows: absence of symptoms (0-15 points), mild disorder (20-45 points), moderate disorder (50-65 points), and severe disorder (70-100 points) [15-17]. Based on these scores, participants were categorized into groups with and without TMD.

The second questionnaire was the Oral Behaviors Checklist (OBC), part of Axis II of the Diagnostic Criteria for Temporomandibular Disorders, used to assess parafunctional oral habits over the previous month. It consists of 21 items, including two related to sleep-related habits and 19 to habits during wakefulness. Questions 14 and 19,

related to singing and playing musical instruments involving the mouth or jaw, were excluded; therefore, 19 items were included in the evaluation. Sleep-related habits were scored as follows: never = 0, <1 night/month = 1, 1–3 nights/month = 2, 1–3 nights/week = 3, and 4–7 nights/week = 4. Awake behaviors were scored from 0 to 4 based on frequency: 0 = never, 1 = rarely, 2 = sometimes, 3 = frequently, and 4 = always during wakefulness. The total score ranged from 0 to 76 points [11–14], categorized as follows: 0 = none, 1–16 = low OBC, and 17–76 = high OBC.

Statistical methods of data analysis

Statistical analyses were performed using SPSS IBM software (version 22). Descriptive statistics included means and standard deviations for continuous variables, and absolute and relative frequencies for nominal variables. Parametric methods applied to quantitative variables included the independent samples t-test, one-way analysis of variance (ANOVA), and Pearson's correlation. The Mann–Whitney U test was used as a non-parametric method for nominal and ordinal variables.

Results

A total of 183 participants were included, comprising 38 males and 145 females. Of the total sample, 68 participants (37.2%) had no TMD, whereas 115 (62.8%) presented with TMD. The majority of participants (87%) reported mild TMD, while a smaller proportion reported moderate (9.6%) or severe TMD (3.5%). Cumulative percentages indicated that most participants (96.5%) had mild or moderate forms of the disorder, suggesting relatively low overall severity.

The Mann–Whitney U test revealed significant differences in the presence of parafunctional oral habits between groups with and without TMD. Participants with TMD exhibited certain habits more frequently compared to those without TMD, with statistically significant differences confirmed (Table 1).

The one-way analysis of variance (ANOVA) examined the relationship between parafunctional oral habit scores and the prevalence of TMD symptoms and signs. The results of the ANOVA (Table 2) showed significant differences in several aspects of oral health. Participants experiencing difficulty in mouth opening, muscle fatigue or pain during chewing, headaches, ear or TMJ pain, joint sounds during chewing or opening, tooth clenching or grinding, or occlusal discomfort demonstrated significantly higher score of parafunctional oral habits (OBC) compared to those without TMD symptoms and signs.

Correlation analysis demonstrated a weak to moderate positive correlation between the Oral Behaviors Checklist (OBC) and the Fonseca Anamnestic Index (FAI) ($r = 0.295$, $p < 0.001$, $n = 115$). The correlation coefficient indicates the presence of significant weak to moderate association between parafunctional oral habits (OBC) and TMD symptoms (FAI) (Figure 1). These findings suggest that individuals with TMD who report a higher frequency of parafunctional oral habits tend to exhibit a higher level of TMD symptoms and clinical signs.

The results of the Student's t-test indicated the presence of gender-related differences in the scores of the Fonseca Anamnestic Index (FAI) and the Oral Behaviors Checklist (OBC). The mean FAI score for male participants was 17.2 (SD = 16.2, $n = 38$), whereas female participants demonstrated a significantly higher mean score of 26.5 (SD = 15.9, $n = 145$). The t-test results confirmed a statistically significant difference between genders ($t = -3.19$, $p = 0.002$), indicating that women reported a higher frequency and severity of TMD symptoms and signs compared to men. With regard to parafunctional oral behaviors assessed using the OBC, the mean score for male participants was 22.0 (SD = 10.0, $n = 37$), while female participants exhibited a slightly higher mean score of 24.3 (SD = 8.0, $n = 145$). Although females demonstrated higher mean values, the difference was not statistically significant ($t = -1.32$, $p = 0.192$). These findings suggest that, despite observable differences in mean scores, there is insufficient statistical evidence to confirm significant gender-related differences in the prevalence of parafunctional oral behaviors (Table 3).

Table 1. Testing differences using the Mann–Whitney U test in the presence of oral parafunctional habits between groups with and without TMD

	Group				U	p
	Without TMD		With TMD			
	n	Mean Rank	n	Mean Rank		
Clenching or grinding of the teeth during sleep, of which you are aware or have been informed by another person	68	73.1	115	103.2	2625.0	0.000
Sleeping in a position that exerts pressure on the mandible	68	80.0	115	99.1	3095.5	0.012
Grinding of the teeth while awake	68	83.7	115	96.9	3344.0	0.021
Clenching of the teeth while awake	67	70.3	115	103.9	2430.5	0.000
Clenching, touching, or maintaining the teeth in contact when not eating.	68	76.2	115	101.3	2835.5	0.001
Tensing, straining, or maintaining contraction of the muscles without tooth contact or clenching	68	71.1	115	104.4	2487.0	0.000
Protrusion of the mandible forward or laterally, or maintaining it in that position	68	81.4	115	98.3	3189.5	0.008
Applying strong pressure to the teeth with the tongue.	68	81.4	115	98.3	3186.5	0.013
Positioning the tongue between the teeth.	68	88.5	115	94.1	3669.0	0.431
Biting or chewing the tongue, cheeks, or lips, or manipulating them with the tongue	68	79.3	115	99.5	3046.0	0.010
Maintaining the jaw in a rigid or tense position for the purpose of supporting or protecting it	68	80.5	115	98.8	3125.0	0.007
Holding objects between the teeth or biting on items such as hair, pencils or pens, fingers, nails, pipes, etc	68	83.9	115	96.8	3357.5	0.083
Chewing gum	68	93.8	115	90.9	3787.5	0.714
Supporting the chin with the hand	68	81.3	115	98.3	3184.0	0.029
Chewing food on only one side.	68	79.5	115	99.4	3058.0	0.011
Eating between meals (refers to food requiring mastication)	68	90.7	115	92.8	3818.5	0.779
Continuous speaking (e.g., teaching, sales presentations, customer service work	68	85.2	115	96.1	3444.5	0.159
Yawning	68	86.9	115	95.0	3562.5	0.268
Holding a phone between the head and shoulder	68	89.0	115	93.8	3707.0	0.524

n – sample size, Mean Rank – mean rank of variables, U – value of the Mann–Whitney U test for independent samples, p – probability of rejecting the null hypothesis at a 5% significance level

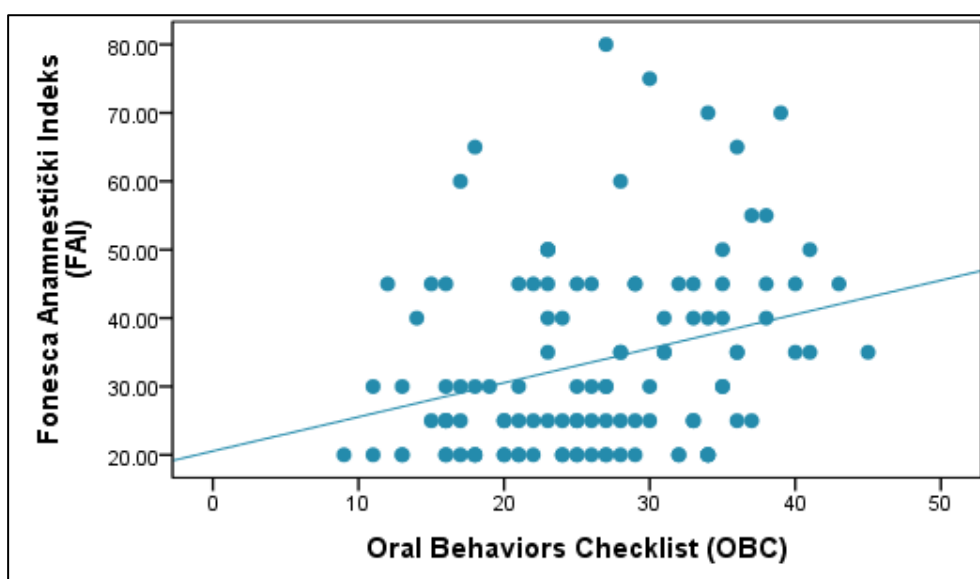


Figure 1. Correlation between oral parafunctional habits (OBC) and TMD symptoms (FAI)

Table 2. Association between prevalence of TMD signs and symptoms and parafunctional oral habits scores (OBC)

		Oral Behaviors Checklist (OBC)				
		n	Mean	SD	F	p
Do you experience difficulty during wide mouth opening?	No	143	23	8	3,226	0,042
	Sometimes	29	25	8		
	Yes	10	30	8		
Do you have difficulty in mandibular movement?	No	167	24	8	1,094	0,337
	Sometimes	8	27	7		
	Yes	7	27	9		
Do you experience fatigue or pain in the masticatory muscles during chewing?	No	141	23	8	5,956	0,003
	Sometimes	28	28	10		
	Yes	13	26	8		
Do you suffer from frequent headaches?	No	117	23	8	3,124	0,046
	Sometimes	38	26	9		
	Yes	27	26	9		
Do you have neck pain or cervical stiffness?	No	89	23	8	2,093	0,126
	Sometimes	41	25	9		
	Yes	52	25	8		
Do you have ear pain or pain in the TMJ region?	No	148	23	8	6,005	0,003
	Sometimes	17	30	7		
	Yes	17	26	8		
Have you ever noticed any sounds within your TMJ during chewing or mouth opening?	No	50	22	8	8,624	0,000
	Sometimes	35	21	7		
	Yes	97	26	8		
Do you have habits such as clenching or grinding your teeth?	No	98	21	8	14,074	0,000
	Sometimes	31	26	7		
	Yes	53	28	9		
Do you feel that your teeth do not occlude properly during biting?	No	109	22	8	7,343	0,001
	Sometimes	25	26	9		
	Yes	48	27	8		
Do you consider yourself a tense (nervous) person?	No	182	24	8		/
	Sometimes	0	.	.		
	Yes	0	.	.		

n – sample size, Mean – arithmetic mean, SD – standard deviation, F – value of the F-test (ANOVA), p – probability of rejecting the null hypothesis at a 5% significance level / – not tested due to an inappropriate frequency distribution in groups

Table 3. Testing differences in the degree of oral parafunctional habits and TMD symptoms between sexes

	Sex						t	p
	Male			Female				
	N	Mean	SD	N	Mean	SD		
Fonesca Anamnestički Indeks (FAI)	38	17,2	16,2	145	26,5	15,9	-3,19	0,002
Oral Behaviors Checklist (OBC)	37	22,0	10,0	145	24,3	8,0	-1,32	0,192

n – sample size, Mean – arithmetic mean, SD – standard deviation, t – value of the Student's t-test for independent samples, p – probability of rejecting the null hypothesis at a 5% significance level

Discussion

The findings of the present study demonstrated that specific parafunctional oral behaviors are significantly more prevalent among students with TMD compared to those without TMD. These behaviors include tooth clenching and grinding, sleeping in positions that exert pressure on the mandible, awake bruxism, maintaining tooth

contact (clenching or touching) when not engaged in mastication, sustained contraction of masticatory muscles without occlusal contact, mandibular protrusion or lateral movement, excessive tongue pressure against the dentition, biting or chewing of the tongue, cheeks, or lips, maintaining the mandible in a rigid or tense position for support or protection, resting the chin on the hand, and unilateral mastication (Table 1).

These findings are consistent with those reported by Hoffman et al. in whose study as many as 47% of participants with TMD reported the presence of parafunctional behaviors, particularly tooth clenching. Furthermore, their study indicated an increased prevalence of comorbid conditions among patients with TMD, including fibromyalgia, depression, rheumatoid arthritis, allergies, and chronic fatigue syndrome [2]. Several studies have demonstrated that individuals with bruxism have an elevated risk of developing temporomandibular disorders [3, 21-24]. Winocur et al. identified that in addition to bruxism there is other behavioral risk factors for intra-articular and muscular dysfunction, including habitual chin support, excessive gum chewing, and jaw play activities [18]. Beyond parafunctional behaviors, Özdiñç et al. emphasized the role of perceived stress and sleep quality. Their findings indicated that individuals with TMD exhibit poorer sleep quality and higher levels of perceived stress compared to healthy controls [15].

The results of the ANOVA test showed that students with higher scores of parafunctional oral behaviors (high OBC scores) had significantly greater prevalence of TMD-related symptoms and clinical signs, including difficulty in mouth opening ($p = 0.042$), muscle fatigue or pain during mastication ($p = 0.003$), pain in the temporomandibular joint (TMJ) region ($p = 0.003$), joint sounds during mouth opening or mastication ($p < 0.001$), parafunctional activities such as clenching or grinding ($p < 0.001$), perceived occlusal disharmony ($p < 0.001$), and headache ($p = 0.046$) (Table 2). These findings indicate a potentially harmful effect of parafunctional oral habits on the stomatognathic system. The present results are in agreement with findings reported by Michelotti et al. who suggested that parafunctional activities act as precipitating factors for certain TMD subgroups and that daytime clenching and grinding contribute to the development of myofascial pain as well as internal derangements of the temporomandibular joint, including disc displacement [19]. Conversely, studies by Manfredini and Lobbezoo indicate that prolonged jaw clenching may induce acute muscular tenderness but does not necessarily represent a

primary etiological factor in the onset of chronic pain conditions [25].

Furthermore, the results of this study demonstrated a weak to moderate positive correlation between parafunctional oral behaviors and TMD symptoms ($r = 0.295$, $p < 0.001$). Students exhibiting a higher frequency of parafunctional habits also presented with a greater number of TMD-related symptoms and signs (Figure 1). These findings suggest that parafunctional oral behaviors may play an important role in the multifactorial etiology of TMD and confirm their association as reported in previous studies [26, 27]. Glaros et al. reported that parafunctional oral habits, as well as emotional states such as stress and sadness, are strongly associated with the intensity of orofacial pain. Increased muscle tension resulting from parafunctional activity may lead to multiple biological consequences affecting both temporomandibular joints and masticatory muscles. Reduction of parafunctional activity through appropriate therapeutic interventions has been shown to significantly decrease pain intensity [28]. Similarly, Kobs et al. demonstrated a statistically significant relationship between the degree of palpatory tenderness of the masticatory muscles and temporomandibular joints and the intensity of clenching and grinding behaviors [29].

The present study also confirmed that female participants reported TMD symptoms and signs more frequently than male participants ($p = 0.002$) (Table 3), which is in accordance with findings by Hoffman et al. who reported that as many as 90% of female participants exhibited TMD-related symptomatology [2]. Likewise, Winocur et al. reported a higher prevalence of TMD symptoms and signs in females, identifying both parafunctional behaviors and female sex as significant risk factors in the development of TMD [18]. In contrast, no statistically significant difference was observed between male and female participants with regard to the prevalence of parafunctional oral behaviors (OBC scores) ($p = 0.192$), indicating that these behaviors were similarly distributed across both sexes.

Conclusion

The prevalence of TMD symptoms and clinical signs such as masticatory muscle and joint pain, difficulty in mouth opening, temporomandibular joint sounds, and headaches was higher among students with increased scores of parafunctional oral habits (OBC). Students exhibiting a greater number of parafunctional oral habits demonstrated a higher prevalence of TMD-related symptoms and

signs, thereby confirming a significant association between parafunctional oral habits (OBC) and TMD symptoms (FAI). Parafunctional oral habits represent an important contributing factor within the multifactorial etiology of temporomandibular disorders.

Declaration of interest: There is no conflict of interest.

References

1. Gauer R, Semidey M. Diagnosis and Treatment of Temporomandibular Disorders. *Am Fam Physician*. 2015; 91(6): 378-86.
2. Hoffmann RG, Kotchen JM, Kotchen TA, Cowley T, Dasgupta M, Cowley AW. Temporomandibular disorders and associated clinical comorbidities. *Clin J Pain*. 2011; 27(3): 268-274.
3. Bruguiera F, Sciote JJ, Roland-Billecart T, Raoul G, Machuron F, Ferri J, Nicot R. Preoperative parafunctional or dysfunctional oral habits are associated with the temporomandibular disorders after orthognathic surgery: An observational cohort study. *J Oral Rehabil*. 2019; 46(4): 321-329
4. Wadhwa S, Kapila S. TMJ Disorders: future innovations in diagnostics and therapeutics. *J Dent Educ*. 2008; 72(8): 930-47.
5. Ohrbach R, Dworkin SF. The Evolution of TMD Diagnosis. *J Dent Res*. 2016; 95(10): 1093-1101.
6. Wieckiewicz M, Boening K, Wiland P, Shiao YY, Paradowska-Stolarz A. Reported concepts for the treatment modalities and pain management of temporomandibular disorders. *J Headache Pain*. 2015; 16(106): 2-12.
7. Scrivani SJ, Keith DA, Kaban LB. Temporomandibular Disorders. *N Engl J Med*. 2008; 359(25): 2693-2705.
8. Yule PL, Durham J, Wassell RW. Pain part 6: temporomandibular disorders. *Dent Update*. 2016; 43(1): 39-48.
9. Okeson JP. Temporomandibularni poremećaji i okluzija. Zagreb: Medicinska naklada. 2008.
10. Ingawale S, Goswami T. Temporomandibular Joint: Disorders, Treatments, and Biomechanics. *Ann Biomed Eng*. 2009; 37(5): 976-996.
11. Schiffman E, Ohrbach R. Executive summary of the diagnostic criteria for temporomandibular disorders for clinical and research applications. *J Am Dent Assoc*. 2016; 147(6): 438-445.
12. Ohrbach R, editor. Diagnostic Criteria for Temporomandibular Disorders: Assessment Instruments. Version 15May2016. [Dijagnostički kriteriji za temporomandibularne poremećaje (DK/TMP) Instrumenti procjene: Croatian Version 23March2021] Spalj S, Katic V, Alajbeg I, Celebic A. Trans. www.rdc-tmdinternational.org Accessed on May 15, 2024.
13. Ohrbach R, Knibbe W. Diagnostic Criteria for Temporomandibular Disorders: Scoring Manual for Self-Report Instruments. Version 29May 2016. www.rdc-tmdinternational.org Accessed on May 15, 2024.
14. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet J et al. Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest. *J Oral Facial Pain Headache*. 2014;28(1):6-27.
15. Özdiñç S, Ata H, Halit H, Başak Can H, Sermenli N, Nesrin Turan F. Temporomandibular joint disorder determined by Fonseca anamnestic index and associated factors in 18- to 27-year-old university students. *Cranio* 2020 Sep;38(5): 327-332.

16. Dos Santos Berni KC, Vieira Dibai-Filho A, Rodrigues-Bigaton D. Accuracy of the Fonseca anamnestic index in the identification of myogenous temporomandibular disorder in female community cases. *J Bodyw Mov Ther.* 2015 Jul;19(3): 404-9.
17. Campos JADB, Gonçalves DA, Camparis C, et al. Reliability of a questionnaire for diagnosing the severity of temporomandibular disorder. *Rev Bras Fisioter.* 2009;13(1): 38-43.
18. Winocur E, Littner D, Adams I, Gavish A. Oral habits and their association with signs and symptoms of temporomandibular disorders in adolescents: a gender comparison. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006;102(4): 482-487.
19. Michelotti A, Cioffi I, Festa P, Scala G, Farella M. Oral parafunctions as risk factors for diagnostic TMD subgroups. *J Oral Rehabil.* 2010;37(3): 157-162.
20. Goldstein RE, Clark WA. The clinical management of awake bruxism. *J Am Dent Assoc.* 2017;148(6): 387-391.
21. Ohayon MM, Li KK, Guilleminault C. Risk factors for sleep bruxism in the general population. *Chest.* 2001;119(1): 53-61.
22. Shetty S, Pitti V, Satish Babu CL, Surendra Kumar GP, Deepthi BC. Bruxism: a literature review. *J Indian Prosthodont Soc.* 2010;10(3): 141-8.
23. Lobbezoo F, Ahlberg J, Glaros AG, Kato T, Koyano K, Lavigne GJ et al. Bruxism defined and graded: an international consensus. *J Oral Rehabil.* 2013;40(1): 2-4.
24. Giraki M, Schneider C, Schafer R, Singh P, Franz M, Raab WHM et al. Correlation between stress, stress-coping and current sleep bruxism. *Head Face Med.* 2010;6(1): 2.
25. Manfredini D, Lobbezoo F. Relationship between bruxism and temporomandibular disorders: a systematic review of literature from 1998 to 2008. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010;109(6): 26-50.
26. Karabicak GO, Hazar Kanik Z. Temporomandibular disorder prevalence and its association with oral parafunctions, neck pain, and neck function in healthcare students: A cross-sectional study. *Cranio.* 2023 Jan;41(1):9-15.
27. Paduano S MD, DDS, Bucci R DDS, PhD, Rongo R DDS, PhD, Silva R DDS, Michelotti A DDS. Prevalence of temporomandibular disorders and oral parafunctions in adolescents from public schools in Southern Italy. *Cranio.* 2020 Nov;38(6):370-375. doi: 10.1080/08869634.2018.1556893. Epub 2018 Dec 14. PMID: 30547719.
28. Glaros AG, Williams K, Lausten L. The role of parafunctions, emotions and stress in predicting facial pain. *J Am Dent Assoc.* 2005;136(4): 451-458.
29. Kobs G, Bernhardt O, Kocher T, Meyer G. Oral parafunctions and positive clinical examination findings. *Baltic Dent Maxillofac J.* 2005;7(3): 81-83.
30. Rugh JD, Harlan J. Nocturnal bruxism and temporomandibular disorders. *Adv Neurol.* 1988; (49): 329-41.

ASSOCIATION BETWEEN THE THREE-DIMENSIONAL INDEX AND PANORAMIC ANGULAR PARAMETERS (α AND θ ANGLES) IN IMPACTED MAXILLARY CANINES

Azra Jelesković^{*1}, Vildana Džemidžić¹, Alisa Tiro¹,
Maida Mehadžić², Tamara Topalović Starović³,
Lejla Redžepagić Vražalica¹

¹Department of Orthodontics, School of Dental Medicine, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

²Primary Health Care Center, Bihać, Bosnia and Herzegovina

³Private Dental Practice, Mostar, Bosnia and Herzegovina

DOI 10.69559/issn.2233-1794.2026.15.1.5

*Corresponding author

Azra Jelesković
Department of Orthodontics,
School of Dental Medicine,
University of Sarajevo
Bolnička 4a, 71000 Sarajevo,
Bosnia and Herzegovina
E-mail:
azra.jeleskovic@gmail.com

ABSTRACT

Introduction: Impacted maxillary canines are among the most common orthodontic anomalies and often require comprehensive radiographic assessment for accurate diagnosis and treatment planning. The KPG index is a CBCT-based three-dimensional classification system used to evaluate the severity of canine impaction.

Aim: To assess the association between the KPG index and angular parameters (α and θ angles) in impacted maxillary canines.

Materials and Methods: This retrospective study included 30 patients with impacted maxillary canines treated at the Department and Clinic of Orthodontics, Faculty of Dental Medicine, University of Sarajevo. Cone-beam computed tomography (CBCT) scans and panoramic radiographs were analyzed. The KPG index was determined from CBCT images, while α and θ angles were measured on panoramic radiographs. Correlation analysis was performed to evaluate the relationship between the KPG index and angular parameters.

Results: The mean KPG index was 13.17 ± 7.29 , the mean α angle was $32.93 \pm 21.34^\circ$, and the mean θ angle was $53.87 \pm 19.91^\circ$. A statistically significant moderate positive correlation was found between the KPG index and α angle ($r_s = 0.635$, $p < 0.001$). No statistically significant association was observed between the KPG index and θ angle ($r_s = -0.234$, $p = 0.206$).

Conclusion: The α angle showed a significant positive association with the KPG index and may represent a useful adjunctive parameter in the assessment of impacted maxillary canines. In contrast, the θ angle was not significantly associated with impaction severity. Although panoramic radiographs provide valuable diagnostic information, CBCT-based three-dimensional imaging remains the gold standard for evaluating impacted maxillary canines and supporting orthodontic treatment planning.

Keywords: impacted maxillary canine; KPG index; cone-beam computed tomography; panoramic radiography; orthodontic diagnosis.

Introduction

Impaction of maxillary canines represents a common orthodontic anomaly, and, after third molars, maxillary canines are the most frequently impacted teeth in the human dentition [1]. The reported prevalence of impacted maxillary canines ranges from 0.9% to 3.3%, occurring more frequently in females and predominantly presenting with palatal localization [2].

Permanent maxillary canines play a crucial role in masticatory function, dentofacial aesthetics, occlusal harmony, and dental stability [3]. Therefore, early recognition of this condition is of great importance, as it enables more accurate diagnosis, appropriate treatment planning, and prevention of complications associated with impacted canines and their management [4].

Timely and accurate diagnosis of impacted canines is essential due to potential complications such as root resorption of adjacent teeth, cystic changes, and ankylosis of the affected tooth [5,6].

Several imaging modalities are available for the assessment of impacted canines, including panoramic radiography (PR) and cone-beam computed tomography (CBCT). Panoramic radiographs provide a two-dimensional representation of a three-dimensional structure and may therefore result in diagnostic inaccuracies caused by image distortion and superimposition of anatomical structures, which represent the major limitations of this technique [7].

The introduction of CBCT has enabled detailed three-dimensional evaluation of impacted canines, including their position, angulation, relationship with adjacent teeth, and surrounding anatomical structures. CBCT demonstrates superior diagnostic accuracy compared with conventional radiographic methods, particularly in the assessment of adjacent root resorption and surgical-orthodontic treatment planning [8].

Several classification systems and diagnostic approaches have been proposed to evaluate the

severity, position, and treatment difficulty of impacted maxillary canines. Traditionally, two-dimensional methods based on panoramic radiographs have been widely used in clinical practice. These include sector analysis and angular measurements, such as the α and θ angles, which have been shown to assist in predicting canine impaction, estimating treatment difficulty, and evaluating eruption prognosis [9-11].

Furthermore, treatment difficulty indices based on panoramic radiographs have been developed to estimate the complexity of orthodontic management and expected treatment duration [12]. Classification systems such as the Yamamoto classification have also been used to describe the position and orientation of impacted teeth using panoramic radiographs [13].

Among three-dimensional classification systems, the KPG index is one of the most widely used CBCT-based methods for assessing impacted maxillary canines. The abbreviation KPG originates from the surnames of its developers, Kau, Pan, and Gallerano, who first introduced the index in 2009 as a three-dimensional classification system for canine impactions [14]. The system was subsequently validated and adopted for broader clinical application, demonstrating good reliability and reproducibility in assessing treatment difficulty and canine position [8,15].

The KPG index evaluates the position of both the canine cusp tip and root tip in three spatial dimensions (x, y, and z planes), allowing a comprehensive assessment of impaction severity. Based on the total score, impactions are classified as easy, moderate, difficult, or extremely difficult, thereby providing a more objective evaluation of treatment complexity and orthodontic management [14]. Because of its three-dimensional nature, the KPG index can identify positional characteristics that may not be adequately visualized on conventional radiographs. Consequently, CBCT-based assessment is particularly valuable in cases of severe displacement, suspected root resorption, or when detailed surgical-orthodontic treatment planning is required. However, clinicians should

carefully consider the benefits and risks of CBCT imaging before exposing patients to additional ionizing radiation [16,17].

Panoramic radiography remains the most commonly used initial imaging modality because of its lower radiation dose, lower cost, and widespread availability.

In addition to three-dimensional classification systems, angular parameters also play an important role in the diagnostic assessment of impacted canines, particularly the α and θ angles. The α angle describes the inclination of the impacted canine relative to the midline, while the θ angle provides an additional parameter for evaluating the spatial position and direction of impaction. Increased angular values have been associated with more severe impactions, greater risk of complications, and more complex orthodontic treatment [18].

Although both the KPG index and panoramic angular measurements have been extensively described individually in the literature, studies investigating their mutual relationship remain limited. To the best of our knowledge, few studies have specifically evaluated the association between CBCT-based KPG index scores and conventional panoramic angular parameters, despite their frequent use in routine orthodontic diagnostics. Determining the correlation between the KPG index and angular measurements may contribute to a more precise assessment of impaction severity and assist clinicians in establishing an accurate diagnosis and selecting the most appropriate treatment approach.

Therefore, this study aimed to evaluate the association between the KPG index and angular measurements (α and θ angles) in impacted maxillary canines.

Materials and Methods

This retrospective study was conducted at the Department and Clinic of Orthodontics, Faculty of Dental Medicine, University of Sarajevo. The study included the analysis of 30 cone-beam computed

tomography (CBCT) scans and 30 panoramic radiographs (OPG) of orthodontic patients with impacted maxillary canines. Ethical approval was obtained from the Ethics Committee under protocol number 02-3-4-17-2-2/26 dated April 10, 2026.

The database of the Department and Clinic of Orthodontics, Faculty of Dental Medicine, University of Sarajevo, was reviewed for the period from 2012 to 2026. Inclusion criteria were patients older than 11 years with impacted maxillary canines who possessed both CBCT and panoramic radiographs. Exclusion criteria included poor image quality and patients with associated pathologies or craniofacial anomalies such as syndromes, cleft lip and palate, and severe developmental abnormalities.

The following parameters were collected for each patient: KPG index score, α angle, and θ angle. Angular measurements were performed on panoramic radiographs. For α angle determination, the long axis of the impacted canine and the facial midline were used [9,10]

The facial midline was defined by a line passing through the midpoint between the maxillary central incisors and the anterior nasal spine. The maxillary occlusal plane was determined by connecting the incisal edge of the maxillary central incisor on the examined side with the mesio-buccal cusp tip of the maxillary first molar. The angle formed between the long axis of the impacted canine and the maxillary occlusal plane represented the θ angle [10, 11].

CBCT images were evaluated using the KPG index, which assesses the position of impacted canines in three spatial dimensions (x, y, and z). The index evaluates both the cusp tip and root tip positions according to their deviation from the normal eruption pathway, with each parameter scored on a scale from 0 to 5. The KPG index was originally introduced by Kau et al. in 2009 as a three-dimensional classification system for impacted maxillary canines [14].

The x-zone represents the horizontal dimension and evaluates the mesiodistal position of the canine cusp tip and root tip relative to adjacent teeth using reconstructed panoramic views from CBCT images [14]. The y-zone represents the vertical dimension

and evaluates the vertical position of the canine cusp tip and root tip relative to adjacent teeth [14]. The z-zone represents the bucco-palatal dimension and evaluates the buccolingual position of the impacted canine using axial CBCT sections [14]. Each variable was assigned a score ranging from 0 to 5.

The total KPG index score was obtained by summing the scores of the cusp tip and root tip positions in all three spatial dimensions (x, y, and z). Based on the final score, the severity of impaction was categorized according to the original KPG index classification proposed by Kau et al. [14]:

0–9 points: Easy impaction

10–14 points: Moderate impaction

15–19 points: Difficult impaction

20 points or more: Extremely difficult impaction

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics software (IBM Corp., Armonk, NY, USA). Descriptive statistical methods were used to present the collected data, including mean values, standard deviations, minimum and maximum values for the KPG index, α angle, and θ angle.

The normality of data distribution was assessed using the Shapiro–Wilk test. Since the α angle did not show a normal distribution ($p < 0.05$), correlations between the KPG index and angular

parameters were evaluated using Spearman's rank correlation coefficient. The strength of correlation was interpreted as weak (0.00–0.39), moderate (0.40–0.69), and strong (0.70–1.00). Statistical significance was set at $p < 0.05$.

Results

The Shapiro–Wilk test demonstrated normal distribution for the KPG index ($p = 0.099$) and θ angle ($p = 0.305$), whereas the α angle showed a non-normal distribution ($p = 0.014$). Therefore, Spearman's rank correlation coefficient was used for correlation analysis.

The study included 30 patients with impacted maxillary canines. The mean KPG index was 13.17 ± 7.29 , the mean α angle was 32.93 ± 21.34 , and the mean θ angle was 53.87 ± 19.91 (Table 1).

A statistically significant moderate positive correlation was observed between the KPG index and α angle ($r_s = 0.635$, $p < 0.001$). The scatter plot demonstrated a positive association between the KPG index and α angle values (Figure 1).

In contrast, no significant correlation was found between the KPG index and θ angle ($r_s = -0.234$, $p = 0.206$), indicating no statistically significant association between these variables (Table 2).

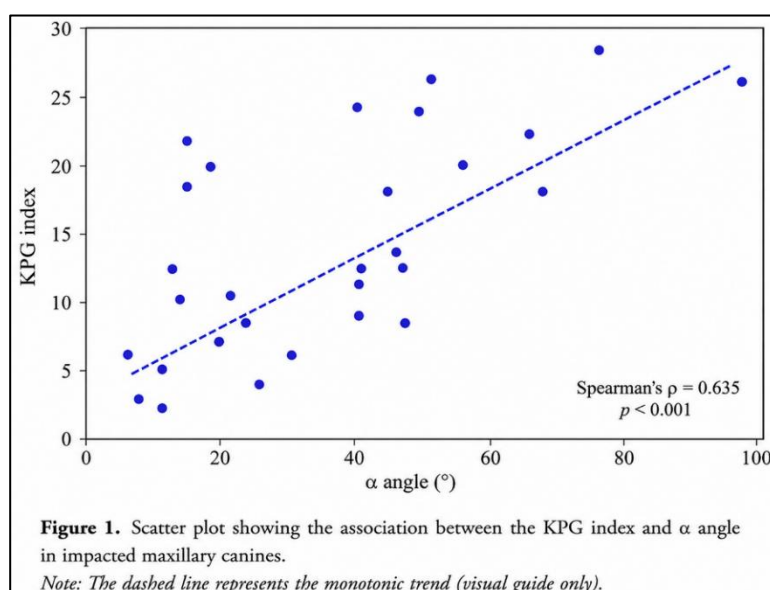


Figure 1. Correlation between the KPG index and α angle in impacted maxillary canines.

Table 1. Descriptive statistics of evaluated variables

Variable	Mean	SD	Distribution
KPG index	13.17	7.29	Normal
α angle (°)	32.93	21.34	Non-normal
θ angle (°)	53.87	19.91	Normal

Table 2. Correlation analysis between the KPG index and angular parameters

Variables	Spearman's ρ (rs)	p-value	Interpretation
KPG index vs α angle	0.635	<0.001	Moderate positive correlation
KPG index vs θ angle	-0.234	0.206	No significant correlation

Note: Spearman's rank correlation coefficient was used because the α angle did not show a normal distribution according to the Shapiro–Wilk test.

Discussion

The present study evaluated the association between the KPG index and angular parameters (α and θ angles) in impacted maxillary canines. The results demonstrated a statistically significant moderate positive correlation between the KPG index and α angle ($rs = 0.635$, $p < 0.001$), whereas no significant correlation was found between the KPG index and θ angle ($rs = -0.234$, $p = 0.206$).

Impacted maxillary canines represent one of the most challenging conditions in orthodontic diagnosis and treatment planning. Accurate assessment of canine position is essential because the severity of displacement directly influences treatment complexity, duration, and prognosis. The introduction of cone-beam computed tomography (CBCT) has enabled three-dimensional evaluation of impacted canines, overcoming the limitations of conventional two-dimensional radiography. Consequently, the KPG index was developed as a CBCT-based three-dimensional classification system for assessing the position and treatment difficulty of impacted maxillary canines [8]. The reliability and reproducibility of the KPG index have been confirmed in previous investigations, supporting its clinical applicability [15].

The significant positive correlation between the KPG index and the α angle observed in the present study suggests that greater canine angulation is associated with greater displacement severity. This finding is consistent with the concept that angular deviation reflects the extent to which the impacted canine differs from its normal eruption path. Previous studies have shown that

increased canine angulation is frequently associated with more complicated orthodontic traction and less favorable eruption patterns [9]. Furthermore, several authors have emphasized that radiographic angular measurements can provide valuable prognostic information regarding treatment difficulty and treatment duration [19].

Nevertheless, the correlation identified in this study was moderate rather than strong, indicating that α angle alone cannot fully explain the variability in KPG scores. This observation is expected because the KPG index incorporates multiple spatial dimensions, including the position of both the crown and root in the sagittal, vertical, and transverse planes [14]. Therefore, while angular measurements provide useful information, they cannot replace a comprehensive three-dimensional assessment. Similar conclusions were reported by Dalessandri et al., who demonstrated that CBCT-based KPG evaluation offers more reliable assessment of impacted canines than conventional two-dimensional measurements alone [15].

In contrast, no statistically significant relationship was observed between the KPG index and θ angle. The weak negative correlation found in the present study suggests that θ angle may not be a reliable indicator of impaction severity. This lack of association may be explained by the fact that θ angle evaluates only a specific aspect of canine orientation and may be influenced by individual anatomical variations. Additionally, the multidimensional nature of the KPG index likely captures positional characteristics that are not adequately represented by a single angular measurement. Similar findings

have been reported in studies investigating the relationship between skeletal and positional variables and KPG scores, where certain radiographic parameters showed limited predictive value for treatment difficulty [20].

From a clinical perspective, the present findings suggest that α angle may serve as a useful adjunctive parameter during the initial assessment of impacted maxillary canines, particularly when CBCT analysis is not immediately available. However, treatment planning should not rely solely on angular measurements. Comprehensive CBCT evaluation and KPG index assessment remain essential for accurate estimation of treatment complexity and prognosis. Recent validation studies have further demonstrated that although the KPG index has good predictive value and reliability, additional factors such as patient age, root morphology, adjacent root resorption, and treatment mechanics should also be considered when determining treatment difficulty [21].

These findings are consistent with the results of the systematic review and meta-analysis by Peralta-Mamani et al. [17], which compared CBCT and panoramic radiography in the assessment of impacted maxillary canines and root resorption of adjacent teeth. The authors concluded that CBCT provides a statistically significantly more accurate evaluation of the mesiodistal and labio-palatal position of impacted canines, as well as their relationship to adjacent teeth and the presence of root resorption. Furthermore, CBCT was shown to provide clinically relevant information that may significantly contribute to diagnosis and treatment planning in cases where panoramic radiographs are insufficient. These findings further support the results of the present study and reinforce the role of three-dimensional imaging as the gold standard in the assessment of impacted maxillary canines.

The present study has several limitations. The sample size was relatively small and all patients were recruited from a single institution, which may limit the generalizability of the findings. Furthermore, the retrospective design may have introduced selection bias. Future studies, including larger multicenter samples, are warranted to further investigate the relationship between the KPG index and panoramic angular parameters.

Conclusion

In conclusion, the results of this study demonstrated a statistically significant, moderate positive correlation between the KPG index and the α angle, indicating that greater canine angulation is associated with greater impaction severity. In contrast, the θ angle showed no significant association with the KPG index.

These findings suggest that the α angle may serve as a useful adjunctive diagnostic parameter, while the KPG index remains a comprehensive three-dimensional tool for assessing the severity of impacted maxillary canines and facilitating orthodontic treatment planning. Although panoramic radiographs (OPGs) can provide valuable information for the initial diagnosis and treatment planning of impacted maxillary canines, three-dimensional CBCT-based imaging is currently considered the gold standard, as it enables a more accurate assessment of tooth position, its relationship to adjacent anatomical structures, and potential treatment-related complications.

Declaration of Interest: The authors declare that they have no financial, professional, or personal interests that could have influenced the results, interpretation of data, or conclusions presented in this manuscript. The authors further declare that there is no conflict of interest related to the publication of this work.

References

1. Chrystinasari NA, Narmada IB, Triwardhani A. Position of unilateral/bilateral permanent canine impaction on the prognosis of treatment with KPG index: 3D cone beam computed tomography analysis. *J Int Dent Med Res*. 2021;14(4):1523-1530.
2. Ceraulo S, Barbarisi A, Oliva B, Moretti S, Caccianiga G, Lauritano D, et al. Treatment options in impacted maxillary canines: a literature review. *Dent J (Basel)*. 2025;13(9):433.
3. Wriedt S, Jaklin J, Al-Nawas B, Wehrbein H. Impacted upper canines: examination and treatment proposal based on 3D versus 2D diagnosis. *J Orofac Orthop*. 2012;73:28-40.
4. Park JH, Srisurapol T, Tai K. Impacted maxillary canines: diagnosis and management. *Dent Today*. 2012;31:62,64-66.
5. Liu DG, Zhang WL, Zhang ZY, Wu YT, Ma XC. Localization of impacted maxillary canines and observation of adjacent incisor resorption with cone-beam computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008;105:91-98.
6. Lai CS, Suter VG, Katsaros C, Bornstein MM. Localization of impacted maxillary canines and root resorption of neighbouring teeth: a study assessing the diagnostic value of panoramic radiographs in two groups of observers. *Eur J Orthod*. 2014;36:450-456.
7. Bender IB. Factors influencing the radiographic appearance of bony lesions. *J Endod*. 1982;8:161-170.
8. San Martín DE, English JD, Kau CH, Gallerano RL, McGrory KR, Salas AM, et al. The KPG index—a novel 3D classification system for maxillary canine impactions. *Tex Dent J*. 2012;129(3):265-274.
9. Ericson S, Kurol J. Radiographic assessment of maxillary canine eruption in children with clinical signs of eruption disturbance. *European Journal of Orthodontics*. 1986;8(3):133-140.
10. Warford JH Jr, Grandhi RK, Tira DE. Prediction of maxillary canine impaction using sectors and angular measurement. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2003;124(6):651-655.
11. Lindauer SJ, Rubenstein LK, Hang WM, Andersen WC, Isaacson RJ. Canine impaction identified early with panoramic radiographs. *Journal of the American Dental Association*. 1992;123(3):91-97.
12. Pitt S, Hamdan A, Rock P. A treatment difficulty index for unerupted maxillary canines. *Eur J Orthod*. 2006;28(2):141-144.
13. Yamamoto G, Ohta Y, Tsuda Y, Tanaka A, Nishikawa K, Tanne K. A new classification of impacted canines and second premolars using orthopantomography. *Angle Orthod*. 2003;73(5):516-520.
14. Kau CH, Pan P, Gallerano RL, English JD, Xia JJ, McGrory KR. A novel 3D classification system for canine impactions—the KPG index. *Int J Med Robot*. 2009;5(3):291-296.
15. Dalessandri D, Migliorati M, Rubiano R, Visconti L, Contardo L, Di Lenarda R, Martin C. Reliability of a novel CBCT-based 3D classification system for maxillary canine impactions in orthodontics: the KPG index. *Scientific World Journal*. 2013 Oct 9; 2013:921234.
16. Rodrigues MGS, Alarcón OMV, Rocha ECJF, Capelozza ALA. Cone-beam computed tomography: formation of the image, indications and selection criteria. *Odontol Clín-Cient*. 2010;9:115-118.
17. Peralta-Mamani M, Rubira CM, López-López J, Honório HM, Rubira-Bullen IR. CBCT vs panoramic radiography in assessment of impacted upper canine and root resorption of the adjacent teeth: a systematic review and meta-analysis. *J Clin Exp Dent*. 2024;16(2):e198-e222.
18. Margot R, Maria C-P, Ali A, Annouschka L, Anna V, Guy W. Prediction of maxillary canine impaction based on panoramic radiographs. *Clin Exp Dent Res*. 2020;6:44-50.
19. Stewart JA, Heo G, Glover KE, Williamson PC, Lam EW, Major PW. Factors that relate to treatment duration for patients with palatally impacted maxillary canines. *Am J Orthod Dentofacial Orthop*. 2001 Mar;119(3):216-25.
20. Ajami S, Shahidi S, Azadeh N, Nasr Jalali H, Zare M. Difficulty of palatal impacted canine treatment in different sagittal and vertical skeletal malocclusions: A retrospective 3D evaluation. *Int Orthod*. 2020 Mar;18(1):89-95.
21. Bajjad AA, Ahemad MS, Gupta S, Mehjabeen F, Guin S, Mehra S, Rajesh R. Assessment of clinical validity of KPG index for 3D classification of impacted maxillary canines by cone beam computed tomography in patients. *Orthod Craniofac Res*. 2024 Dec;27 Suppl 2:48-55.

ORAL MANIFESTATIONS OF NICOTINE POUCH USE: CURRENT KNOWLEDGE

Tijana Adamović^{*1}, Verica Pavlić^{1,2}, Valentina Veselinović¹, Nataša Trtić¹, Ognjenka Janković¹, Adriana Arbutina¹, Irena Kuzmanović Radman¹, Renata Josipović¹, Jana Ilić³, Jovana Lovrić², Mirjana Gojkov Vukelić⁴

¹Medical faculty University of Banja Luka, Banja Luka, Bosnia and Herzegovina

²Department of Periodontology and Oral medicine, The Republic of Srpska Institute of Dentistry, Banja Luka, Bosnia and Herzegovina

³Health Care Center of Banja Luka, Banja Luka, Bosnia and Herzegovina

⁴Department of Oral medicine and Periodontology, University of Sarajevo-Faculty of Dentistry

*Corresponding author

Tijana Adamović, professor
Department of Periodontology
and Oral Medicine,
Medical Faculty University of
Banja Luka, Bosnia and
Herzegovina.

E-mail address:
tijana.adamovic@med.unibl.org

DOI 10.69559/issn.2233-1794.2026.15.1.6

ABSTRACT

Nicotine dependence remains one of the most complex and widespread global public health challenges. Despite extensive prevention efforts and regulatory actions, its prevalence continues to be high. In recent years, there has been rapid development of non-combustible nicotine delivery products, including nicotine pouches (NP), which represent a newer category within the smokeless, tobacco-free market. These pouches are placed in the oral vestibule, between the lip and the gum, allowing nicotine to be gradually absorbed over approximately 30 minutes per use. However, their effects on oral health are still not well understood. This narrative review therefore aims to summarize and clarify the current evidence regarding the oral manifestations associated with NP use.

Key words: Nicotine pouches, Oral health, Narrative review, Oral lesions.

Introduction

To date, nicotine dependence is considered one of the global most complex and widespread public health problems [1]. As the main psychoactive component of tobacco, nicotine leads to pronounced physical and psychological dependence. Despite numerous preventive campaigns and regulatory measures, the prevalence of this condition in the general population remaining high [1–3]. Nicotine dependence does not represent solely an individual health problem, but also a significant social and economic burden to healthcare systems and contributes to the rise of non-communicable diseases [1].

Epidemiological studies indicate a consistently high prevalence of use of both, conventional tobacco products and modern nicotine alternatives [4].

The mechanism of action of nicotine is based on its selective binding to nicotinic cholinergic receptors in the brain, which stimulates the release of dopamine and produces a sense of pleasure. The cessation of nicotine intake disrupts the activity of the reward centre and triggers withdrawal symptoms, making this dependence particularly difficult to treat [5–7]. In addition to conventional tobacco products, nicotine is today consumed through various alternative forms.

Non-combustible nicotine-containing products have seen intensive development in recent years, with nicotine pouches (NP) emerging as a new category within the smokeless, tobacco-free product market. They appeared on the United States market in 2016, and have been available in Europe since 2018. They appeared on the market of Bosnia and Herzegovina relatively recently, with wider regional availability recorded from 2021 onwards [8, 9]. In terms of method of use and external appearance, they are similar to Swedish snus. However, unlike snus, NP do not contain tobacco leaves. They most commonly consist of a microcrystalline cellulose matrix impregnated with nicotine, which may be derived from tobacco leaves (natural nicotine) or obtained synthetically.

The addition of flavourings, plant fibres, and other additives contributes to their functional characteristics and sensory properties [10].

NP are used by being placed in the vestibule (between the lip and the gum), thereby ensuring the gradual absorption of nicotine over a period of 30 minutes per use [10–12]. The absorption of nicotine from the NP depends on the pH value of the pouch, which is why pH regulators are also added to these products. The higher the pH, the greater the capacity of nicotine to be absorbed through the oral mucosa. Thus, if the pH of the NP is close to 10, nicotine can be transformed into almost 99% freebase nicotine, which is more bioavailable, can pass through the oral mucosa more rapidly, and increase the concentration of nicotine in the bloodstream [13, 14].

NPs are available in a variety of flavours (e.g. peppermint, spearmint, tobacco, liquorice, citrus, berry) and strengths (low, medium, strong, extra strong), which differ from one another in terms of their nicotine content. The concentration of nicotine in smokeless tobacco products is high. The average nicotine level in conventional cigarettes is approximately 6–12 mg per cigarette, depending on the brand. Disposable e-cigarettes contain 39–48 mg of nicotine per cartridge [15]. The nicotine level in NP ranges from 4 mg to 14 mg per pouch (depending on the strength), and an average of 3 to 10 pouches are used per day, resulting in a high daily nicotine intake [15–17].

Since their appearance on leading global markets, NP have recorded a sharp rise in sales and growing prevalence, which has raised serious public health concerns, particularly due to their frequent use among young people. Their popularity among adolescents and younger adults is significantly associated with intensive marketing strategies on social media, a wide selection of appealing flavours, as well as the possibility of discreet use in various settings (e.g. at work, in school classrooms, during training sessions, or indoors). Although they are often presented as a less harmful alternative to conventional smoking, given that they involve neither combustion nor tobacco, these products still enable nicotine intake. Exposure to nicotine in this

form may have adverse effects on the cardiovascular system, while in younger populations it may negatively impact brain development [9, 12, 18].

The oral effects of NP, however, remain insufficiently studied. Existing research and clinical observations indicate that prolonged direct contact of the NP with oral tissue may cause keratosis at the site of application, leukoplakia, and periodontal disease [6, 15, 16, 19–22]. However, the majority of available studies are limited by small sample sizes, short follow-up periods, and heterogeneity in methodological approaches, which prevents the drawing of reliable clinical conclusions. It is precisely this gap in the literature that makes the systematisation of existing evidence not only useful, but essential.

Materials and methods

The methodology of this paper was based on a systematic search of the available scientific literature, with the aim of identifying relevant studies examining the effects of NP on oral health and changes in the oral mucosa. The search was conducted in the PubMed/MEDLINE electronic database.

The search strategy encompassed a combination of Medical Subject Headings (MeSH) and free-text keywords. The following terms were used as keywords: "nicotine pouches", "oral mucosa", "smokeless tobacco", "smokeless tobacco keratosis", "periodontitis", "gingival recession", "oral cancer" and "oral leukoplakia". Boolean operators AND and OR were used to combine search terms, enabling more precise retrieval of relevant studies.

Inclusion Criteria

Studies were considered eligible for inclusion if they were observational (cross-sectional, cohort, or case studies), systematic reviews, meta-analyses, or experimental studies examining the effects of NP on oral health. Research conducted on

participants of all age groups who use NP was included. Relevant outcomes pertained to changes in the oral cavity, including changes in the oral mucosa, periodontal disease, gingival recession, leukoplakia and potentially malignant and malignant lesions. Only peer-reviewed publications written in English and published between January 2020 and January 2026 were included. Alongside contemporary sources, earlier studies providing a foundation for understanding pathophysiological mechanisms were also integrated into the methodological framework.

Exclusion Criteria

Studies that did not directly examine the effects of NP or smokeless tobacco products on oral health were excluded from the analysis, as were papers not available in full text. Duplicates, conference abstracts, letters to the editor, and studies published in languages other than English were also excluded.

Study Selection and Data Extraction

The selection process involved independent assessment of titles and abstracts by two researchers (T. A, V. P), followed by full-text analysis to determine eligibility based on the inclusion criteria. Disagreements were resolved through consensus and discussion. The initial search identified a total of 115 records. Identified records were exported from the PubMed/Medline database into the reference manager Zotero, where duplicates were removed through a combination of automated detection and manual verification. After removal of duplicates and application of inclusion and exclusion criteria, 21 studies were included in the final analysis. The remaining 13 references used in this paper refer to institutional reports, guidelines, books, and review articles included as background literature for contextualisation of the topic and explanation of pathophysiological mechanisms, and were not subject to systematic selection. The study selection flow is presented in accordance with PRISMA guidelines (Figure 1).

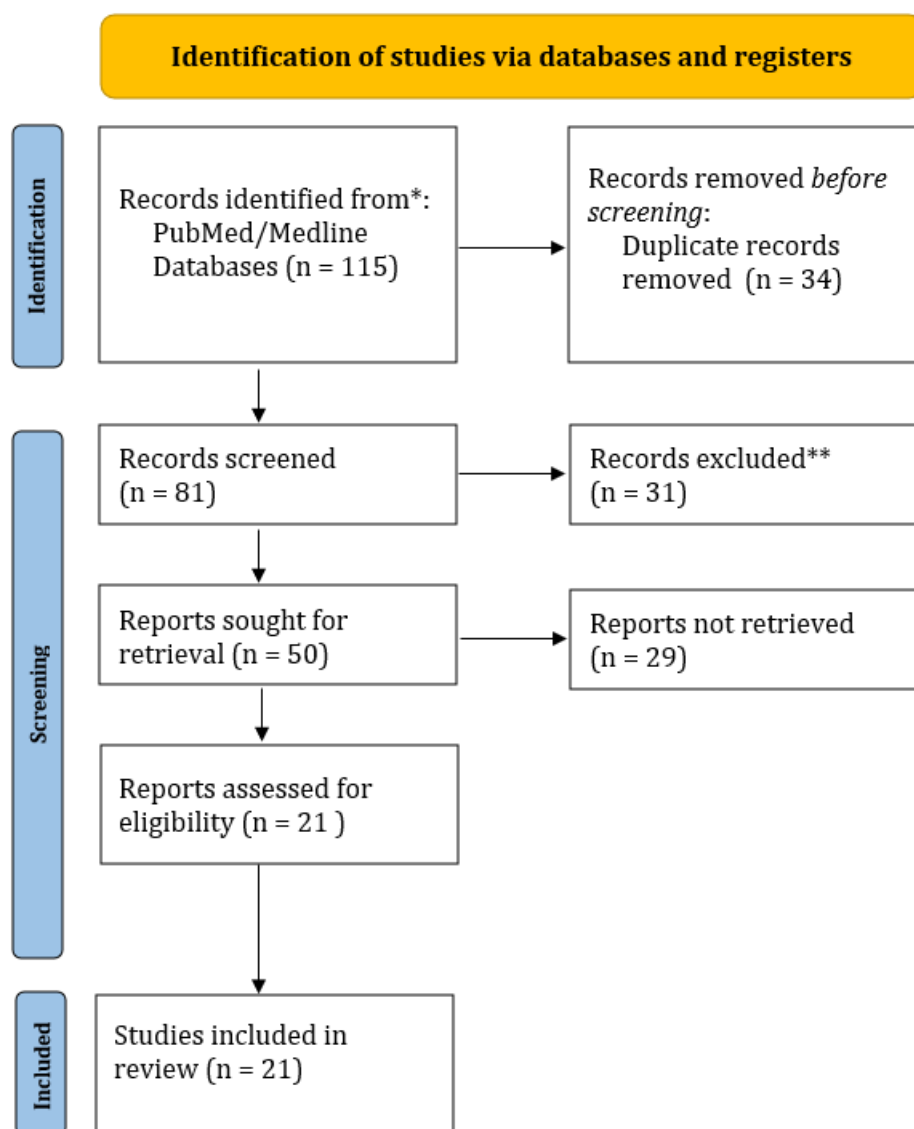


Figure 1. PRISMA flowchart for narrative review

Quality Assessment

Due to the exploratory nature of this paper and the heterogeneity in the design of the included studies, a formal assessment of the risk of bias using standardised tools was not conducted. The methodological quality of the studies was considered descriptively.

Data Synthesis

Due to heterogeneity in study design, definition of exposure, and product composition, a meta-analysis was not conducted. The results were synthesised narratively and grouped into thematic sections: changes in the oral mucosa, potentially malignant and malignant lesions, and periodontal disease.

Results and Discussion

The results of the conducted analyses indicate that the emergence of NP on the market represents a significant public health challenge, with the promoted concept of "reduced harm" frequently failing to align with data on nicotine concentration and pharmacokinetics.

Pharmacokinetics and Bioavailability

When a NP is placed in the oral cavity, between the gum and the lip, nicotine is released under the action of saliva and passes by diffusion through the oral mucosa into the bloodstream. The passage of nicotine into the bloodstream occurs primarily through the non-keratinised buccal mucosa.

Nicotine is a weak base, and its absorption depends on the pH of the surrounding environment. At higher pH values, a greater proportion of nicotine converts to its unionised, free (freebase nicotine) form, which is more readily absorbed through the oral mucosa. The process of nicotine dissolution and mucosal permeation may also be influenced by the volume of saliva produced [13]. Increased salivary secretion may enhance nicotine release, whereas excessive salivation can lead to swallowing of saliva, thereby reducing local absorption and intensifying unpleasant sensory effects such as throat irritation. Placement of the NP in an area with a greater mucosal absorption surface, such as the upper lip, may increase nicotine uptake. As a consequence of the conversion of nicotine to its free base form, users of NP are exposed to a continuous and elevated level of this alkaloid, which favours the development of pronounced physiological dependence, often more intense than that observed in conventional smokers [13, 23, 24].

NP do not, as a rule, contain classical tobacco-specific nitrosamines (TSNAs) to the extent characteristic of combustible tobacco products; however, certain toxicological risks persist. TSNAs may occur in various forms, including N-nitrosoanatabine (NAT), N-nitrosornicotine (NNN), N-nitrosoanabasine (NAB), and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK). Mallock and colleagues identified the presence of tobacco-specific nitrosamines (TSNAs) in 26 out of a total of 44 analysed NP products, with the highest recorded concentrations of N-nitrosornicotine (NNN) and N-nitrosamino ketone (NNK) amounting to 13 ng and 5.4 ng per pouch, respectively [8]. In addition to nicotine and TSNAs, other potentially harmful constituents were detected in certain products, including chromium and formaldehyde, further highlighting the need for a thorough safety assessment. Such a composition may have potential implications for oral and periodontal health, acting through various biological and pathophysiological mechanisms [8, 11, 16, 25].

Changes in the Oral Mucosa: Keratoses and Precancerous Lesions

The use of NP is considered a significant risk factor for the development of various white lesions in the oral cavity [26]. Certain white lesions may carry the potential for malignant transformation, which is why timely recognition and diagnosis are of critical importance in the prevention of oral cancer. There are two key reasons why the use of NP is associated with potentially harmful effects on the oral mucosa. First and foremost, their application between the lip and the gum allows prolonged and direct contact with the mucosa, which favours more frequent and extended use compared to other tobacco or nicotine products. In addition, the high nicotine content, predominantly absorbed through the oral mucosa, further increases the risk of local adverse changes [19].

Repeated application of NP in the vestibular region of the oral cavity may give rise to subjective and objective signs on the oral mucosa, including redness, tingling, itching and a burning sensation. These changes are not necessarily confined to the site of contact, but may extend to other parts of the oral cavity and even the pharynx. Furthermore, in a certain number of users, disturbances in taste perception may occur. In long-term and heavy users of NP, changes in the quantity and quality of salivary secretion may also develop, which may further affect the integrity and function of the oral mucosa [20].

One of the most common conditions associated with the use of NP is smokeless tobacco keratosis (STK). It develops as a consequence of prolonged mechanical irritation of the oral mucosa caused by the application of NP. The degree of keratinisation is determined by the frequency and duration of the habit. In the early stages, STK presents clinically as a whitish-greyish plaque with a slightly wrinkled surface. In advanced stages, pronounced hyperkeratosis occurs, accompanied by the formation of a characteristic indentation, a mucosal "pouch" [26, 27]. When the pouch is placed closer to soft, mobile tissues, such as the frenulum, the lesions take on the appearance of a white line. In other cases, the lesions appear more cloud-like, with varying intensities of white colouration.

Histopathological findings reveal cyclic parakeratosis associated with epithelial acanthosis. In some cases, signs of epithelial dysplasia and the presence of hyperchromatic nuclei in the basal layer have been recorded. Changes in the connective tissue are subtle and are mainly reflected in collagenous sclerosis around blood vessels and nerve structures. Clinical experience has shown that if a healthy individual ceases to use NP, oral lesions may resolve within a period of six weeks to six months. Should the lesion fail to resolve or change in appearance, surgical excision with biopsy is indicated [15, 26, 28].

Leukoplakia

Leukoplakia is one of the possible consequences of prolonged NP use, a potentially malignant disorder that manifests clinically as white lesions on the oral mucosa. This condition is of particular clinical significance as it is regarded as a precancerous state, given its potential for progression to squamous cell carcinoma [2]. Leukoplakia is predominantly recorded in the population over the age of 40, with epidemiological data indicating a higher prevalence among men and an approximately six-fold greater frequency among users of smokeless tobacco products compared to non-users. Prolonged mechanical pressure and continuous exposure to chemical constituents may represent predisposing factors for the development of leukoplakia, although a reliable causal relationship with NP use cannot yet be unequivocally established. Clinically, leukoplakia may encompass a spectrum of changes ranging from benign hyperkeratosis to epithelial dysplasia and carcinoma in situ, which is why histological verification is of paramount importance for adequate risk assessment and the establishment of a definitive diagnosis [20, 30]. Experimental studies demonstrate that smokeless tobacco products may increase oxidative stress, stimulate the production of nitric oxide, and lead to the suppression of tumour-protective pathways, providing a biological explanation for potential malignant transformation [21].

Oral Cavity Carcinoma

Long-term epidemiological data that would clearly define a direct association between the use

of NP and the development of oral carcinoma are currently limited, primarily due to the relatively recent emergence of these products on the market and an insufficient number of studies. Existing research indicates that NP may lead to localised changes in the oral mucosa, including the appearance of white lesions and inflammatory reactions at sites of application. However, reliable evidence confirming a direct causal relationship between their use and malignant transformation has not yet been clearly established in long-term studies. In contrast, for traditional smokeless tobacco products containing tobacco-specific carcinogens, such as snus, a clear association with the development of premalignant lesions of the oral mucosa and oral carcinoma has been established across various population groups [19, 20]. The intensity and distribution of risk vary depending on the chemical composition and type of product, as well as regional patterns of consumption, including frequency, duration and method of use.

Periodontal Disease

The use of smokeless tobacco products is considered one of the significant risk factors for the development of periodontal diseases such as gingivitis, periodontitis and peri-implantitis [31].

The most widely accepted explanation for the relationship between NP and periodontal disease proceeds from the assumption that nicotine, as their principal toxic constituent, interacts with host cells and modifies the inflammatory response to microbial stimuli. Such mechanisms may result in direct or indirect damage to periodontal tissues.

Experimental *in vitro* studies have demonstrated that exposure to nicotine leads to inhibition of periodontal ligament fibroblast function and reduced stem cell viability, alongside increased production of reactive oxygen species (ROS). Nicotine also participates in the development of periodontal disease through modulation of the cytokine response, stimulating increased secretion of IL-1 β and IL-8, as well as IL-6, IL-10, and IFN- γ , and prostaglandin PGE₂, while simultaneously reducing the expression of MMP-2. Experimental models demonstrate that nicotine, both in healthy periodontium and in cases of periodontitis, causes

significant bone loss, particularly in furcation regions, while simultaneously reducing alveolar bone regeneration by increasing the number of osteoclasts and enhancing the expression of nuclear factor kappa-B ligand (NF- κ B ligand) [22].

In addition to nicotine, the constituents of NP, including flavourings, raise concern due to their potential impact on general and oral health. More than 15 000 different flavourings are available for smokeless products, among which 2,3-hexanedione (creamy, fruity), ethyl butyrate (fruity, apple) and DL-menthol (menthol, mint) are notable examples. These flavourings may accelerate the development of physical nicotine dependence in adolescents and increase emotional attachment to NP through enhanced positive and reduced negative subjective experiences. Menthol, as a common additive, also affects the viability and proliferation of human periodontal ligament fibroblasts, inducing increased oxidative stress, pro-inflammatory reactions, and accelerated cellular senescence. Furthermore, the menthol flavouring facilitates the passage of toxic substances, such as nitrosonornicotine (NNN) and nicotine, through the buccal and sublingual mucosa, increasing the risk of soft tissue damage in the oral cavity. These effects indicate that flavouring additives in NP may represent a potential risk to the health of the periodontium and oral tissues. Flavoured nicotine products may also lead to an imbalance in the oral and periodontal microbiota, interfere with the local innate immune response and contribute to the development of periodontitis through interaction between the respiratory microbiota and the immune system [16, 32–34]. Changes in the pH value and chemical composition of saliva create a microenvironment conducive to the proliferation of anaerobic bacteria, which are aetiologically associated with the development of periodontal disease. The results of the study by Miluna-Meldere and colleagues indicate a possible association between NP use and the presence of periodontopathogenic bacteria in saliva [15]. The bacteria *Tannerella forsythia*, *Prevotella intermedia*, and *Porphyromonas gingivalis* were detected in NP users, but were absent in the control group. It was particularly noted that their presence was more

pronounced in subjects with long-term and heavy use (more than ten pouches per day over several years). These findings suggest that NP may contribute to oral microbiota dysbiosis and potentially increase the risk of periodontal disease [15, 16].

The study by Alkhatib suggests a potential association between the use of NP and the occurrence of localised pathological changes in the oral cavity, such as gingival recession [21]. The changes are localised precisely at the sites where the pouches are regularly applied, pointing to a clear topographical relationship. Continuous and repeated exposure to these products may cause mechanical irritation and chemical irritation of the gingiva and oral mucosa, leading to soft tissue damage. Although the precise pathophysiological mechanism has not yet been fully elucidated, similarities can be observed with the effects of smokeless tobacco products, which have been shown to be associated with gingivitis, gingival recession, and the formation of periodontal pockets [16, 19, 21].

Conclusion

This narrative literature review systematised the available evidence on the effects of NP on oral health, with particular emphasis on changes in the oral mucosa, periodontal tissue and potential malignant risk. The results indicate that the use of NP may lead to local mucosal changes at the site of application, including keratotic white plaque-like lesions and localised gingival recession. The reversibility of some of these changes following cessation of use represents a clinically relevant finding; however, it does not preclude the need for regular monitoring. Periodontal effects remain inconsistent in the literature and are difficult to separate from the influence of confounding factors, such as the level of oral hygiene and concurrent cigarette smoking. Reliable long-term data on the malignant potential of NP are not yet available, necessitating the application of the precautionary principle in clinical practice.

Dental practitioners play a key role in the early detection of lesions, patient counselling and timely referral for biopsy in cases of persistent, indurated, or morphologically irregular lesions. Particular attention should be paid to the younger population, which is most exposed to aggressive marketing strategies on social media.

Future research should be methodologically rigorous, with long-term follow-up and clearly defined exposure criteria. At the same time, it is essential to introduce more stringent regulatory control over the composition of NP, with particular emphasis on upper limits for pH values and nicotine concentrations, in order to reduce

addictive potential and minimise the risk of developing oral pathologies.

Declaration of Interest: The authors declare that there are no conflicts of interest regarding the publication of this paper.

Author contributions: Conceptualization; Tijana Adamović, Verica Pavlić Investigation; Tijana Adamović, Valentina Veselinović, Nataša Trtić, Ognjenka Janković Methodology; Tijana Adamović, Verica Pavlić, Adriana Arbutina, Irena Kuzmanović Radman, Renata Josipović Supervision; Jana Ilić, Jovana Lovrić, Mirjana Gojkov Vukelić.

References

1. European Commission. Attitudes of Europeans towards tobacco and related products. Special Eurobarometer 539. Brussels: European Commission; 2024.
2. Substance Abuse and Mental Health Services Administration (SAMHSA). Results from the 2022 National Survey on Drug Use and Health: detailed tables. Rockville (MD): SAMHSA; 2023.
3. World Health Organization. WHO report on the global tobacco epidemic 2023. Geneva: World Health Organization; 2023.
4. Jackson SE, Brown J, Beard E. Associations of prevalence of e-cigarette use with quit attempts, quit success, use of smoking cessation medication, and the overall quit rate among smokers in England: a time-series analysis of population trends 2007–2022. *Nicotine Tob Res.* 2024;26(7):826-34.
5. Benowitz NL. Pharmacology of nicotine: addiction, smoking-induced disease, and therapeutics. *Annu Rev Pharmacol Toxicol.* 2009;49:57-71.
6. Jackson JM, Weke A, Holliday R. Nicotine pouches: a review for the dental team. *Br Dent J.* 2023;235(8):643-46.
7. Volkow ND, Koob GF, McLellan AT. Neurobiologic advances from the brain disease model of addiction. *N Engl J Med.* 2016;374(4):363-71.
8. Mallock N, Schulz T, Malke S, Dreijack N, Laux P, Luch A. Levels of nicotine and tobacco-specific nitrosamines in oral nicotine pouches. *Tob Control.* 2024;33(2):193-99.
9. Azzopardi D, Liu C, Murphy J. Chemical characterization of tobacco-free 'modern' oral nicotine pouches and their position on the toxicant and risk continuums. *Drug Chem Toxicol.* 2022;45(5):2246-54.
10. Dowd AN, Thrul J, Czaplicki L, Kennedy RD, Moran MB, Spindle TR. A cross-sectional survey on oral nicotine pouches: characterizing use-motives, topography, dependence levels, and adverse events. *Nicotine Tob Res.* 2024;26(2):245-49.
11. Back S, Masser AE, Rutqvist LE, Lindholm J. Harmful and potentially harmful constituents (HPHCs) in two novel nicotine pouch products in comparison with regular smokeless tobacco products and pharmaceutical nicotine replacement therapy products (NRTs). *BMC Chem.* 2023;17(1):9.
12. McGrath-Morrow SA, Gorzkowski J, Groner JA, Rule AM, Wilson K, Tanski SE, et al. The effects of nicotine on development. *Pediatrics.* 2020;145(3):e20191346.
13. Li X, Sriram A, Zhuang S, Aldeek F. Evaluation of factors impacting nicotine permeation in oral nicotine pouch products. *ACS Omega.* 2025;10(39):45644-655.

14. Heshmati J, Bates EL, Shahan S, Visintini S, Quirouette E, Mullen KA, et al. Nicotine pouch pharmacokinetics compared to smoked tobacco: a systematic review and meta-analysis. *Drug Alcohol Depend Rep.* 2025;17:100389.
15. Miluna-Meldere S, Vanka SA, Skadins I, Kroica J, Sperga M, Rostoka D. Oral mucosal changes caused by nicotine pouches: case series. *Diagn Pathol.* 2024;19(1):127.
16. Ye D, Rahman I. Emerging oral nicotine products and periodontal diseases. *Int J Dent.* 2023;2023:9437475.
17. Patwardhan S, Fagerström K. The new nicotine pouch category: a tobacco harm reduction tool? *Nicotine Tob Res.* 2022;24(4):623-25.
18. Hrywna M, Gonsalves NJ, Delnevo CD, Wackowski OA. Nicotine pouch product awareness, interest and ever use among US adults who smoke, 2021. *Tob Control.* 2023;32(6):782-85.
19. Rungraungrayabkul D, Gaewkhiew P, Vichayanrat T, Shrestha B, Buajeeb W. What is the impact of nicotine pouches on oral health: a systematic review. *BMC Oral Health.* 2024;24(1):889.
20. Bogdanska K, Kubik M, Mazur M, Dudek A, Szkudlarek W, Bogdański A, et al. Oral health consequences of smokeless tobacco use: a narrative review. *Cureus.* 2025.
21. Alkhatib OA. Localized gingival recession and leukoplakia associated with nicotine pouch use: two clinical case reports. *BMC Oral Health.* 2025;25(1):2004.
22. Holliday RS, Campbell J, Preshaw PM. Effect of nicotine on human gingival, periodontal ligament and oral epithelial cells: a systematic review of the literature. *J Dent.* 2019;86:81-8.
23. Al-Otaibi HM, Althobiani MA. Nicotine pouches: a narrative review of the existing literature. *Front Public Health.* 2025;13:1641308.
24. Liu J, Rensch J, Wang J, Jin X, Vansickel A, Edmiston J, et al. Nicotine pharmacokinetics and subjective responses after using nicotine pouches with different nicotine levels compared to combustible cigarettes and moist smokeless tobacco in adult tobacco users. *Psychopharmacology (Berl).* 2022; 239(9): 2863-73.
25. Edwards SH, Rossiter LM, Taylor KM, Holman MR, Zhang L, Ding YS, et al. Tobacco-specific nitrosamines in the tobacco and mainstream smoke of US commercial cigarettes. *Chem Res Toxicol.* 2017;30(2):540-51.
26. Kaabi HH. Smokeless tobacco keratosis in oral mucosa with epithelial dysplasia: a case report. *Medicine (Baltimore).* 2024;103(15):e37771.
27. Nautiyal M, Kumar Vadivel J, Ramalingam K. Prevalence of keratosis in the oral cavity: a clinical retrospective study. *Cureus.* 2024.
28. Petruzzelli CJ, Varano A, Desrosiers A, Hossler EW, Mowad CM. Smokeless tobacco keratosis. *Dermatol Online J.* 2023;29(3).
29. Wils LJ, Brakenhoff RH. Oral potentially malignant disorders, an update. In: Vermorken JB, Langendijk JA, Leemans CR, Machiels JP, Nicolai P, O'Sullivan B, editors. *Critical issues in head and neck oncology* [Internet]. Cham: Springer Nature Switzerland; 2025 [cited 2026 Apr 3]. p. 3-20. Available from: https://link.springer.com/10.1007/978-3-031-84539-0_1.
30. Speight PM, Khurram SA, Kujan O. Oral potentially malignant disorders: risk of progression to malignancy. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2018;125(6):612-27.
31. Fisher MA, Taylor GW, Tilashalski KR. Smokeless tobacco and severe active periodontal disease, NHANES III. *J Dent Res.* 2005;84(8):705-10.
32. Marynak KL, Wang X, Borowiecki M, Kim Y, Tynan MA, Emery S, et al. Nicotine pouch unit sales in the US, 2016-2020. *JAMA.* 2021;326(6):566.
33. Shaikh S, Tung W, Pang C, Lucas J, Li D, Rahman I. Flavor classification/categorization and differential toxicity of oral nicotine pouches (ONPs) in oral gingival epithelial cells and bronchial epithelial cells. *Toxics.* 2022;10(11):660.
34. Mehta A, Ramanarayanan V, Karuveettil V, Janakiram C. Association between smokeless tobacco use and risk of periodontitis in Asian countries: a systematic review and meta-analysis. *Asian Pac J Cancer Prev.* 2021;22(10):3061-74.

THE IMPORTANCE OF IMPLEMENTING IMMUNOHISTOCHEMICAL METHODS IN THE DIFFERENTIAL DIAGNOSIS OF ODONTOGENIC KERATOCYST AND AMELOBLASTOMA

Anela Hardaga-Muzurović^{*1}, Amina Vejselović²

¹Doctor of Dental Medicine, Oral Surgery Specialist, Oral Surgery Clinic, Faculty of Dentistry with Dental Clinical Center, University of Sarajevo, Bosnia and Herzegovina

²Doctor of Dental Medicine, Independent Researcher, Sarajevo, Bosnia and Herzegovina

DOI 10.69559/issn.2233-1794.2026.15.1.7

*Corresponding author

dr. Anela Hardaga-Muzurović,
Oral surgery specialist
Faculty of Dentistry with Dental
Clinical Center, University of
Sarajevo, Bosnia and
Herzegovina
Department of Oral Surgery,
Bolnička 4A, 71 000 Sarajevo,
Bosnia and Herzegovina
Phone: +387(33)214 294
e-mail: dranelahm@gmail.com

ABSTRACT

The clinical similarity between odontogenic keratocyst and ameloblastoma requires the use of additional diagnostic methods to determine accurate diagnosis. Immunohistochemistry is used in the pathohistological diagnostics of odontogenic keratocysts and ameloblastomas, as well as in decision-making regarding the appropriate therapy and extent of surgical radicality, because their characteristics, such as recurrence and invasiveness, are imperative in therapy planning.

Keywords: odontogenic keratocyst, ameloblastoma, immunohistochemistry, recurrence.

Introduction

Odontogenic keratocyst and ameloblastoma are classified as benign lesions with a high recurrence rate and invasive growth [1, 2]. Accurate differential diagnosis of odontogenic keratocyst and ameloblastoma is of great importance due to their frequent recurrences and different treatment approaches. Immunohistochemical methods are used in pathohistology to determine an accurate diagnosis, indicate the risk of recurrence and potential malignant alterations and are therefore used in the differential diagnosis of cysts and tumors.

Characteristics of odontogenic keratocyst and ameloblastoma

Odontogenic keratocyst is classified as a cyst of odontogenic origin [3, 4]. Odontogenic keratocyst is usually located in the posterior part of the mandible [2, 3, 4]. In the upper jaw the odontogenic keratocyst can invade the maxillary sinus and nasal cavity and even the orbit, infratemporal fossa and base of the skull [5]. Recurrence of odontogenic keratocyst can cause the presence of satellite cysts and the inability to completely remove the odontogenic keratocyst due to its structure and expansive growth. Accurate diagnosis and appropriate treatment of odontogenic keratocysts are of great importance due to their frequent recurrences that grow rapidly and potentially transform into malignancy [1, 6, 7] (Figure 1).

Ameloblastoma is a neoplasm of odontogenic epithelial origin characterized by invasive growth that destroys the jawbone and a high possibility of postoperative recurrence [2]. The usual localization of ameloblastoma is ramus of the mandible. Malignant ameloblastoma is associated with metastases and has histological features of ameloblastoma in contrast to ameloblastic carcinoma which has features of a true malignant neoplasm [9] (Figure 2).

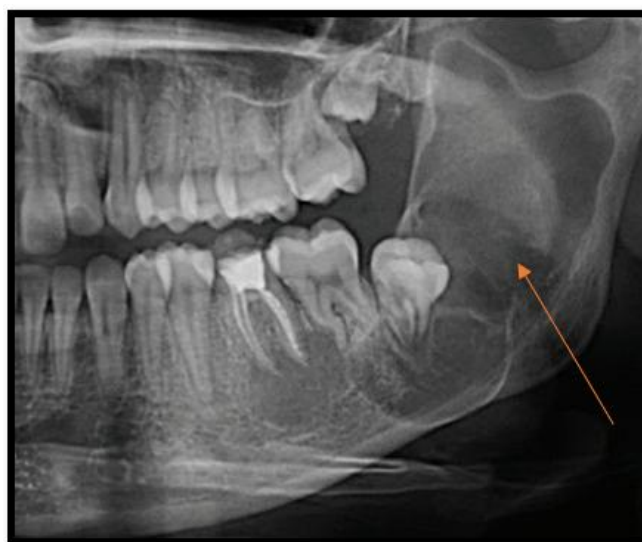


Figure 1: Radiographic image shows radiolucency in the posterior part of the mandible that indicates an odontogenic keratocyst. Source: Şen B, Dünder N, Aslan E, Işık G, Özyiğit Büyüktalancı D, 2024 [8]

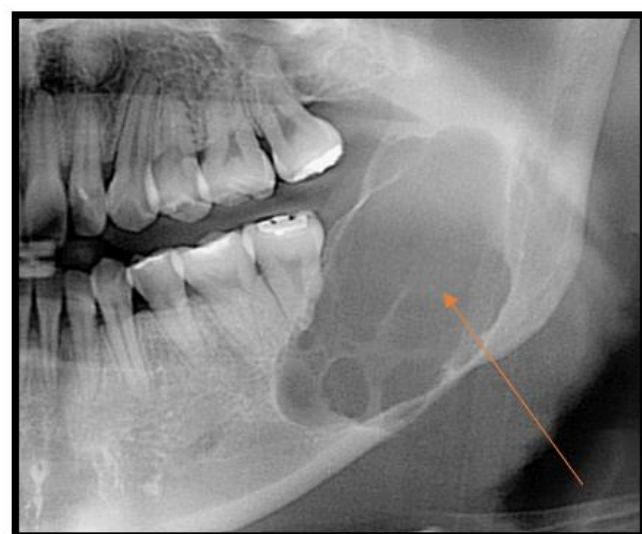


Figure 2: Radiographic image shows radiolucency in the posterior part of the mandible that indicates an ameloblastoma. Source: Kim JE, Cho JB, Yi WJ, Heo MS, Lee SS, Huh KH, 2025 [10]

Immunohistochemistry

Immunohistochemistry is an important pathohistological diagnostic method that can detect markers in a tissue sample. Multiplex immunohistochemistry/immunofluorescence is an improved method that can be used to detect multiple markers in a single tissue sample [11]. Immunohistochemical methods are used in clinical diagnostics - especially in oncological pathology, prognosis and therapy of diseases, they are based on the reaction between specific antibodies and antigens in a tissue sample in order to identify specific markers that can be used for differential diagnosis, classification of diseases and assessment of the course of the disease. Immunohistochemical methods can be used to differentiate benign from malignant tumors, classify pathological lesions, identify the origin of metastases and in the differential diagnosis of cysts and cystic neoplasms of the jaw [12, 13]. The implementation of immunohistochemistry represents a major advance in diagnostics [12].

The aim of this review is to present the importance and possibilities of pathohistological diagnostics using immunohistochemical methods in the diagnosis and differential diagnosis of odontogenic keratocysts and ameloblastomas.

Materials and Methods

The process of searching for relevant scientific literature consisted of reviewing and analyzing electronic scientific databases: Pubmed, Science Direct, Google Scholar and Cochrane Library. A total of 57 articles were reviewed, while 23 articles were included in the review. Data from textbook literature was also used in this review.

Discussion and Conclusion

Research has shown that the biological behavior of cysts and tumors is dictated by their proliferative activity, therefore the expression of

cell proliferation markers in immunohistochemistry can be very useful in clinical application [14]. Overexpression of markers indicating the risk of recurrence of odontogenic keratocysts may help during treatment planning and influence the decision on more radical approaches in terms of extraction of teeth affected by the pathological lesion and more extensive osteotomy to prevent recurrence [15]. Many factors influence the occurrence of recurrences of odontogenic keratocysts, which is why precise diagnostics is necessary with the implementation of additional examinations such as immunohistochemical methods in order to reduce the frequent recurrences with appropriate therapy, that is, by conservative treatment of pathological lesions with a good prognosis and a more radical approach in the case of an estimated risk of recurrence which may include jaw resection [16]. Different expressions of immunohistochemical markers provide insight into information about the characteristics and biological behavior of odontogenic lesions and enable precise differential diagnostics and individualized treatments improving their success [17].

According to the available results, a higher expression of the COX-2 marker was found in odontogenic keratocysts than in ameloblastomas [18].

Calretinin is a specific tumor marker for ameloblastoma. Studies have shown that the immunohistochemical expression of calretinin is higher in ameloblastoma than in odontogenic keratocysts, which indicates a difference in the invasiveness of these lesions [14, 19]. Calretinin can be used in immunohistochemistry for the differential diagnosis of odontogenic keratocyst and ameloblastoma as well as for the evaluation of their biological behavior [19]. Based on the findings, it can be concluded that the evaluation of this immunohistochemical marker may provide significant information about the biological behavior of odontogenic keratocyst and ameloblastoma, which significantly contributes in differential diagnostics and consequently impacts treatment approach.

In odontogenic keratocysts, the expression of Bcl-2, CK17, CK19 and CK10 immunohistochemical markers was recorded [13, 20]. Bcl-2, CK17 markers were also recorded in ameloblastoma, but in different places compared to odontogenic keratocysts [13]. Current research suggests that increased expression of the CD10 marker indicates tumor progression, therefore this marker can be an indicator of the invasiveness of ameloblastoma and odontogenic keratocyst [21].

Research data suggest that the expression of the immunohistochemical marker Bcl-x is increased in ameloblastoma compared to odontogenic keratocyst, which may be an indicator of the invasiveness of ameloblastoma, indicating the importance of this marker in diagnostics [22]. Disease progression may be monitored by evaluation of CK10 and Bcl-x immunohistochemical markers which indicate invasiveness of odontogenic keratocyst and ameloblastoma.

Identification of overexpression of CD34 and Ki-67 markers by immunohistochemical methods can indicate the risk for the development of recurrence of odontogenic keratocysts and help in its prevention. The Ki-67 marker enables the assessment of proliferative activity and the possibility of recurrence of odontogenic keratocysts [23]. Ki-67 can also be used to assess the risk of recurrence of ameloblastoma [15, 24]. Ki-67 and p53 markers are very significant in assessing the extent of surgical procedure in odontogenic keratocysts [17]. According to the literature review it can be concluded that Ki-67 and p53 markers used in immunohistochemical methods can be significant in assessing the risk of recurrence and malignant alteration of ameloblastoma [25]. Ki-67 and p53 markers can be used to differentiate benign from malignant pathological lesions [26]. Increased values of the immunohistochemical markers Ki-67, p53, Bcl-2 and PCNA, which play a significant role in the pathogenesis of odontogenic lesions, in odontogenic keratocysts indicate a risk of recurrence [17]. Increased immunohistochemical expression of the Ki-67 marker indicates the need

for more radical surgical procedures in odontogenic keratocysts, while in the presence of Bcl-2 markers in recurrences of odontogenic keratocysts inhibition of the Bcl-2 protein can be attempted which requires additional clinical trials and research [17]. The implementation of Ki-67 and p53 immunohistochemical markers can provide information significant for decision-making regarding the extent of surgical procedure as their increased expression indicate the risk of recurrence of odontogenic keratocyst and ameloblastoma.

Through the use of PTCH1 immunohistochemical marker it is possible to detect mutations of PTCH1 gene of the SHH pathway that affect the behavior of odontogenic keratocysts and ameloblastoma, therefore, by inactivating these mutations a therapeutic effect could be achieved [17]. The PTCH1 gene mutation is an important factor in the development of Gorlin-Goltz syndrome [20].

According to the research results, the expression of the SOX2 marker by immunohistochemical methods is higher in odontogenic keratocyst compared to ameloblastoma [27]. The marker SOX2 has the ability to detect the presence of stem cells, therefore its elevated values may indicate the possibility of self-renewal and proliferation of odontogenic keratocysts [27].

The results of immunohistochemical expression of EGFR and survivin markers in odontogenic keratocysts and ameloblastomas can provide significant information about invasiveness, malignancy and the possibility of recurrence [28]. EGFR marker values are often elevated in malignant lesions which are invasive [28]. According to the research results, EGFR expression is increased in odontogenic keratocysts compared to ameloblastomas [28]. Survivin participates in apoptosis and cell division, therefore, its values are of great importance [28]. According to research elevated values of survivin are found in malignant lesions, it is also found that higher values of survivin are in ameloblastoma compared to odontogenic keratocysts [28].

By implementing immunohistochemical methods in the diagnosis and differential diagnosis of odontogenic keratocysts and ameloblastomas it is possible to identify specific markers (antigens) in a tissue sample by reaction with specific antibodies, thereby obtaining detailed information about the risk of recurrence, biological behavior - invasiveness and the possibility of malignant alteration of pathological lesions.

Immunohistochemical methods confirm the diagnosis, especially when standard pathohistological methods are not precise enough, and based on the information obtained it is possible to predict the development and progression of the disease which enables appropriate therapy planning and improved treatment outcomes in oral and maxillofacial surgery.

References

1. Khalele BAE. The anecdote of viral etiopathogenia in ameloblastoma and odontogenic keratocyst: Why don't we let it go? *J Oral Biol Craniofac Res.* 2017;7(2):101-105.
2. Mašić T, Ajanović M, Babajić E, Dizdarević K, Dervišević A, Dizdarević D, et al. *Osnovi maksilofacijalne hirurgije.* Sarajevo: Avicena; 2011.
3. Athira CP, Niveditha, Sundaram ITS, Thampy LM, Sadasivan S, Raj S. Odontogenic Keratocyst with Diverse Histopathological Features. *Oral and Maxillofacial Pathol J.* 2023; 14(2): 229-232.
4. Stoelinga PJW. The odontogenic keratocyst revisited. *International Journal of Oral and Mxillofacial Surgery.* 2022; 51(11): 1420-1423.
5. Shear M, Speight P. *Cysts of the Oral and Maxillofacial Regions* Fourth edition. Blackwell Munksgaard; 2007.
6. Sharif FN, Oliver R, Sweet C, Sharif MO. Interventions for the treatment of keratocystic odontogenic tumours. *Cochrane Database Syst Rev.* 2015;2015(11):CD008464.
7. Nayak MT, Singh A, Singhvi A, Sharma R. Odontogenic keratocyst: What is in the name?. *J Nat Sci Biol Med.* 2013; 4(2): 282-285.
8. Şen B, Dünder N, Aslan E, Işık G, Özyiğit Büyüktalancı D. Large Keratocyst Extending to Mandibular Ramus and Coronoid Process: A Case Report. *ADO Klinik Bilimler Dergisi.* 2024;13(3):537-42.
9. Neville BW, Damm DD, Allen CM, Bouquot JE. *Oral and Maxillofacial Pathology* Third edition Neville. Saunders Elsevier; 2008.
10. Kim JE, Cho JB, Yi WJ, Heo MS, Lee SS, Huh KH. Classification and prognostic evaluation of ameloblastoma using multiplanar CT imaging: a retrospective analysis. *BMC Oral Health.* 2025;25:115.
11. Tan WCC, Nerurkar SN, Cai HY, Ng HHM, Wu D, Wee YTF, et al. Overview of multiplex immunohistochemistry/immunofluorescence techniques in the era of cancer immunotherapy. *Cancer Commun (Lond).* 2020;40(4):135-153.
12. Duraiyan J, Govindarajan R, Kaliyappan K, Palanisamy M. Applications of immunohistochemistry. *J Pharm Bioallied Sci.* 2012;4(Suppl 2): S307-9.

Additional research is necessary on specific immunohistochemical markers that can be used for precise diagnostics of odontogenic keratocysts and ameloblastomas.

Acknowledgments: The authors have no financial relationships relevant to this article to disclose.

Declaration of Interest: The authors declare that they have no conflict of interest.

Authors' Contributions: Conceptualisation, Methodology, Validation, Writing – review and editing: AHM; Investigation, Acquisition, analysis and interpretation of data, Writing – original draft: AV; Approved final version: AHM, AV.

13. Cserni D, Zombori T, Stájer A, Rimovszki A, Cserni G, Baráth Z. Immunohistochemical Characterization of Reactive Epithelial Changes in Odontogenic Keratocysts. *Pathol Oncol Res.* 2020;26(3):1717-1724.
14. Jeyaraj P. Diagnostic and Prognostic value of Immunohistochemistry in Destructive Paediatric Maxillary Pathologies. *J Immunological Sci.* (2020); 4(4): 1-13.
15. Naruse T, Yamashita K, Yanamoto S, Rokutanda S, Matsushita Y, Sakamoto Y, et al. Histopathological and immunohistochemical study in keratocystic odontogenic tumors: Predictive factors of recurrence. *Oncol Lett.* 2017;13(5):3487-3493.
16. Giovacchini F, Bensi C, Paradiso D, Belli S, Mitro V, Tullio A. Factors influencing the recurrence of keratocysts: monocentric study. *J Oral Med Oral Surg.* 2020;26:1.
17. Imeida LE, Lloyd D, Boettcher D, Kraft O, Zammuto S. Immunohistochemical Analysis of Dentigerous Cysts and Odontogenic Keratocysts Associated with Impacted Third Molars—A Systematic Review. *Diagnostics.* 2024;14(12):1246.
18. Martín-Hernán F, Campo-Trapero J, Cano-Sánchez J, García-Martín R, Martínez-López M, Ballestín-Carcavilla C. A comparative study of the expression of cyclin D1, COX-2, and KI-67 in odontogenic keratocyst vs. ameloblastoma vs. orthokeratinized odontogenic cyst. *Rev Esp Patol.* 2022;55(2):90-95.
19. Siva Sukumaran P, Padmakumar Sreenivasan K. Immunohistochemical Evaluation of Calretinin in Ameloblastoma, Odontogenic keratocyst and Dentigerous Cyst. *Oral and Maxillofacial Pathology Journal.* 2022; 13(2):82-86.
20. Cserni D, Zombori T, Vörös A, Stájer A, Rimovszki A, Daru K, et al. A Clinicopathological Approach to Odontogenic Cysts: the Role of Cytokeratin 17 and bcl2 Immunohistochemistry in Identifying Odontogenic Keratocysts. *Pathol Oncol Res.* 2020;26(4):2613-2620.
21. Hormozi E, Fard VN, Naseri MA, Jahromi NH, Keshani F. Comparison of immunohistochemical expression of CD10 in keratocystic odontogenic tumor and ameloblastoma. *Dent Res J (Isfahan).* 2016;13(2):110-6.
22. Shukla P, Prabhu S, Jose M, Sripathi Rao BH. Comparative immunohistochemical study of Bcl-X in ameloblastoma, keratocystic odontogenic tumor and adenomatoid odontogenic tumor. *J Oral Maxillofac Pathol.* 2017;21(1):51-57.
23. D'Amario M, Pizzolante T, Magnacca C, Mariani I, Capogreco M, Lupi E. Ki67 as a proliferation marker: A study on odontogenic keratocysts and radicular cyst. *Journal of Stomatology Oral and Maxillofacial Surgery.* 2025;126(3):102313.
24. Pires HF, França GM, Morais HGF, Silva WRD, Freitas RA, Galvão HC. Clinicopathological and Immunohistochemical Risk Predictors for Ameloblastoma Recurrence. *Head Neck Pathol.* 2025;19(1):22.
25. Yahaya JJ, Bwambale P, Morgan ED, Abraham ZS, Owor G, Wabinga H. Immunohistochemical Expression of Ki-67 and p53 and Their Prognostic Role in Ameloblastoma: A Longitudinal Study. *Oman Med J.* 2024;39(2):e607.
26. Martínez-Martínez M, Mosqueda-Taylor A, Carlos-Bregni R, Pires FR, Delgado-Azanero W, Neves-Silva R, et al. Comparative histological and immunohistochemical study of ameloblastomas and ameloblastic carcinomas. *Med Oral Patol Oral Cir Bucal.* 2017;22(3):e324-e332.
27. Pereira T, Shetty SJ, Punjabi V, Vidhale RG, Gotmare SS, Kamath P. Immunohistochemical expression of SOX2 in OKC and ameloblastoma: A comparative study. *J Oral Maxillofac Pathol.* 2023;27(4):685-692.
28. Baddireddy SM, Manyam R, Thomas DC. Expression of EGFR and survivin in ameloblastoma, odontogenic keratocyst and calcifying odontogenic cyst - An immunohistochemical study. *J Oral Maxillofac Pathol.* 2023;27(2):424.

INFLUENCE OF SNUS ON THE ORAL MUCOSA OF CHILDREN

Šejla Pošković*, Hanela Gojak

Public Health Center Sarajevo, Sarajevo, Bosnia and Herzegovina

DOI 10.69559/issn.2233-1794.2026.15.1.8

*Corresponding author

Dr Šejla Pošković
Specialist in Pediatric and
Preventive Dentistry
Public Health Center Sarajevo,
Sarajevo, Bosnia and
Herzegovina
Phone: +387 (0)61 219 054
Email: sejlaposkovic@gmail.com

ABSTRACT

Snus use among children and adolescents is increasing, largely due to online availability and informal distribution despite legal restrictions. The oral mucosa of children is particularly vulnerable to the harmful effects of snus because it is thinner, more permeable, and more sensitive than adult mucosa. As a result, exposure to nicotine, nitrosamines, and chemical irritants leads to rapid development of mucosal lesions, including reactive leucoplakia, ulcerations, hyperkeratosis, gingival inflammation, and disturbances in the oral microbiome. Mechanical irritation from the snus pouch further exacerbates tissue damage. Psychological factors, such as peer influence and misconceptions about snus being less harmful than cigarettes, contribute to its rising use. Dentists play a crucial role in early detection, parental education, and prevention. Interdisciplinary collaboration is essential to mitigate the health risks associated with snus use in children.

Key words: Snus, Smokeless tobacco, Oral mucosa lesions, Children and adolescents, Reactive leucoplakia, Hyperkeratosis, Gingival recession, Oral microbiome, Public health, Dental prevention.

Introduction

Snus is a form of smokeless tobacco placed in the oral cavity, most commonly between the gingiva and the mucosa of the cheek or lip. Although its sale is legally prohibited to minors, online availability and private distribution channels have led to a rapid increase in use among children and adolescents. This trend represents a major public health issue, particularly due to the high nicotine content and numerous irritants that act directly on oral structures.

The oral mucosa of children is anatomically thinner, less keratinized, and more sensitive compared adult mucosa. Because of this, children exhibit faster and more intense reactions to harmful substances from snus. Harmful effects include inflammation, hyperkeratosis, ulcerations, gingival changes, and disruption of the microbiological balance. Since this is an increasingly common occurrence, dentists play an important role in early detection and education.

Discussion

1. Pharmacological and mechanical effects of snus in children

Snus contains high concentrations of nicotine, nitrosamines, and other chemical compounds that are rapidly absorbed through the oral mucosa. In children, due to pronounced vascularization and thinner epithelium, absorption occurs more quickly, increasing the risk of systemic and local effects. Mechanical pressure from the snus pouch causes chronic microtrauma, further aggravating mucosal damage.

2. Clinical changes in the oral mucosa

Reactive leucoplakia: A white, thickened area often develops at the site where the snus pouch is held. Ulcerations and erosions are the result of chemical irritation. Gingival changes include localized gingivitis and recession. Snus also alters the oral microbiome, increasing the risk of caries and periodontal disease. Premalignant changes may occur with long-term use.

3. Psychological aspects

Adolescents often use snus due to peer pressure or the belief that it is "less harmful than cigarettes."

4. Role of the dentist and prevention

The dentist should regularly examine the mucosa, educate parents, and provide advice on discontinuing snus use. Early detection of most lesions leads to complete regression of changes.

Conclusion

The harmful effects of snus use among children and adolescents are becoming an increasingly significant concern in dental practice.

Snus causes numerous changes to the oral mucosa, including ulcerations, hyperkeratosis, gingival changes, and microbiome disturbances. The dentist has a responsible role in identifying at-risk children, early detection of lesions, and educating parents and the school community. Prevention and an interdisciplinary approach are key to reducing the harmful consequences of snus use in children.

References

1. Lennon AM, Walsh PM. Oral health effects of smokeless tobacco use in adolescents. *Journal of Pediatric Dentistry*. 2020;42(3):145–151.
2. Rodu B, Jansson C. Smokeless tobacco and oral cancer: A review of the epidemiologic evidence. *American Journal of Preventive Medicine*. 2004;27(6):488–497.
3. Hatsukami DK, Severson HH. Oral smokeless tobacco: Health risks and harm reduction. *Journal of Oral Pathology & Medicine*. 1999;28(4):241–252.
4. Boffetta P, Hecht S, Gray N, Gupta P, Straif K. Smokeless tobacco and cancer. *The Lancet Oncology*. 2008;9(7):667–675.
5. World Health Organization (WHO). Smokeless Tobacco and Public Health: A Global Perspective. WHO Report, 2021.
6. Institute for Public Health of the Federation of Bosnia and Herzegovina. Annual Health Statistics Reports (Godišnji izvještaji o zdravstvenom stanju stanovništva). These reports include data on tobacco use trends among youth.
7. Global Youth Tobacco Survey (GYTS) – Bosnia and Herzegovina. WHO & CDC collaboration, latest available edition (FBiH and RS separately). Includes data on smokeless tobacco and youth habits.
8. Halilović E, Selimović-Dragaš M, Kobašlija S. Oral health status of adolescents in Bosnia and Herzegovina. *Acta Stomatologica Naissi*. 2015;31(72):1594–1602.
9. Ministry of Health of the Federation of BiH. Strategy for Tobacco Control in FBiH.

10th DENTAL CONGRESS OF BOSNIA AND HERZEGOVINA WITH INTERNATIONAL PARTICIPATION; May 2026, Mostar, Bosnia and Herzegovina

ABSTRACTS OF INVITED LECTURES

UTJECAJ MIKROBIOMA NA ORALNO ZDRAVLJE

doc. dr. Sanita Maleškić-Kapo

Medicinski fakultet, Univerzitet u Sarajevu, Bosna i Hercegovina

SAŽETAK

Oralni i crijevni mikrobiom predstavljaju složene i dinamične zajednice mikroorganizama koje imaju ključnu ulogu u održavanju lokalne i sistemske homeostaze, kao i ukupnog zdravlja domaćina. Ravnoteža između komensalnih i potencijalno patogenih mikroorganizama od presudnog je značaja za integritet tvrdih i mekih oralnih tkiva, dok disbioza oralnog mikrobioma značajno doprinosi razvoju najčešćih oralnih oboljenja, uključujući karijes, gingivitis, parodontitis, periimplantitis i lezije oralne sluznice. Istovremeno, crijevni mikrobiom ima centralnu ulogu u regulaciji metabolizma, imunološkog odgovora i sistemske inflamacije, pri čemu poremećaji njegove strukture i funkcije mogu utjecati na oralno zdravlje putem tzv. oralno-crijevnih osi.

Danas je poznato da promjene u sastavu i funkciji oralnog i crijevnog mikrobioma ne djeluju izolovano, već su međusobno povezane i povezane sa razvojem sistemskih stanja poput dijabetesa melitusa, kardiovaskularnih bolesti i poremećaja imunog odgovora, što dodatno naglašava značaj holističkog pristupa oralnom i općem zdravlju. Savremena istraživanja ukazuju na ključnu ulogu mikrobioma u fiziološkim i patološkim procesima, pri čemu se poseban značaj pridaje mehanizmima disbioze, interakcijama mikroorganizama s imunim sistemom domaćina te utjecaju egzogenih i endogenih faktora, uključujući prehranu, oralnu higijenu, pušenje i primjenu antimikrobnih sredstava.

Analiza ovih odnosa ima značajne kliničke implikacije, posebno u kontekstu razvoja personaliziranih terapijskih pristupa, racionalne upotrebe antiseptika i antibiotika, kao i potencijalne primjene probiotika i prebiotika u prevenciji i liječenju oralnih oboljenja.

Cilj ovog rada je prikazati savremena saznanja o sastavu i funkciji oralnog i crijevnog mikrobioma, njihovoj ulozi u očuvanju oralne i sistemske homeostaze te razvoju najčešćih oralnih oboljenja, uz naglasak na klinički značaj ovih spoznaja za unapređenje preventivnih i terapijskih pristupa u stomatološkoj praksi.

IMPACT OF THE MICROBIOME ON ORAL HEALTH

assist prof. dr. Sanita Maleškić-Kapo

Faculty of Medicine, University of Sarajevo, Bosnia and Herzegovina

ABSTRACT

The oral and gut microbiomes represent complex and dynamic communities of microorganisms that play a crucial role in maintaining local and systemic homeostasis, as well as overall host health. The balance between commensal and potentially pathogenic microorganisms is of fundamental importance for the integrity of both hard and soft oral tissues, while dysbiosis of the oral microbiome significantly contributes to the development of the most common oral diseases, including caries, gingivitis, periodontitis, peri-implantitis, and lesions of the oral mucosa. At the same time, the gut microbiome plays a central role in regulating metabolism, immune response, and systemic inflammation, whereby disturbances in its structure and function can affect oral health through the so-called oral-gut axis.

It is now well established that changes in the composition and function of both the oral and gut microbiomes do not occur in isolation but are interrelated and associated with the development of systemic conditions such as diabetes mellitus, cardiovascular diseases, and immune disorders, further emphasizing the importance of a holistic approach to oral and general health. Contemporary research highlights the key role of the microbiome in physiological and pathological processes, with particular emphasis on mechanisms of dysbiosis, microbial interactions with the host immune system, and the influence of exogenous and endogenous factors, including diet, oral hygiene, smoking, and the use of antimicrobial agents.

The analysis of these relationships has significant clinical implications, particularly in the context of developing personalized therapeutic approaches, rational use of antiseptics and antibiotics, as well as the potential application of probiotics and prebiotics in the prevention and treatment of oral diseases.

The aim of this paper is to present current knowledge on the composition and function of the oral and gut microbiomes, their role in maintaining oral and systemic homeostasis and in the development of the most common oral diseases, with an emphasis on the clinical relevance of these findings for improving preventive and therapeutic strategies in dental practice.

IMPLANTI U ESTETSKOJ ZONI

doc. dr. Zoran Šušak¹, dr. sci. Jovana Šušak²

¹ Medicinski fakultet, Goce Delcev University, Sjeverna Makedonija

² Karakamčev Dental Center, Skopje, Sjeverna Makedonija

SAŽETAK

Nadoknada jednog zuba dentalnim implantatom predstavlja jednu od najčešćih kliničkih situacija sa kojima se doktori dentalne medicine svakodnevno susreću. Primjena pojedinačnih implantoloških nadoknada dobro je etablirana još od objavljivanja prvih podataka.

Dok su se u prošlosti ekstrakcione alveole ostavljale netaknute mjesecima nakon vađenja zuba prije tretiranja rezidualnog grebena, danas je moguće primijeniti koncept „jedna hirurgija, jedno vrijeme“, što predstavlja veliku prednost i za pacijenta i za kliničara.

Nadoknada pojedinačnog zuba implantatom predstavlja izazov, posebno u izrazito kompromitovanim regijama. U ovom predavanju bit će predstavljene osnove teorijskog znanja o ključnim konceptima i metodama liječenja za uspješne procedure postavljanja pojedinačnih implantata u savremenoj stomatologiji (slobodna ruka naspram vođene implantologije).

Kroz primjere iz kliničke prakse prikazat će se postavljanje implantata u prednjoj i stražnjoj regiji. Također će biti predstavljene komplikacije i rizici implantološke terapije u estetskoj zoni.

Ciljevi predavanja:

1. Razumjeti biološku osnovu primjene pojedinačnih implantata u implantologiji.
2. Upoznati se s primjerima kliničke primjene pojedinačnih implantata u različitim situacijama u prednjoj i stražnjoj regiji.

IMPLANTS IN ESTHETIC ZONE

assist. prof. dr. Zoran Šušak¹, dr. Jovana Šušak, PhD²

¹ Faculty of Medicine, Goce Delcev University, North Macedonia

² Karakamčev Dental Center, Skopje, North Macedonia

ABSTRACT

The replacement of the single tooth with a dental implant is one of the most common clinical situations practitioners face on a daily basis. The use of single implants restorations is well established since the first data were published.

While in the past sockets were left untouched for months after tooth extraction before attending to the residual ridge, today it is possible to perform "one surgery, one time" which is a huge benefit to both the patient and clinician alike.

Single tooth replacement with an implant is challenging especially in a highly compromised site. In this lecture, we will present the foundation of theoretical knowledge of key concepts and treatment methods for successful single-tooth implant placement procedures in modern dentistry (free hand versus guided).

Through examples from clinical practice we will present the implant placement in the anterior and posterior region. Also, we will present the implant complications and risks in the esthetic zone.

Learning objectives:

1. To understand the biological background of use of single implants in implantology.
2. To see examples of clinical application of single implants in different scenarios in anterior and posterior region.

LIJEKOVI OD ZNAČAJA U DENTALNOJ MEDICINI: ANALGETICI, ANTIBIOTICI, ORALNI ANTISEPTICI: FARMAKOLOŠKI PREGLED

prim. dr. Meliha Mehić

Bosnalijek d.d. Sarajevo, Bosna i Hercegovina

SAŽETAK

Uloga farmakologije u dentalnoj medicini je esencijalna u području kontrole infekcije te bola, s ciljem poboljšanja konačnih terapijskih ishoda kao i unapređenja rezultata u procesu oporavka pacijenta. Antibiotici i analgetici, pored lokalnih anestetika najčešće su korišteni lijekovi kod stomatološkog pacijenta. Uz ove lijekove, oralni antiseptici na bazi lizozima se tradicionalno koriste u liječenju afti, aftoznog stomatitisa, herpetičnih lezija, gingivitisa i drugih upalnih stanja bukalno-faringealne sluzinice kao i erozivno-ulceroznih lezija postoperativne i traumatske etiologije. Uz paracetamol, nesteroidni antiinflamatorni lijekovi su "state of the art" tretmana bolnih stanja zahvaljujući dokazanim analgetskim efektima uz potrebu da se racionalnom farmakoterapijom "pravog lijeka, pravom pacijentu u pravu dozu i dovoljno dugo" pored terapijske efikasnosti obezbijedi visok stepen podnošljivosti i sigurnosti primjenjenih analgetika uz minimalan rizik od pojave neželjenih reakcija. Primjenom principa racionalnog korištenja antibiotika nastoje se minimizirati opasnosti od razvoja antimikrobne rezistencije uzimajući u obzir izrazito veliku primjenu antibiotika u stomatologiji kao jednog od ključnih razloga za nastanak globalne problematike otpornosti bakterija na primjenjivane antibiotike. Prirodni antibiotik lizozim kao enzibiotik, smatra se jednim od moćnih potencijalnih oružja u borbi protiv antimikrobne rezistencije.

Uzimajući u obzir prekomjernu primjenu antibiotika, različite stepene sigurnosti i podnošljivosti nesteroidnih antireumatika te oralne antiseptike čija osnova nije prirodnog porijekla, tema ima za cilj predstaviti maksimalan farmakološki potencijal pojedinih lijekova iz navedenih skupina kod stomatološkog pacijenta.

DRUGS OF IMPORTANCE IN DENTAL MEDICINE: ANALGESICS, ANTIBIOTICS, ORAL ANTISEPTICS – A PHARMACOLOGICAL REVIEW

prim. dr. Meliha Mehić

Bosnalijek d.d. Sarajevo, Bosna i Hercegovina

ABSTRACT

The role of pharmacology in dental medicine is essential in the areas of infection and pain control, with the aim of improving final therapeutic outcomes as well as enhancing patient recovery results. Antibiotics and analgesics, in addition to local anesthetics, are the most commonly used medications in dental patients. Alongside these drugs, oral antiseptics based on lysozyme have traditionally been used in the treatment of aphthae, aphthous stomatitis, herpetic lesions, gingivitis, and other inflammatory conditions of the buccopharyngeal mucosa, as well as erosive and ulcerative lesions of postoperative and traumatic etiology. Along with paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs) represent the "state of the art" in the treatment of painful conditions due to their proven analgesic effects. However, rational pharmacotherapy—"the right drug, for the right patient, in the right dose, and for an adequate duration"—is necessary to ensure, in addition to therapeutic efficacy, a high level of tolerability and safety of administered analgesics with minimal risk of adverse reactions. The application of rational antibiotic use principles aims to minimize the risk of antimicrobial resistance development, considering the extensive use of antibiotics in dentistry as one of the key contributors to the global problem of bacterial resistance to commonly used antibiotics. The natural antibiotic lysozyme, as an "enzibiotic," is considered one of the powerful potential tools in the fight against antimicrobial resistance.

Taking into account the excessive use of antibiotics, varying safety and tolerability profiles of non-steroidal anti-inflammatory drugs, and oral antiseptics that are not of natural origin, this topic aims to present the maximal pharmacological potential of selected drugs from these groups in dental patients.

SAVREMENI SEKVENCIJALNI KONCEPTI MINIMALNO INVAZIVNE ESTETSKE TERAPIJE U ZONI PREDNJIH ZUBA

prof. dr. Ljiljana Bjelović

Medicinski fakultet Foča Univerziteta u Istočnom Sarajevu,
Bosna i Hercegovina

SAŽETAK

Razvoj stomatoloških materijala i nove minimalno invazivne procedure značajno su unaprijedili kvalitet i estetiku prednjih zuba. Estetska potreba za savršenim osmijehom raste iz godine u godinu, a odnosi se na oblik, položaj, boju i dobro poravnanje zuba. Minimalno invazivan pristup u savremenoj restaurativnoj i estetskoj stomatologiji predstavlja filozofiju liječenja koja se zasniva na očuvanju maksimalne količine zdravih zubnih tkiva uz postizanje optimalne funkcije, estetike i dugoročne stabilnosti restauracije. Poseban značaj ovaj koncept ima u terapiji prednjih zuba, gdje su estetski zahtjevi izraženi, a gubitak i minimalne količine gleđi i dentina može imati dugoročne biološke i funkcionalne posljedice.

Minimalno invazivni tretmani indikovani su kod brojnih kliničkih stanja, uključujući diskoloracije zuba (fluoroza, tetraciklinski i minociklinsko-indukovani pigmenti), površinske defekte gleđi, molarno-incizivna hipomineralizacija, traumatska hipokalcifikacija, hipoplazije, frakture incizalnog ruba, dijasteme, blage rotacije i nepravilnosti oblika zuba, kao i estetske korekcije osmijeha bez narušavanja okluzalnih odnosa. Kod ovih stanja cilj terapije nije zamjena izgubljenog tkiva, već njegova optička i funkcionalna harmonizacija uz minimalno uklanjanje zubne supstance. Bjeličaste promjene boje gleđi su stanja uzrokovana poremećajima u razvoju gleđi. Svi ovi uslovi su povezani sa smanjenjem mineralne faze gleđi, promjenom njegovog hemijskog sastava, a samim tim i optičkih karakteristika. Posteruptivne promjene na gleđi nastaju nakon nicanja zuba i povezane su sa akumulacijom dentalnog plaka na površini gleđi i njenom početnom površinskom demineralizacijom. Rastresitost u frontalnoj regiji zubnog niza, neusklađenost u veličini zuba i alveolarnog grebena i ortodontske nepravilnosti predstavljaju veoma čestu pojavu kod odraslih pacijenata. Kompozitne restauracije omogućavaju korekciju oblika, boje i veličine zuba uz minimalnu ili potpunu odsutnost preparacije. Savremeni kompozitni materijali, zahvaljujući unaprijeđenim optičkim svojstvima i biomehaničkoj stabilnosti,

omogućavaju estetsku mimikriju prirodnih zubnih tkiva i visoku funkcionalnost.

Minimalno invazivne zahvate moguće je izvesti na mliječnim ili stalnim zubima ako nema znakova ireverzibilnog pulpitisa. Prvi je preduslov za primjenu minimalno invazivnog postupka rana dijagnostika. U svakodnevnom kliničkom radu prije svega se primjenjuju konvencionalni dijagnostički postupci tzv. zlatni standard, odnosno kombinacija vizuelno-taktilnih i radiografske tehnike snimanja. Dodatno su dostupni i savremeni dijagnostički postupci koji kliničaru mogu pomoći u prepoznavanju najranijih početnih promjena i potvrditi dijagnozu. Nakon uspješne i pravovremene dijagnoze treba napraviti plan terapije, odabrati minimalno invazivnu tehniku i pristupiti liječenju.

Predloženi tretmani u zbrinjavanju bjeličastih diskoloracija (tzv. *white spot*), u rasponu od invazivnih keramičkih vinira i krunica do kompozitnih nadoknada, u ovim slučajevima mogu ukloniti veće količine zdravog zubnog tkiva, skuplji su i mogu biti dugotrajni. Iako su estetski zahtjevi za savršenim osmijehom sve veći, postoje mogućnosti za rješavanje ekonomskih problema. Neki konvencionalni pristupi u liječenju bijelih diskoloracija, kao što su lokalna primjena remineralizujućih agenasa, mikroabrazija i izbjeljivanje predstavljaju pokušaje da se preokrene demineralizacija gleđi i/ili da se poboljša izgled zuba. Također, razvijeni su poboljšani materijali i tehnike za uklanjanje ili maskiranje promjene boje kako bi se riješili ovi neestetski uslovi.

Stoga je ovaj članak imao za cilj da ukaže na značaj savremenih sekvencijalnih koncepta minimalno invazivne estetske terapije u zoni prednjih zuba kao i kliničke korake tehnika izbjeljivanja zuba, mikroabrazije i primjene infiltranata smole. Injekciona metoda kompozitnih faseta predstavlja sofisticiranu, predvidivu i minimalno invazivnu alternativu konvencionalnim estetskim restauracijama prednjeg segmenta. Predstavlja estetsku, bezbolnu proceduru, kojom dobijamo još prirodniji, ljepši i precizniji izgled nego sa klasičnim kompozitnim fasetama.

Prvi predloženi tretman u zbrinjavanju diskoloracije gleđi je izbjeljivanje zuba u ordinaciji sa 40% vodonik peroksidom (*Opalescence™ Boost™, Ultradent, SAD*). Izbjeljivanje zuba ima za cilj smanjenje kontrasta između bijelih tačaka i ostalih netaknutih dijelova zuba, minimiziranje hromatskih razlika i poboljšanje estetske percepcije boje. Izvode se tri sesije izbjeljivanja zuba prema preporukama proizvođača, sa intervalom od jedne nedelje između svake.

Mikroabrazija je terapijski postupak kojim se poboljšava izgled površine gleđi, uklanjaju površinski defekti i obojenja te podstiče remineralizacija. Na zube se nanosi mikroabrazivna pasta koja je mješavina hlorovodonične kiseline niske koncentracije i abrazivne paste sa sitnim zrnima silicijum karbida. Kiseline uklanja mineralni sadržaj, ostavljajući spoljašnjih 22–27 µm gleđi oslobođenim i razmekšanim, a abraziv umješan u sastav kiseline mehančki uklanja taj sloj gleđi. Površina zuba polira se posebnim gumicama ili četkicama na koje se nanosi abrazivno sredstvo, sa malim brojem obrata u intervalima od 20–30 sekundi, uz odgovarajuće ispiranje. Iako je količina gleđi koja se uklanja relativno mala, često je dovoljna da se uklone obojenja, i to najčešće obojenja ekzogenog porijekla. Na kraju postuka zubi se isperu i fluorizuju 2% gel u trajanju od 4 minuta, a pacijent se naručuje na kontrolni pregled za 3–6 nedelja.

Jedan od najnovijih postupaka u minimalno invazivnoj stomatologiji svakako je infiltracijska tehnika. Primjenjuje se za uklanjanje početnih karijesnih lezija, tzv. bijelih mrlja na glatkim i aproksimalnim površinama. Zasniva se na infiltraciji nekavitiranih lezija do koje dolazi zbog kapilarnih sila, a količina infiltrata zavisi od širine pora. Zbog demineralizacije karijesnih lezija stvaraju se minerali kalcijuma i fosfora koji putuju niz koncentracijski gradijent iz lezije kroz pore prema usnoj šupljini. Dio se odlaže u površinskoj zoni lezije te smanjuje pore, pa je potrebno jetkanje i to hlorovodoničnom kiselinom kako bi se te pore otvorile i osigurao neometan prodor smole u pore gleđi. Prednosti su metode jednostavan postupak i gotovo potpuna infiltracija karijesne lezije, a takvo je otpornije na demineralizaciju. „Icon“ (DMG, Germany), infiltracijski koncept, je inovativni materijal u terapiji za maskiranje bijelih diskoloracija gleđi, početnih karijesnih lezija. Ovo je smola niske viskoznosti koja se nanosi na površinu zuba koja posljedično infiltrira mikropore gleđi. Smolni infiltrati su agensi koji kapilarno prodiru kroz pore demineralizovane ili hipomineralizovane gleđi, mijenjajući indeks prelamanja strukture zuba i potpuno ili djelimično maskirajući pojavu bjeličastih promjena boje gleđi. Postupak se izvodi istog dana kada i poslednja sesija mikroabrazije prema uputstvima proizvođača. Nakon završetka tretmana, obojenost bijelih opaciteta se značajno poboljša na prednjim zubima, promovirajući prednosti i posljedično vraćajući estetiku zahvaćenim dentalnim elementima.

Injekciona tehnika izrade kompozitnih faseta predstavlja savremeni, minimalno invazivni pristup estetskoj rehabilitaciji frontalnog segmenta zubnog luka. Ovaj postupak omogućava preciznu kontrolu anatomije, morfologije i optičkih karakteristika restauracije korištenjem transparentnih silikonskih matrica i viskoznog, najčešće tečnog kompozita. Za razliku od klasičnog slojevitog modelovanja, injekciona metoda smanjuje operatorsku zavisnost, ubrzava kliničku proceduru te omogućava ponovljiv i predvidljiv estetski rezultat. Uspjeh terapije započinje sveobuhvatnom kliničkom procjenom. Neophodna je analiza boje, oblika, proporcija zuba, položaja rubova gingive, te odnosa usnica–zubni niz u statičkoj i dinamičkoj estetici. Procjenjuju se fonetika, linija osmijeha i okluzalni kontakti, budući da su to faktori koji direktno utiču na dugoročnu stabilnost restauracije. Digitalno planiranje i wax-up predstavljaju fundamentalne faze. Wax-up može biti izrađen analogno (vosak na modelu) ili digitalno (CAD dizajn). Na osnovu wax-up-a izrađuje se transparentna silikonska matrica – ključni element koji kasnije vodi injekciju kompozita.

Imajući u vidu aktuelne trendove, ekspanziju stomatoloških materijala koja je usmjerena ka estetici, možemo zaključiti da je razvoj novih minimalno invazivnih procedura unapredio estetiku i to u oblasti boje, teksture i kvaliteta, za koje je poznato da značajano utiču na celokupni estetski rezultat. Injekciona metoda kombinuje koncept digitalnog dizajna, preciznu silikonsku matricu i adhezivnu tehniku u postupak koji eliminiše većinu manuelnih varijabli svojstvenih slojevitom modelovanju kompozita. Time omogućava izuzetnu estetsku transformaciju osmijeha, uz maksimalno očuvanje prirodnih struktura.

CONTEMPORARY SEQUENTIAL CONCEPTS OF MINIMALLY INVASIVE AESTHETIC THERAPY IN THE ANTERIOR TOOTH REGION

prof. dr. Ljiljana Bjelović

Faculty of Medicine Foča of University of East Sarajevo
Bosnia and Herzegovina

ABSTRACT

The development of dental materials and new minimally invasive procedures has significantly improved the quality and aesthetics of anterior teeth. The aesthetic demand for a perfect smile is increasing year by year and relates to tooth shape, position, color, and proper alignment. A minimally invasive approach in modern restorative and aesthetic dentistry represents a treatment philosophy based on preserving the maximum amount of healthy dental tissue while achieving optimal function, aesthetics, and long-term stability of restorations. This concept is particularly important in the treatment of anterior teeth, where aesthetic demands are high, and even minimal loss of enamel and dentin may have long-term biological and functional consequences.

Minimally invasive treatments are indicated in numerous clinical conditions, including tooth discolorations (fluorosis, tetracycline- and minocycline-induced pigmentation), superficial enamel defects, molar-incisor hypomineralization, traumatic hypocalcification, hypoplasia, incisal edge fractures, diastemas, mild rotations and tooth shape irregularities, as well as aesthetic smile corrections without disturbing occlusal relationships. In these conditions, the goal of therapy is not to replace lost tissue, but to achieve its optical and functional harmonization with minimal removal of dental structure.

Whitish enamel discolorations are conditions caused by disturbances in enamel development. All these conditions are associated with a reduction in the mineral phase of enamel, changes in its chemical composition, and consequently its optical properties. Post-eruptive enamel changes occur after tooth eruption and are associated with plaque accumulation on the enamel surface and initial surface demineralization. Crowding in the anterior region of the dental arch, discrepancies in tooth size and alveolar bone, and orthodontic irregularities are very common in adult patients.

Composite restorations enable correction of tooth shape, color, and size with minimal or no tooth preparation. Modern composite materials, thanks to improved optical properties and

biomechanical stability, allow aesthetic mimicry of natural dental tissues and high functional performance.

Minimally invasive procedures can be performed on primary or permanent teeth if there are no signs of irreversible pulpitis. The first prerequisite for a minimally invasive approach is early diagnosis. In everyday clinical practice, conventional diagnostic methods are primarily used as the gold standard, including a combination of visual-tactile examination and radiographic imaging. Additionally, modern diagnostic techniques are available to help clinicians identify the earliest changes and confirm diagnosis. After successful and timely diagnosis, a treatment plan should be made, a minimally invasive technique selected, and therapy initiated.

Proposed treatments for whitish discolorations (so-called white spots), ranging from invasive ceramic veneers and crowns to composite restorations, may remove larger amounts of healthy tooth tissue, are more expensive, and may be long-lasting. Although aesthetic demands for a perfect smile are increasing, there are also economically accessible solutions. Some conventional approaches for treating white discolorations, such as topical remineralizing agents, microabrasion, and bleaching, aim to reverse enamel demineralization and/or improve tooth appearance. In addition, improved materials and techniques have been developed to remove or mask discolorations in order to address these unaesthetic conditions.

Therefore, this article aims to highlight the importance of contemporary sequential concepts of minimally invasive aesthetic therapy in the anterior region, as well as the clinical steps of tooth bleaching techniques, microabrasion, and resin infiltration. The injection technique for composite veneers represents a sophisticated, predictable, and minimally invasive alternative to conventional aesthetic restorations in the anterior segment. It is an aesthetic, painless procedure that provides a more natural, more beautiful, and more precise result compared to classical composite veneers.

The first proposed treatment for enamel discoloration management is in-office tooth bleaching using 40% hydrogen peroxide (Opalescence™ Boost™, Ultradent, USA). Tooth bleaching aims to reduce the contrast between white spots and the surrounding intact tooth structure, minimize chromatic differences, and improve aesthetic color perception. Three bleaching sessions are performed according to the manufacturer's recommendations, with a one-week interval between each session.

Microabrasion is a therapeutic procedure that improves enamel surface appearance, removes superficial defects and stains, and promotes remineralization. A microabrasive paste is applied to the teeth, consisting of a low-concentration hydrochloric acid mixed with an abrasive paste containing fine silicon carbide particles. The acid removes mineral content, leaving the outer 22–27 µm of enamel softened and demineralized, while the abrasive mechanically removes this layer. The tooth surface is then polished using rubber cups or brushes with abrasive agents at low speed in 20–30 second intervals, with adequate rinsing. Although the amount of enamel removed is relatively small, it is often sufficient to eliminate stains, most commonly of extrinsic origin. At the end of the procedure, teeth are rinsed and fluoridated with 2% gel for 4 minutes, and the patient is scheduled for a follow-up in 3–6 weeks.

One of the most recent minimally invasive procedures is the infiltration technique. It is used for the treatment of initial carious lesions, i.e., white spot lesions on smooth and approximal surfaces. It is based on the infiltration of non-cavitated lesions driven by capillary forces, where infiltrant penetration depends on pore size. Due to demineralization, mineral components such as calcium and phosphate diffuse along the concentration gradient from the lesion toward the oral cavity. Part of these minerals is redeposited in the superficial zone of the lesion, reducing porosity; therefore, acid etching with hydrochloric acid is required to open the pores and enable proper resin penetration.

The advantages of this method include a simple procedure and nearly complete infiltration of the carious lesion, making it more resistant to demineralization. "Icon" (DMG, Germany) is an infiltration system used for masking white enamel discolorations and early carious lesions. It is a low-viscosity resin that penetrates enamel microporosities, altering the refractive index of the structure and partially or completely masking white spot lesions. The procedure is performed on the same day as the final microabrasion session according to the manufacturer's instructions. After treatment, the appearance of white opacities on anterior teeth is significantly improved, restoring aesthetics to the affected dental elements.

The injection technique for composite veneers represents a modern minimally invasive approach for aesthetic rehabilitation of the anterior dental segment. This procedure allows precise control of anatomy, morphology, and optical properties using

transparent silicone matrices and flowable composite materials. Unlike classical layering techniques, the injection method reduces operator dependency, shortens clinical time, and provides reproducible and predictable aesthetic results.

Successful therapy begins with comprehensive clinical assessment, including analysis of tooth color, shape, proportions, gingival margin position, and lip-tooth relationships in static and dynamic smile aesthetics. Phonetics, smile line, and occlusal contacts are also evaluated, as these factors directly influence long-term restoration stability. Digital planning and wax-up represent fundamental stages. The wax-up may be performed analogically (wax on model) or digitally (CAD design). Based on the wax-up, a transparent silicone matrix is fabricated, which serves as a guide for composite injection.

Considering current trends and the expansion of dental materials focused on aesthetics, it can be concluded that the development of new minimally invasive procedures has improved aesthetics in terms of color, texture, and quality, all of which significantly influence the overall aesthetic outcome. The injection technique combines digital design concepts, precise silicone matrices, and adhesive techniques into a procedure that eliminates most manual variables inherent in classical composite layering. This enables exceptional aesthetic transformation of the smile while maximally preserving natural tooth structure.

AUTOTRANSPLANTACIJA: MIT ILI ČINJENICA**prof. dr. A. Burak Çankaya**

Univerzitet u Istanbulu, Turska

SAŽETAK

Autogena transplantacija zuba, poznata i kao autotransplantacija, predstavlja alternativni terapijski pristup za nadoknadu izgubljenih zuba i korekciju dentalnih anomalija kada je dostupan odgovarajući donor-zub. Autotransplantacija može pružiti zadovoljavajuća rješenja za estetske, funkcionalne i okluzalne probleme.

Na uspješnost autotransplantacije utiču brojni preoperativni i postoperativni faktori, uključujući starost pacijenta, razvojni stadij i tip transplantiranog zuba, kao i pravilna adaptacija između površine korijena transplantiranog zuba i recipijentnog ležišta, atraumatski postupak te postoperativna stabilizacija.

Iako su dentalni implantati dostigli veoma prihvatljive stope uspješnosti, posebno u prisustvu umnjaka, autotransplantacija treba biti razmatrana kao alternativna terapijska opcija.

AUTOTRANSPLANTATION: A MYTH OR A FACT**prof. dr. A. Burak Çankaya**

University of Istanbul, Türkiye

ABSTRACT

Autogenous tooth transplantation, also known as autotransplantation, is an alternative treatment for replacing missing teeth and correcting dental anomalies when a suitable donor is available. Autotransplantation can provide satisfactory solutions for aesthetic, functional, and occlusal problems.

The success rate of autotransplantation is influenced by several pre-operative and post-operative factors, including the patient's age, developmental stage, and type of transplanted tooth, as well as proper adaptation between the root surface of the transplanted tooth and the recipient site, atraumatic procedure, and postoperative stabilization.

Although dental implants have reached quite acceptable success rates, especially in the presence of a wisdom teeth autotransplantation should come to mind as an alternative treatment option.

“CHAIR-SIDE” ASISTIRANJE U TOKU ENDODONTSKOG TRETMANA

prof. dr. Lajla Hasić-Branković

Stomatološki fakultet Univerziteta u Sarajevu,
Bosna i Hercegovina

SAŽETAK

Tradicionalno, posao stomatološke sestre je imao akcenat na preoperativnoj pripremnoj fazi, koja je podrazumijevala pripremu radnog mjesta, sterilizaciju i dezinfekciju instrumenata, te njihovo sortiranje.

Međutim, danas je akcenat pomjeren na intraoperativno asistiranje. Asistent je, kao i stomatolog, aktivni sudionik tretmana. Zato i govorimo o “Chair-side” asistiranju.

Endodoncija 21. vijeka se je donijela nekoliko bitnih doktrinarnih i tehnoloških novina koje su značajno uticale na opis poslova i zadataka dentalnog asistenta:

- Rad uz optičko uvećanje ili upotrebu operativnog mikroskopa,
- Rad u aseptičnim uslovima uz upotrebu koferdama,
- Mogućnost preciznog određivanja radne dužine korijenskih kanala,
- Mogućnost njihove obrade mašinskim instrumentima,
- Poboljšanje svojstava iriganasa te pojednostavljivanje tehnika punjenja kanala,
- Tendencija da se kompletna endodontska procedura obavi u jednoj ili eventualno 2 posjete.

Pri navedenim procedurama, dentalni asistent zauzima mnogo aktivniju ulogu u odnosu na raniji period. Njegova kompetencija u velikoj mjeri zavisi od poznavanja ključnih koraka u toku endodontskog tretmana, poznavanje svojstava i sastava materijala, medikamenata, tehnika obrade kanala, konstrukcije i upotrebe endodontskog instrumentarija, itd.

Predavanje ima za cilj da ukazati na moderne izazove koji se postavljaju pred dentalnog asistenta i njegov mnogo asertivniji i aktivniji angažman u toku endodontskog tretmana u odnosu na endodonciju prošlog vijeka.

CHAIR-SIDE” ASSISTANCE DURING ENDODONTIC TREATMENT

prof. dr. Lajla Hasić-Branković

Faculty of Dentistry of University of Sarajevo,
Bosnia and Herzegovina

ABSTRACT

Traditionally, the role of the dental assistant was focused on the preoperative preparation phase, which included preparation of the working area, sterilization and disinfection of instruments, and their organization.

However, today the emphasis has shifted toward intraoperative assistance. The assistant, just like the dentist, is an active participant in the treatment process. Therefore, we refer to this as “chair-side” assistance.

Endodontics in the 21st century has introduced several important doctrinal and technological innovations that have significantly influenced the duties and responsibilities of the dental assistant:

- Working under optical magnification or using an operating microscope,
- Working in aseptic conditions with the use of a rubber dam,
- The possibility of precise working length determination of root canals,
- The possibility of canal preparation using mechanical instruments,
- Improved properties of irrigants and simplified root canal obturation techniques,
- The tendency to complete the entire endodontic procedure in one or at most two visits.

During these procedures, the dental assistant assumes a much more active role compared with previous periods. Their competence largely depends on understanding the key steps of endodontic treatment, the properties and composition of materials and medicaments, canal preparation techniques, and the design and use of endodontic instruments.

The aim of this lecture is to highlight the modern challenges faced by dental assistants and their significantly more assertive and active involvement during endodontic treatment compared with endodontics of the previous century.

KOMPLIKACIJE POVREDA ZUBA

prof. dr. Vanja Petrović

Stomatološki fakultet Univerziteta u Beogradu, Srbija

SAŽETAK

Traumatska povreda zuba predstavlja akutnu transmisiju energije na zub i potporna tkiva koja rezultira frakturom (prelomom krunice ili korena) ili/i dislokacijom parodontalnog ligamenta u vidu razvlačenja ili sabijanja. Specifičnosti zarastanja zubnih tkiva i potpunog aparata ogledaju se u mnogobrojnim komplikacijama koje se mogu javiti nakon povrede zuba i u slučajevima gdje su terapijske procedure odrađene u skladu sa savremenim kliničkim protokolima. Komplikacije povreda zuba – kao termin, se zato isključivo odnosi na očekivani procenat negativnih kliničkih ishoda i gubitka (naročito stalnih) zuba i gdje je terapija bila brza i adekvatna i nikako se ne odnosi na stručne greške ili neadekvatnu terapiju. Razlikuju se povrede mliječnih i stalnih zuba. Kod stalnih se razlikuje terapija zuba sa završenim i nezavršenim rastom korijena. Terapijski cilj kod težih povreda stalnih zuba je maksimalno vremenski dugo očuvanje zuba u alveoli ili bar do onog uzrasta kada je indikovana protetska terapija ili implantati. Uvijek treba imati na umu psihološki vrlo osjetljiv period mladog životnog doba i posljedice koje u tom smislu može da ostavi gubitak zuba. Pošto u savremenoj stomatološkoj nauci nismo uspjeli da riješimo najčešće komplikacije (resorpciju korijena i posljedičan gubitak zuba), akcenat je uvijek na primarnoj prevenciji (da se izbjegnu rizična mjesta i situacije), a zatim i na sekundarnoj- pravovremeno ukazivanje prve pomoći i adekvatna terapija.

COMPLICATIONS OF DENTAL INJURIES

prof. dr. Vanja Petrović

Faculty of Dentistry of University of Belgrade, Serbia

ABSTRACT

Traumatic dental injury represents an acute transmission of energy to the tooth and supporting tissues, resulting in fracture (crown or root fracture) and/or dislocation of the periodontal ligament in the form of stretching or compression. The specific characteristics of healing in dental and supporting tissues are reflected in the numerous complications that may occur following dental trauma, even in cases where therapeutic procedures have been performed according to contemporary clinical protocols. Therefore, the term complications of dental injuries refers exclusively to the expected percentage of negative clinical outcomes and tooth loss (particularly permanent teeth) in cases where treatment was prompt and adequate, and does not refer to professional errors or inadequate therapy. A distinction is made between injuries to primary and permanent teeth. In permanent dentition, treatment approaches differ depending on whether root development is complete or incomplete. The therapeutic goal in severe injuries of permanent teeth is to preserve the tooth in the alveolus for as long as possible, or at least until the age when prosthetic therapy or dental implants become indicated. You should always keep in mind the psychologically very sensitive period of young life and the consequences that tooth loss can have in this sense. Since in modern dental science we have not been able to solve the most common complications (root resorption and persistent tooth loss), the emphasis is always on primary prevention (to avoid risky places and situations), and then on secondary prevention - timely indication of first aid and adequate therapy.

KLINIČKI IZAZOVI U TERAPIJI MOLARNO INCIZIVNIH HIPOMINERALIZACIJA

prof. dr. Amra Arslanagić

Stomatološki fakultet Univerziteta u Sarajevu,
Bosna i Hercegovina

SAŽETAK

Molarno-incizivne hipomineralizacije često se susreću u svakodnevnom radu i predstavljaju izazov u kliničkom radu. Izlaganje je usmjereno na praktične aspekte stomatološkog rada, od pravovremene dijagnostike do odabira najprikladnijih terapijskih rješenja. Predstaviće se dostupni terapijski pristupi: profilaksa, neinvazivna terapija, privremeni postupci, trajne restauracije i ekstrakcija. Posebna pažnja posvećena je preporukama za tretman hipomineraliziranih prednjih zuba. Cilj predavanja je ponuditi konkretne i lako primjenjive smjernice za svakodnevne kliničke odluke.

CLINICAL CHALLENGES IN THE TREATMENT OF MOLAR INCISOR HYPOMINERALIZATION

prof. dr. Amra Arslanagić

Faculty of Dentistry of University of Sarajevo,
Bosnia and Herzegovina

ABSTRACT

Molar incisor hypomineralization is frequently encountered in everyday clinical practice and represents a significant clinical challenge. This lecture is focused on the practical aspects of dental management, from timely diagnosis to the selection of the most appropriate therapeutic solutions. Available treatment approaches will be presented, including prophylaxis, non-invasive therapy, temporary procedures, permanent restorations, and extraction. Special attention will be given to recommendations for the treatment of hypomineralized anterior teeth. The aim of the lecture is to provide concrete and easily applicable guidelines for everyday clinical decision-making.

KOLIKO JE PRIMJENA FAKTORA RASTA DOPRINIJELO POBOLJŠANJU REGENERATIVNE PARODONTOLOŠKE KIRUGIJE?

prof. dr. Darko Božić

Stomatološki fakultet Sveučilišta u Zagrebu, Hrvatska

SAŽETAK

Od kada je prije 30 godina Emdogain stavljen na tržište radi poticanja regeneracije parodonta, pojavilo se nekoliko novih čimbenika rasta kao što su hijaluronska kiselina, FGF-2 ili rh-PDGF. Međutim, pitanja su je li upotrebom ovih proteina poboljšani klinički ishod u odnosu na ono što je postignuto ranije prije njihova pojavljivanja, je li novostvoreni pričvrstak stabilniji, ima li manje komplikacija, te djeluju li bolje kada se miješaju s različitim biomaterijalima. Ovo predavanje će obuhvatiti podatke iz životinjskih i in vitro studija do ljudskih histoloških i kliničkih rezultata te pokušati dati odgovore na gore postavljena pitanja prikazujući dugoročne rezultate u početno periodontno teško kompromitiranih zuba.

HOW MUCH HAS THE APPLICATION OF GROWTH FACTORS CONTRIBUTED TO THE IMPROVEMENT OF REGENERATIVE PERIODONTAL SURGERY?

prof. dr. Darko Božić

Faculty of Dentistry of University of Zagreb, Croatia

ABSTRACT

Since 30 years ago when Emdogain was put on the market for promoting periodontal regeneration, several new growth factors have emerged such as hyaluronic acid, FGF-2 or rh-PDGF. However, the issues are have these materials enhanced the clinical outcomes above what was achieved in previous times, has the new attachment been more stable, are there less complications and do they perform better when mixed with various biomaterials. This lecture will go from animal and in vitro data to human histological and clinical results and try to give answers to the above raised questions showing long-term results of initially periodontally severely compromised teeth.

PREVENCIJA I ETIOLOŠKA TERAPIJA TVRDIH ZUBNIH TKIVA U DJEČIJEM UZRASTU ZA DOBRO ORALNO ZDRAVLJE CIJELOGA ŽIVOTA

prof. dr. Nina Marković

Stomatološki fakultet Univerziteta u Sarajevu,
Bosna i Hercegovina

SAŽETAK

Glavni cilj stomatologa jeste očuvanje potpuno zdravih zuba u svim životnim dobima. Karijes, posmatran kao oboljenje koje započinje i traje u fazi demineralizacije, a završava kavitacijom kao nepovratnim gubitkom zubnog tkiva, zahtijeva fokus na uzrok nastanka bolesti, a ne samo na sanaciju posljedica. Perzistiranje uslova u usnoj šupljini koji pogoduju demineralizaciji predstavlja kontinuiran izazov u preventivnoj zaštiti i održavanju saniranih zuba.

Cilj: Naglasiti značaj kontinuiranog etiološkog djelovanja i dominantnog preventivnog pristupa u dijagnostici i terapiji, sa krajnjim ciljem očuvanja dento-orálnih funkcija i postizanja dobrog oralnog zdravlja kod pacijenata.

Metode: Kompletna dijagnostika sa procjenom rizika i etiološka terapija predstavljaju kontinuirane i repetitivne terapijske i preventivne postupke. Predavanje nudi vodič za primjenu sredstava za remineralizaciju, tehnika remodelacije dentalnog biofilma i upravljanje faktorima rizika u sprječavanju demineralizacije.

Zaključak: Etiološki i preventivni pristup u stomatološkoj praksi omogućava dugoročno očuvanje oralnog zdravlja i funkcija, te doprinosi održavanju zdravih zuba u svim uzrastima.

Ključne riječi: demineralizacija, remineralizacija, karijes zuba, nekarijesne lezije zuba

PREVENTIVE AND ETIOLOGICAL APPROACHES IN THE THERAPY OF CARIOUS AND NON-CARIOUS LESIONS

prof. dr. Nina Marković

Faculty of Dentistry of University of Sarajevo,
Bosnia and Herzegovina

ABSTRACT

The preservation of healthy teeth at all ages is the primary goal of dentistry. Caries, understood as a disease that begins and persists in the demineralization phase and culminates in cavitation as an irreversible loss of dental tissue, requires a focus on its etiological factors rather than solely on restorative measures. Persistent conditions in the oral cavity that favor demineralization represent a continuous challenge in preventive care and in the maintenance of restored teeth.

Aim: To emphasize the importance of continuous etiological intervention and a preventive approach in diagnosis and therapy, with the ultimate goal of preserving dento-oral functions and ensuring lifelong oral health.

Methods: Comprehensive diagnostics with risk assessment and etiological therapy are proposed as repetitive and ongoing preventive and therapeutic procedures. The lecture provides guidance on the application of remineralization agents, techniques for remodeling the dental biofilm, and strategies for managing risk factors in order to prevent demineralization and maintain oral health.

Conclusion: A dominant preventive and etiological approach in dental practice enables sustainable preservation of oral health and functions, ensuring that patients maintain healthy teeth throughout life.

Keywords: demineralization, remineralization, dental caries, non-carious dental lesions

POTENCIJAL STAKLO-HIBRIDNIH MATERIJALA U RESTAURATIVNOJ STOMATOLOGIJI: MEHANIČKA SVOJSTVA I KLINIČKI ASPEKTI

prof. dr. Kristina Goršeta

Stomatološki fakultet Sveučilišta u Zagrebu, Hrvatska

SAŽETAK

Staklenoionomerni cementi (SIC) već desetljećima zauzimaju važno mjesto u restaurativnoj stomatologiji zahvaljujući svojoj kemijskoj adheziji na zubna tkiva, biokompatibilnosti i sposobnosti otpuštanja fluorida. Cilj ovog predavanja je prikazati potencijal staklenih ionomera u restaurativnoj stomatologiji kroz analizu njihovih mehaničkih svojstava i kliničkih aspekata primjene. Poseban naglasak stavljen je na mehanička svojstva, otpornost na trošenje, snagu svezivanja i rubno propuštanje te ponašanje materijala u vlažnom oralnom okruženju. Iako su konvencionalni staklenoionomeri cementi mehanički inferiorniji u odnosu na kompozitne materijale, njihov razvoj doveo je do unaprijeđenih formulacija, uključujući viskoviskozne, staklo-hibridne i nano-ionomerne cemente, koji pokazuju poboljšana mehanička svojstva i kliničku izdržljivost. Klinički aspekti primjene SIC-a obuhvaćaju indikacije poput restauracija u cervikalnoj regiji, privremenih i trajnih ispuna u područjima s manjim okluzalnim opterećenjem, dječjoj stomatologiji te atraumatskim restaurativnim postupcima (ART). Istodobno, ograničenja primjene uključuju osjetljivost na vlagu tijekom početnog svezivanja, nižu otpornost na lom te estetska ograničenja u usporedbi s kompozitima. Zaključno, staklo-hibridni materijali predstavljaju vrijedan restaurativni materijal s jasno definiranim indikacijama, osobito u minimalno invazivnoj stomatologiji i kod pacijenata s povećanim karijesnim rizikom. Daljnja istraživanja i razvoj materijala usmjereni su na poboljšanje njihovih mehaničkih svojstava i proširenje kliničke primjene.

THE POTENTIAL OF GLASS-HYBRID MATERIALS IN RESTORATIVE DENTISTRY: MECHANICAL PROPERTIES AND CLINICAL ASPECTS

prof. dr. Kristina Goršeta

Faculty of Dentistry of University of Zagreb, Croatia

ABSTRACT

Glass ionomer cements (GICs) have occupied an important place in restorative dentistry for decades due to their chemical adhesion to dental tissues, biocompatibility, and fluoride release capability. The aim of this lecture is to present the potential of glass ionomer materials in restorative dentistry through an analysis of their mechanical properties and clinical aspects of application. Special emphasis is placed on mechanical properties, wear resistance, bond strength, marginal leakage, and the behavior of materials in the moist oral environment. Although conventional glass ionomer cements are mechanically inferior to composite materials, their development has led to improved formulations, including high-viscosity, glass-hybrid, and nano-ionomer cements, which demonstrate enhanced mechanical properties and clinical durability. Clinical aspects of GIC application include indications such as cervical restorations, temporary and permanent restorations in areas with lower occlusal load, pediatric dentistry, and atraumatic restorative treatment (ART). At the same time, the limitations of these materials include moisture sensitivity during the initial setting phase, lower fracture resistance, and esthetic limitations compared with composite materials. In conclusion, glass-hybrid materials represent a valuable restorative option with clearly defined indications, particularly in minimally invasive dentistry and in patients with increased caries risk. Further research and material development are focused on improving their mechanical properties and expanding their clinical applications.

KO DONOSI ODLUKE O ORTODONTSKOM TRETMANU – ORTODONT, INSTAGRAM, TIKTOK ...

prof. dr. Vildana Džemidžić

Stomatološki fakultet Univerziteta u Sarajevu,
Bosna i Hercegovina

SAŽETAK

U savremenoj ortodontskoj praksi društvene mreže zauzimaju sve značajniju ulogu u komunikaciji sa pacijentima, profesionalnoj edukaciji te oblikovanju percepcije ortodontske terapije. Platforme poput Instagrama, TikToka, YouTubea omogućavaju brzo dijeljenje informacija, vizualni prikaz rezultata tretmana te direktnu interakciju između ortodonta i pacijenta.

Cilj ovog rada je analizirati ulogu društvenih mreža u ortodonciji, sa posebnim naglaskom na njihov uticaj na informiranost pacijenata, donošenje odluka o ortodontskom tretmanu te profesionalnu i etičku odgovornost ortodonata. Prezentirat će se prednosti korištenja društvenih mreža, poput povećane dostupnosti informacija, edukacije pacijenata, jačanja povjerenja; ali i potencijalni rizici kao što su širenje netačnih ili pojednostavljenih informacija, nerealna očekivanja pacijenata, te etičke i profesionalne izazove sa kojima se susreću ortodonti.

Dostupni podaci ukazuju na značajan uticaj društvenih mreža na izbor ortodonta i prihvatanje terapije, posebno kod mlađih pacijenata, pri čemu stručan, transparentan i etički sadržaj imaju ključnu ulogu u izgradnji povjerenja.

Društvene mreže predstavljaju moćan alat u ortodontskoj specijalističkoj praksi, ali njihova učinkovita primjena zahtijeva kritički pristup, odgovorno korištenje, jasno definisane profesionalne smjernice i kontinuiranu edukaciju kako bi se njihov potencijal iskoristio za dobrobit i pacijenta i ortodonta.

WHO MAKES DECISIONS ABOUT ORTHODONTIC TREATMENT – ORTHODONTIST, INSTAGRAM, TIKTOK...

prof. dr. Vildana Džemidžić

Faculty of Dentistry of University of Sarajevo,
Bosnia and Herzegovina

ABSTRACT

In modern orthodontic practice, social media is playing an increasingly important role in communication with patients, professional education, and shaping the perception of orthodontic treatment. Platforms such as Instagram, TikTok, and YouTube enable rapid information sharing, visual display of treatment results, and direct interaction between orthodontists and patients.

The aim of this paper is to analyze the role of social media in orthodontics, with a particular emphasis on their impact on patient awareness, decision-making about orthodontic treatment, and the professional and ethical responsibility of orthodontists. The advantages of using social media, such as increased availability of information, patient education, and strengthening trust will be presented; as well as potential risks such as the spread of inaccurate or simplified information, unrealistic patient expectations, and ethical and professional challenges faced by orthodontists.

Available data indicate a significant influence of social networks on the choice of orthodontist and the acceptance of treatment, especially among young patients, by which professional, transparent and ethical content play a key role in building trust.

Social networks represent a powerful tool in orthodontic specialist practice, but their effective application requires a critical approach, responsible use, clearly defined professional guidelines and continuous education in order to exploit their potential for the benefit of both the patient and the orthodontist.

BOJA U STOMATOLOGIJI: PROBLEMI I RJEŠENJA**prof. dr. Rade D. Paravina**Stomatološki fakultet Univerziteta u Teksasu, Hjuston,
Sjedinjene Američke Države**SAŽETAK**

Boja i izgled imaju ključnu ulogu u postizanju estetskih rezultata i reprodukciji prirodnog izgleda dentalnih restauracija. Ovo predavanje pružit će pregled najnovijih dostignuća i njihove kliničke primjene. Biće predstavljeni primjeri i praktični prijedlozi za unapređenje funkcionalne estetike.

Teme uključuju prirodu boje, vizuelno i instrumentalno određivanje nijanse, interpretaciju kliničkih rezultata zasnovanu na dokazima, izbor materijala, kontrolu kvaliteta i značaj translucencije. Također će biti dat pregled interakcija boje između kompozitnih smola i okoline („kameleonski efekat“), uključujući odgovarajuću terminologiju, aspekte nauke o boji, kliničke prednosti, implikacije i buduće pravce razvoja.

Ova prezentacija doprinijet će razumijevanju pojave boje kod nove generacije dentalnih materijala te pružiti kliničke i istraživačke preporuke. Biće predstavljeni savremeni pristupi usmjereni ka poticanju promjene paradigme u stomatološkoj estetici.

Ciljevi kursa:

1. Razumjeti prirodu pojave boje te uporediti tradicionalne (empirijske) i savremene (na dokazima zasnovane) tehnike određivanja nijanse.
2. Upoznati se sa „kameleonskim efektom“ između kompozitnih smola i okoline, odgovarajućom terminologijom, aspektima nauke o boji, kliničkim prednostima, implikacijama i budućim pravcima razvoja.
3. Uporediti pitanja vezana za translucenciju i njihov klinički značaj iz perspektive svakodnevne stomatološke prakse.

COLOR IN DENTISTRY: PROBLEMS AND SOLUTIONS**prof. dr. Rade D. Paravina**Faculty of Dentistry of University of Texas, Houston
United States of America**ABSTRACT**

Color and appearance are vital for esthetic outcomes and replicating the natural appearance of dental restorations. This lecture will provide an update on the latest developments and their clinical applications. Examples and practical suggestions for enhanced functional esthetics will be presented.

This includes topics such as the nature of color, visual and instrumental shade matching, evidence-based interpretation of clinical results, materials selection, quality control, and the relevance of translucency. In addition, an overview of color interactions between resin composites and the surroundings will be provided (the "chameleon" effect), addressing the corresponding terminology, color science aspects, clinical advantages, implications, and future directions.

This presentation will contribute to understanding the color appearance of a new generation of dental materials and provide clinical and research recommendations. State-of-the-art approaches aimed at provoking a paradigm shift will be presented.

Course Objectives:

1. Understand the nature of color appearance, and contrast traditional (empirical) and contemporary (evidence-based) color matching techniques
2. Learn about the "chameleon effect" between resin composites and the surroundings, the corresponding terminology, color science aspects, clinical advantages, implications, and future directions
3. Compare the translucency-related issues and their clinical relevance from the day-to-day dentistry point of view

OBLAST STOMATOLOGIJE: DENTALNA IMPLANTOLOGIJA

**PODIZANJE DNA MAKSILARNOG SINUSA
TRANSKRESTALNOM I LATERALNOM
TEHNIKOM - PRIKAZ SLUČAJA**Brigita Babić¹, Franka Babić², Zdenko Šarac²¹Studentica 5. godine Studija dentalne medicine, Medicinski fakultet Sveučilišta u Mostaru²Studij dentalne medicine, Medicinski fakultet, Sveučilište u Mostaru**SAŽETAK**

Uvod: Stražnji segment gornje čeljusti predstavlja izazov u implantologiji zbog resorpcije alveolarne kosti nakon gubitka zuba. Podizanje dna maksilarnog sinusa kirurški povećava vertikalnu dimenziju kosti i doprinosi uspješnoj implantoprotetskoj rehabilitaciji pacijenta. Dostupne su različite kirurške metode podizanja sinusa, a izbor pristupa određuje se prema potrebama augmentacije i očekivanoj invazivnosti zahvata.

Materijali i metode: Pacijentica se javlja zbog funkcionalne rehabilitacije. Klinički pregled i radiološka analiza pokazali su smanjenu visinu alveolarne kosti. Indicirano je podizanje dna maksilarnog sinusa prije ugradnje implantata. Primijenjene su dvije tehnike: transkrestalna na strani s manjim nedostatkom kosti i lateralna na strani s izraženijom atrofijom.

Rezultati: Obje tehnike omogućile su uspješno povećanje volumena kosti i stvaranje uvjeta za daljnju implantološku terapiju. Sve je potvrđeno radiološkim nalazom nakon zahvata. Zahvati su protekli bez značajnih intraoperativnih komplikacija, postoperativno cijeljenje bilo je uredno. Prisutnost ranije ugrađenih implantata utjecala je na planiranje i izvedbu zahvata.

Zaključak: Obje tehnike podizanja dna maksilarnog sinusa pokazale su visoku razinu uspješnosti u povećanju volumena kosti. Odabir odgovarajućeg pristupa temelji se na kliničkoj i radiološkoj procjeni uz adekvatno planiranje i preciznu kiruršku izvedbu.

Ključne riječi: maksilarni sinus, transkrestalni pristup, lateralni pristup, implantati, augmentacija kosti

FIELD OF DENTISTRY: DENTAL IMPLANTOLOGY

**PREVALENCE OF BLACK CHROMOGENIC
DISCOLORATIONS OF BACTERIAL GENESIS IN THE
POPULATION OF BOSNIA AND HERZEGOVINA**Brigita Babić¹, Franka Babić², Zdenko Šarac²¹5th-year Dental Medicine Student, Faculty of Medicine, University of Mostar²Dental Medicine, School of Medicine, University of Mostar**ABSTRACT**

Introduction: The posterior segment of the maxilla presents a challenge in implantology due to alveolar bone resorption following tooth loss. Sinus lift surgically increases the vertical bone height and contributes to successful implant-prosthetic rehabilitation. Various surgical techniques for sinus lift are available, and the choice of approach is determined by the augmentation requirements and expected invasiveness of the procedure.

Materials and Methods: The patient came in for functional rehabilitation. Clinical examination and radiological analysis revealed reduced alveolar bone height. Sinus lift was indicated prior to implant placement. Two techniques were applied: a transcrestal approach on the side with less bone deficiency and a lateral approach on the side with more pronounced atrophy.

Results: Both techniques successfully increased bone volume and created favorable conditions for further implant therapy, as confirmed by postoperative radiological findings. The procedures were completed without significant intraoperative complications, and postoperative healing was uneventful. The presence of previously placed implants influenced the planning and execution of the procedures.

Conclusion: Both sinus lift techniques demonstrated a high level of success in increasing bone volume. The choice of approach should be based on clinical and radiological assessment, with careful planning and precise surgical execution being key factors for achieving a long-term stable and successful therapeutic outcome.

Keywords: maxillary sinus, transcrestal approach, lateral approach, implants, bone augmentation

OBLAST STOMATOLOGIJE: DENTALNA PATOLOGIJA

**PRIENOS ORALNIH MIKROORGANIZAMA
IZMEĐU ČOVJEKA I MAČKE: MOGUĆE
POSLEDICE PO ORALNO ZDRAVLJE****Alma Husović, Selma Jakupović**

Stomatološki fakultet, Univerzitet u Sarajevu, Bosna i Hercegovina

SAŽETAK

Oralna šupljina čovjeka i mačke predstavlja kompleksan ekosistem mikroorganizama koji može biti podložan međusobnom prijenosu usljed bliskog kontakta. Cilj rada je analizirati potencijal prijenosa mikroorganizama između čovjeka i mačke i njihov uticaj na oralno zdravlje.

Proveden je pregled dostupne naučne literature iz oblasti mikrobiologije i veterinarske medicine, sa fokusom na oralni mikrobiom, zoonoze i mehanizme transmisije mikroorganizama između vrsta.

Identifikovano je da oralna mikrobiota i kod čovjeka i kod mačke sadrži brojne potencijalno patogene mikroorganizme, uključujući bakterije rodova *Streptococcus*, *Staphylococcus* i *Pasteurella*. Blizak kontakt, poput lizanja, ugriza ili dijeljenja životnog prostora, može omogućiti dvosmjerni prijenos mikroorganizama. Takav prijenos može dovesti do disbioze oralnog mikrobioma i povećanog rizika za razvoj oralnih oboljenja kao što su gingivitis i parodontitis.

Iako su direktni dokazi o međusobnoj transmisiji oralnog mikrobioma između čovjeka i mačke ograničeni, postoje značajni indirektni dokazi koji ukazuju na mogućnost takve interakcije i njen potencijalni uticaj na oralno zdravlje obje vrste.

Ključne riječi: oralni mikrobiom, zoonoze, mačke, čovjek, oralno zdravlje

FIELD OF DENTISTRY: DENTAL PATHOLOGY

**TRANSMISSION OF ORAL MICROORGANISMS
BETWEEN HUMANS AND CATS: POSSIBLE
IMPLICATIONS FOR ORAL HEALTH****Alma Husović, Selma Jakupović**

Faculty of Dentistry, University of Sarajevo, Bosnia and Herzegovina

ABSTRACT

The oral cavity of both humans and cats is a complex ecosystem of microorganisms that may be subject to mutual transmission due to close contact. The aim of this study was to analyze the potential transmission of microorganisms between humans and cats and their impact on oral health.

A review of available scientific literature in the fields of microbiology and veterinary medicine was conducted, with a focus on the oral microbiome, zoonoses, and mechanisms of interspecies microbial transmission.

It was identified that the oral microbiota of both humans and cats contains numerous potentially pathogenic microorganisms, including bacteria from the genera *Streptococcus*, *Staphylococcus*, and *Pasteurella*. Close contact, such as licking, biting, or sharing the same living environment, may enable bidirectional transmission of microorganisms. Such transmission may lead to dysbiosis of the oral microbiome and an increased risk of developing oral diseases such as gingivitis and periodontitis.

Although direct evidence of oral microbiome transmission between humans and cats is limited, there is significant indirect evidence suggesting the possibility of such interactions and their potential impact on the oral health of both species.

Keywords: oral microbiome, zoonoses, cats, humans, oral health

OBLAST STOMATOLOGIJE: DENTALNA TRAUMATOLOGIJA

TRAUMATSKA ETIOLOGIJA HRONIČNOG APIKALNOG PARODONTITISA U DJEČJOJ DOBI- PRIKAZ SLUČAJA**Adisa Filipović–Goga¹, Nedim Leto², Džejma Suljić Hujić³, Ineta Šehović⁴**¹Javna Ustanova Dom zdravlja sa Stacionarom Kakanj²Klinika za maksilofacijalnu hirurgiju, Kantonalna bolnica Zenica³Klinika za oralnu medicinu i paradontologiju, Stomatološki klinički centar Univerziteta Sarajevo.⁴Klinika za dentalnu patologiju i endodonciju, Stomatološki klinički centar Univerziteta Sarajevo**SAŽETAK**

Uvod: Dentalne traume u adolascntnom uzrastu predstavljaju čest javnozdravstveni i klinički problem. Klinička prezentacija ovih stanja često je varijabina i može dovesti do dijagnostičkih i terapijskih dilema, naročito u slučajevima perzistentne infekcije i neadekvatnog odgovora na inicijalno liječenje.

Prikaz slučaja: Četrnaestogodišnji dječak se javlja u pratnji roditelja u ambulantu dentalne patologije i endodoncije po uputi stomatologa koji je predhodno započeo endodontsku terapiju koja nije davala rezultate. Iz anamneze saznajemo da je riječ o udarcu loptom u području gornjih frontalnih zuba koja se desila tri mjeseca prije pojave prvih simptoma te da neposredno nakon povrede nisu posjetili stomatologa. Tri mjeseca nakon povrede dolazi do diskoloracije zuba, bola i otoka. Uprkos endodontskoj terapiji, prisutna je perzistentna purulentna sekrecija i ponavljana egzacerbacija što navodi ordinarijusa na slanje u ambulantu dentalne patologije i endodoncije gdje se kliničkim pregledom utvrdi vestibularni apsces u području gornjeg lijevog lateralnog sjekutića (22) i palatinalna bolnost. Izvršena je incizija, drenaža, te pacijent upućen na CBCT dijagnostiku. CBCT nalaz je ukazao na opsežne osteolitičke lezije sa resorpcijom alveolarne kosti u području zuba 21 i 22 što je potvrđivalo hronični apikalni parodontitis sa akutnom egzacerbacijom. Pacijent se upućuje hirurgu, koji nakon detaljne analize se odlučuje na ekstrakciju zuba 21 i 22.

Zaključak: Prikazani slučaj naglašava značaj detaljne anamneze, pravilne i pravovremene dijagnostike i primjene CBCT-a u slučaju trauma.

Pravovremena, precizna dijagnostika ključna je za adekvatno planiranje i liječenje.

Ključne riječi: Dentalna trauma, hronični apikalni parodontitis, osteolitičke lezije.

FIELD OF DENTISTRY: DENTAL TRAUMATOLOGY

TRAUMATIC ETIOLOGY OF CHRONIC APIKAL PERIODONTITIS IN CHILDHOOD: A CASE REPORT**Adisa Filipović–Goga¹, Nedim Leto², Džejma Suljić Hujić³, Ineta Šehović⁴**¹Public Health Clinic with Inpatient Care, Kakanj²Department of Maxillofacial Surgery, Zenica Cantonal Hospital³Oral Medicine and Periodontology Clinic, Dental Clinical Center of the University of Sarajevo⁴Dental Pathology and Endodontics Clinic, Dental Clinical Center of the University of Sarajevo**ABSTRACT**

Introduction: Dental trauma during adolescence is a common public health and clinical problem. The clinical presentation of these conditions is often variable and can lead to diagnostic and therapeutic dilemmas, particularly in cases of persistent infection and inadequate response to initial treatment.

Case Report: A 14-year-old boy, accompanied by his parents, was referred to the dental pathology and endodontics clinic by a dentist who had previously initiated endodontic therapy that had proven unsuccessful. According to the medical history, the patient sustained a ball-related trauma to the upper anterior teeth three months before the onset of symptoms, and no dental consultation was sought immediately after the injury. Three months following the trauma, the patient developed tooth discoloration, pain, and swelling. Despite prior endodontic treatment, persistent purulent discharge and recurrent exacerbations were observed, prompting the referring dentist to send him to the dental pathology and endodontics clinic. Clinical examination revealed a vestibular abscess in the region of the upper left lateral incisor (tooth 22) and palatal tenderness. Incision and drainage were performed, and the patient was referred for CBCT evaluation. CBCT imaging revealed extensive osteolytic lesions with alveolar bone resorption in the region of teeth 21 and 22, which confirmed chronic apical periodontitis with acute exacerbation. The patient was referred to a surgeon who, after a detailed assessment, decided to extract teeth 21 and 22.

Conclusion: The presented case highlights the importance of obtaining a thorough medical history, performing accurate and timely diagnosis, and utilizing CBCT in trauma cases.

Timely and precise diagnosis is crucial for appropriate treatment planning and management.

Keywords: Dental trauma, chronic apical periodontitis, osteolytic lesions.

OBLAST STOMATOLOGIJE: DJEČIJA STOMATOLOGIJA

UTJECAJ RAZLOGA PRVOG STOMATOLOŠKOG PREGLEDA NA KASNIJE OBRASCE STOMATOLOŠKIH POSJETA DJECE: PRESJEČNA STUDIJA

Matea Anić¹, Renea Popović¹, Stipo Cvitanović^{1,2}, Monika Šunjić¹, Ružica Zovko^{1,3}¹Medicinski fakultet Sveučilišta u Mostaru²Dom zdravlja Prozor-Rama³Dom zdravlja Mostar

SAŽETAK

Uvod: Gotovo sve suvremene smjernice o oralnom zdravlju djece preporučuju prvi stomatološki pregled do navršene prve godine života ili neposredno nakon nicanja prvog zuba. Takav rani kontakt sa stomatološkom skrbi jako je važan u prevenciji karijesa, praćenju pravilnog rasta i razvoja orofacijalnog sustava te u oblikovanju trajnih zdravih navika.

Cilj: Ispitati povezanost između razloga prvog stomatološkog pregleda i kasnijeg obrasca stomatoloških posjeta djece.

Metode: Provedena je sekundarna analiza presječnog istraživanja na uzorku od 405 roditelja/skrbnika djece. Razlog prvog pregleda kategoriziran je kao zubobolja, preventivni pregled ili upoznavanje s okolinom, a ishod je bila učestalost kasnijih posjeta (samo kada postoji problem, jednom godišnje, dva puta godišnje). Analiza je provedena na 397 ispitanika s potpunim podacima. Povezanost je ispitana Pearsonovim χ^2 testom, a veličina učinka procijenjena Cramerovim V koeficijentom uz razinu značajnosti $p < 0,05$.

Rezultati: Utvrđena je statistički značajna povezanost između razloga prvog pregleda i kasnijeg obrasca posjeta ($\chi^2=31,19$; $p < 0,001$; $V=0,20$). Među djecom koja su prvi put došla zbog zubobolje, 39 od 81 (48,1%) kasnije je dolazilo na redovite kontrole (jednom ili dva puta godišnje). Nasuprot tome, među djecom s preventivnim prvim pregledom, 167 od 214 (78,0%) nastavilo je dolaziti redovito, dok je sličan obrazac zabilježen i kod djece koja su prvi put došla radi upoznavanja sa stomatološkim okruženjem (77 od 102; 75,5%).

Zaključak: Razlog prvog stomatološkog pregleda značajno je povezan s kasnijim obrascem korištenja stomatološke skrbi. Rani preventivni kontakt može potaknuti redovitije dolaske, što naglašava važnost pravodobne edukacije roditelja i ranog uključivanja djece u sustav oralne skrbi.

Ključne riječi: oralno zdravlje djece, stomatološki posjeti, preventivna stomatologija, zdravstveno ponašanje, roditelji, presječna studija

FIELD OF DENTISTRY: PEDIATRIC DENTISTRY

THE IMPACT OF THE REASON FOR THE FIRST DENTAL VISIT ON SUBSEQUENT DENTAL VISIT PATTERNS IN CHILDREN: A CROSS-SECTIONAL STUDY

Matea Anić¹, Renea Popović¹, Stipo Cvitanović^{1,2}, Monika Šunjić¹, Ružica Zovko^{1,3}¹Faculty of Medicine, University of Mostar²Primary Health Care Center Prozor-Rama³Primary Health Care Center Mostar

ABSTRACT

Background: Nearly all contemporary guidelines on child oral health recommend a first dental visit by the age of one year or shortly after the eruption of the first tooth. Such early contact with dental care is very important for caries prevention, monitoring normal orofacial growth and development, and establishing lifelong healthy habits.

Objective: To examine the association between the reason for the first dental visit and subsequent dental attendance patterns in children.

Methods: A secondary analysis was conducted using data from a cross-sectional study involving 405 parents or guardians. The reason for the first dental visit was categorized as toothache, preventive examination, or familiarization with the dental environment, while the outcome was the frequency of subsequent visits (problem-based visits only, once yearly, or twice yearly). The analysis included 397 participants with complete data. Associations were assessed using Pearson's chi-square test, and effect size was estimated using Cramer's V, with statistical significance set at $p < 0.05$.

Results: A statistically significant association was found between the reason for the first dental visit and subsequent attendance patterns ($\chi^2=31.19$; $p < 0.001$; $V=0.20$). Among children whose first visit was due to toothache, 39 of 81 (48.1%) later attended regular check-ups (once or twice yearly). In contrast, among children with a preventive first visit, 167 of 214 (78.0%) continued to attend regularly, while a similar pattern was observed in children who initially attended for familiarization (77 of 102; 75.5%).

Conclusion: The reason for the first dental visit is significantly associated with subsequent patterns of dental care utilization. Early preventive contact may promote regular attendance, highlighting the importance of timely parental education and early integration of children into the dental care system.

Keywords: child oral health, dental visits, preventive dentistry, health behavior, parents, cross-sectional study

OBLAST STOMATOLOGIJE: DJEČJA STOMATOLOGIJA

BIRAJU LI RODITELJI ODGOVARAJUĆU ZUBNU PASTU ZA SVOJU DJECU? ULOGA ZNANJA I DRUGIH ČIMBENIKA: PRESJEČNA STUDIJA**Renea Popović, Stipo Cvitanović, Zvonimir Lukač, Brigita Marić, Ružica Zovko**

Medicinski fakultet Sveučilišta u Mostaru

SAŽETAK

Uvod: Fluor se koristi u prevenciji karijesa; međutim, izbor zubne paste za djecu u velikoj mjeri ovisi o roditeljima. Razina znanja o fluoridu može utjecati na pravilnost tog izbora.

Cilj: Procijeniti biraju li roditelji odgovarajuću pastu za zube za svoju djecu te ispitati povezanost između znanja o fluoridu i pravilnog odabira paste.

Materijali i metode: Provedena je presječna studija u Mostaru (siječanj–lipanj 2025.) na uzorku od 405 roditelja/skrbnika djece. Prikupljeni su podaci o sociodemografskim obilježjima, oralno higijenskim navikama i znanju o fluoridu. Formiran je kompozitni skor znanja o fluoridu (0–100) dodjeljivanjem 1 boda za svaki točan odgovor te 0 bodova za netočan ili odgovor „ne znam“, uz linearnu transformaciju na raspon 0–100; viši skor označava veće znanje. Odgovarajuća pasta definirana je kao uporaba fluoridne paste primjerene dobi, u skladu s važećim preporukama. Za analizu su korišteni hi-kvadrat test, Mann–Whitney U test i logistička regresija.

Rezultati: Odgovarajuću pastu koristilo je 32,4% ispitanika. Roditelji s pravilnim odabirom imali su značajno viši skor znanja (43,3 vs 23,3; $p < 0,001$). U multivarijatnoj analizi, viši skor znanja (OR 1,24; 95% CI 1,18–1,30), viši stupanj obrazovanja (OR 2,22; 95% CI 1,30–3,80) i veća važnost pridana savjetu stomatologa (OR 3,97; 95% CI 2,10–7,50) bili su neovisni prediktori pravilnog odabira paste.

Zaključak: Većina roditelja ne odabire odgovarajuću pastu za djecu. Uočeni nesklad između znanja i ponašanja upućuje na potrebu za ciljanim edukacijskim intervencijama i jačanjem uloge stomatologa u preventivnim strategijama.

Ključne riječi: fluor, zubna pasta, djeca, roditelji, oralno zdravlje

FIELD OF DENTISTRY: PEDIATRIC DENTISTRY

DO PARENTS CHOOSE APPROPRIATE TOOTHPASTE FOR THEIR CHILDREN? THE ROLE OF KNOWLEDGE AND OTHER DETERMINANTS: A CROSS-SECTIONAL STUDY**Renea Popović, Stipo Cvitanović, Zvonimir Lukač, Brigita Marić, Ružica Zovko**

Medical faculty of University of Mostar

ABSTRACT

Background: Fluoride is used in caries prevention; however, the choice of toothpaste for children largely depends on parents.

Objective: To assess whether parents choose appropriate toothpaste for their children and to examine the association between fluoride knowledge and appropriate toothpaste selection.

Materials and Methods: A cross-sectional study (Mostar, January–June 2025) included 405 parents/guardians. Data on sociodemographic, oral hygiene practices and fluoride knowledge were collected. A composite fluoride knowledge score (0–100) was calculated from correct responses (higher scores indicate greater knowledge). Appropriate toothpaste use was defined as age-appropriate fluoride toothpaste in line with current recommendations.

Results: Only 32.4% of parents chose appropriate toothpaste. Parents with appropriate selection had significantly higher knowledge scores (43.3 vs 23.3; $p < 0.001$). In multivariable analysis, higher knowledge score (OR 1.24; 95% CI 1.18–1.30), higher education level (OR 2.22; 95% CI 1.30–3.80), and greater importance assigned to professional dental advice (OR 3.97; 95% CI 2.10–7.50) were independent predictors of appropriate toothpaste selection.

Conclusion: Most parents do not select appropriate toothpaste for their children. The observed gap between knowledge and behavior highlights the need for targeted educational interventions and stronger integration of professional dental guidance into preventive strategies.

Keywords: fluoride, toothpaste, children, parents, oral health

OBLAST STOMATOLOGIJE: DJEČIJA STOMATOLOGIJA

TERAPIJA AVULZIJE GORNJIH STALNIH
CENTRALNIH SJEKUTIĆA SA LOŠOM
PROGNOZOM – PRIKAZ SLUČAJA

Samra Alić Fejzić¹, Damir Duratbegović², Elvana Sobo³,
Zerina Kučinar Sandžić¹, Elmedin Bajrić¹

¹Katedra za preventivnu stomatologiju i pedodonciju, Stomatološki fakultet, Univerzitet u Sarajevu

²Klinika za preventivnu i dječiju stomatologiju, Stomatološki klinički centar, Univerzitet u Sarajevu

³Klinika za oralnu hirurgiju, Stomatološki klinički centar, Univerzitet u Sarajevu

SAŽETAK

Uvod: Avulzija zuba je kompleksna traumatska povreda koju karakteriše kompletno pomjeranje zuba iz njegove alveole, i oštećenje potpornih struktura zuba. Moguće posttraumatske komplikacije su nekroza i infekcija zubne pulpe, obliteracija pulpnog prostora, resorpcija radikularnog prostora, ankiloza i oštećenja marginalne gingive i okolne kosti.

Cilj: Prikaz kliničkog slučaja avulzije gornjih stalnih centralnih sjekutića sa lošom prognozom.

Prikaz slučaja: Pacijent star 10 godina primarno je zbrinut na Klinici za maksilofacijalnu hirurgiju KCUS, gdje su avulzirani zubi 11 i 21 replantirani četiri sata nakon povrede i imobilizirani Pfeifferovim splintom. Dan kasnije upućen je na Stomatološki fakultet UNSA radi korekcije neadekvatne imobilizacije. Ekstirpacija pulpe urađena je mjesec dana nakon povrede, a splint uklonjen nakon 41 dan. Zbog razvoja upalno-zamjenske resorpcije provedeni su višeseansni endodontski tretmani. Nakon gotovo 14 mjeseci uočena je regresija resorptivnih procesa, uz značajnu redukciju korijena. Terapija je završena definitivnom opturacijom oba zuba MTA materijalom.

Diskusija i zaključak: Ishod liječenja avulziranih zuba može biti uspješno cijeljenje ili ekstrakcija. Najvažniji prognostički faktori su vrijeme do replantacije, adekvatna imobilizacija i medij čuvanja zuba prije replantacije.

Ključne riječi: avulzija, mladi trajni zub, komplikacija, replantacija, splint.

FIELD OF DENTISTRY: PEDIATRIC DENTISTRY

THERAPY OF AVULSION OF MAXILLARY
PERMANENT CENTRAL INCISORS WITH A POOR
PROGNOSIS – A CASE REPORT

Samra Alić Fejzić¹, Damir Duratbegović², Elvana Sobo³,
Zerina Kučinar Sandžić¹, Elmedin Bajrić¹

¹Department of Preventive and Pediatric Dentistry, Faculty of Dentistry, University of Sarajevo

²Clinic of Preventive and Pediatric Dentistry, Dental Clinical Center, University of Sarajevo

³Clinic of Oral Surgery, Dental Clinical Center, University of Sarajevo

ABSTRACT

Introduction: Tooth avulsion is a complex traumatic injury characterized by the complete displacement of the tooth from its tooth cup, combined with damage of supporting tooth structures. Possible post-traumatic complications are dental pulp necrosis and infection, pulpal space obliteration, root resorption, ankylosis and damage to the marginal gingiva and surrounding bone.

Aim: To present a clinical case of upper permanent central incisors with a poor prognosis.

Case report: A 10-year-old patient underwent replantation of avulsed teeth 11 and 21 four hours after injury, with placement of a Pfeiffer splint. One day later, retreatment of inadequate immobilization was performed. Pulp extirpation was carried out one month after trauma, and the splint was removed after 41 days. Due to inflammatory replacement resorption, both teeth required multiple endodontic retreatments. After almost 14 months, regression of the resorptive process was observed despite significant root reduction. Treatment was completed with MTA obturation of both canals.

Discussion and conclusion: Avulsed teeth may heal successfully or require extraction if replantation fails. Prognosis depends mainly on the time to replantation, proper immobilization, and the storage medium before replantation.

Keywords: avulsion, young permanent tooth, complication, replantation, splint.

OBLAST STOMATOLOGIJE: DJEČIJA STOMATOLOGIJA

ODGOĐENA REAKCIJA U TRETMANU CERVICALNE FRAKTURE KORIJENA STALNOG SJEKUTICA- PRIKAZ SLUČAJAZerina Kučinar Sandžić¹, Alma Alikadić², Damir Duratbegović², Nina Marković¹¹Katedra za dječiju i preventivnu stomatologiju Stomatološkog fakulteta Univerziteta u Sarajevu²Klinika za dječiju i preventivnu stomatologiju Stomatološkog kliničkog centra Univerziteta u Sarajevu**SAŽETAK**

Uvod: Traumatske povrede tijela su odgovorne za više od 5 miliona smrti na godišnjem nivou. Maksilofacijalna regija je površinom mala u odnosu na ostatak tijela, ali prema podacima na nju otpada 5 % svih tjelesnih povreda u svim dobnim skupinama. Najčešći tip povreda u stalnoj dentaciji su povrede tvrdih zubnih tkiva, dok su u mliječnoj dentaciji češće povrede potpornih tkiva zuba. Cilj rada bio je prikazati važnost sveobuhvatnog kliničkog pregleda i rendgen dijagnostike u svakodnevnoj stomatološkoj kazuistici.

Materijal i metode: U radu je prikazan slučaj pacijentice upućene na endodontski tretman zuba 47, gdje je prilikom kliničkog pregleda usne šupljine uočena pomičnost zuba 21, kao i njegova blaga perkutorna osjetljivost bez prisutne spontane simptomatologije. Dodatno, rendgen dijagnostikom (analizom opg-a) uočena je frakturna pukotina u području korijena zuba 21. Planom tretmana odlučeno je da se fraktura korijena zuba prati uz postavu žičano- kompozitnog splinta u frontalnoj regiji uz adekvatan higijensko -dijetetski režim. Na narednim kontrolnim pregledima uočena je smanjena pokretljivost zuba uz adekvatne reakcije na testove vitaliteta i senzibiliteta.

Rezultati: Nakon skidanja splinta ne dolazi do promjena u pogledu simptomatologije i reakcija na testove. Odlučeno je da se trauma prati u vremenskim intervalima od 40 dana, te ukoliko se pojavi bolna simptomatologija potrebno je uraditi endodontski tretman.

Zaključak: Obuhvatnost kliničkog pregleda važna je za pravilnu dijagnostiku i pravovremenu terapiju i sprečavanje postoperativnih komplikacija.

Glavne riječi: fraktura korijena, splint, trauma tvrdih zubnih tkiva, klinički pregled

FIELD OF DENTISTRY: PEDIATRIC DENTISTRY

DELAYED REACTION IN THE TREATMENT OF CERVICAL FRACTURE OF THE ROOT OF THE PERMANENT INCISOR - CASE REPORTZerina Kučinar Sandžić¹, Alma Alikadić², Damir Duratbegović², Nina Marković¹¹Department of Paediatric and Preventive Dentistry, Faculty of Dental Medicine, University of Sarajevo²Clinic for Pediatric and Preventive Dentistry of the Dental Clinical Center, University of Sarajevo**ABSTRACT**

Introduction: Traumatic injuries are responsible for more than 5 million deaths annually. The maxillofacial region is small in surface area compared to the rest of the body, but according to the data, it accounts for 5% of all physical injuries in all age groups. The most common type of injuries in permanent dentition are injuries to hard dental tissues, while in deciduous dentition, injuries to the supporting tissues of the teeth are more common. The aim of this study was to show the importance of comprehensive clinical examination and X-ray diagnostics in everyday dental case studies.

Materials and methods: This paper presents a case of a patient referred for endodontic treatment of tooth 47, where during a clinical examination of the oral cavity the mobility of tooth 21 was observed, as well as its mild percussion sensitivity without the presence of spontaneous symptomatology. In addition, X-ray diagnostics revealed a fracture crack in the area of the root of the tooth 21. The treatment plan decided that the fracture of the tooth root should be monitored with the placement of a wire-composite splint in the frontal region with an adequate hygienic and dietary regimen. At the following check-ups, reduced tooth mobility was observed with adequate reactions to vitality and sensitivity tests.

Results: After removal of the splint, there are no changes in terms of symptomatology and reactions to tests. It was decided that the trauma should be monitored at intervals of 40 days, and if painful symptomatology occurs, endodontic treatment should be performed.

Conclusion: The comprehensiveness of the clinical examination is important for proper diagnosis and timely therapy and prevention of postoperative complications.

Keywords: root fracture, splint, trauma of hard dental tissues, clinical examination

OBLAST STOMATOLOGIJE: ENDODONCIJA

KOMPARATIVNA ANALIZA REGENERATIVNOG I KONVENCIONALNOG ENDODONTSKOG PRISTUPA KOD TRAUMATSKE POVREDE GORNJEG CENTRALNOG I LATERALNOG SJEKUTIĆA: 18-MJESEČNI FOLLOW-UP**Adna Begović, Mirna Pašić, Madžida Halilović Mehinović, Aida Džanković, Lajla Hasić-Branković**

Katedra za dentalnu patologiju sa endodoncijom, Stomatološki fakultet Univerziteta u Sarajevu

SAŽETAK

Uvod: Traumatske povrede mladih stalnih zuba predstavljaju značajan izazov u endodonciji. Za razliku od konvencionalnog endodontskog tretmana, regenerativna endodoncija kao terapijska opcija nudi mogućnost biološke obnove tkiva. Cilj ovog rada je prikazati „split-mouth“ scenario i uporediti ishode regenerativnog i konvencionalnog tretmana tokom 18-mjesečnog perioda praćenja.

Prikaz slučaja: Četrnaestogodišnji pacijent se javio na Kliniku za dentalnu patologiju i endodonciju radi multiplih povreda prednjih zuba obje vilice zadobijenih prethodnog dana usljed pada s bicikla. Kliničkim pregledom je uočen edem gornje i donje usne, fraktura incizalnog brida zuba 11, te blaga pomičnost zuba interkanine regije. U toku kontinuiranih praćenja, na kontrolnom pregledu nakon osam mjeseci zabilježen je izostanak odgovora zuba 21 i 22 na test vitaliteta, te je za oba zuba postavljena indikacija za regenerativni endodontski tretman. Procedura je sprovedena na visokom kliničkom nivou, strogo poštujući savremene smjernice. Na zubu 21 uspješno je inducirano intrakanalno krvarenje mehaničkom iritacijom periapikalnog tkiva. Nasuprot tome, na zubu 22, uprkos višestrukim pokušajima, nije postignuto zadovoljavajuće krvarenje, zbog čega je sproveden konvencionalni endodontski tretman.

Zaključak: Iako su i regenerativni i konvencionalni terapijski pristup rezultirali kliničkim uspjehom i odsustvom simptoma nakon 18 mjeseci, regenerativna endodoncija bi trebala biti tretman izbora kod adolescenata zbog jedinstvenog potencijala za revitalizaciju.

Ključne riječi: regenerativna endodontska procedura, maksilarni sjekutić, dentalna trauma, krvni ugrušak, endodontski tretman

FIELD OF DENTISTRY: ENDODONTICS

COMPARATIVE ANALYSIS OF REGENERATIVE AND CONVENTIONAL ENDODONTIC APPROACHES IN TRAUMATIC INJURY OF MAXILLARY CENTRAL AND LATERAL INCISORS: 18-MONTH FOLLOW-UP**Adna Begović, Mirna Pašić, Madžida Halilović Mehinović, Aida Džanković, Lajla Hasić-Branković**

Department of Dental Pathology and Endodontics, Faculty of Dentistry of University of Sarajevo

ABSTRACT

Introduction: Traumatic injuries of young permanent teeth represent a significant challenge in endodontics. This case report aims to present a split-mouth scenario and compare the outcomes of regenerative and conventional treatment over an 18-month follow-up period.

Case report: A 14-year-old patient presented to the Clinic of Dental Pathology and Endodontics with multiple traumatic injuries in the intercanine region sustained the previous day in a bicycle accident. Clinical examination revealed edema of both lips, incisal edge fracture of tooth 11, and mild mobility of anterior teeth. Although the teeth had previously demonstrated normal pulp responsiveness, at the 8-month follow-up teeth 21 and 22 showed no response to vitality testing, and regenerative endodontic treatment was indicated for both. The regenerative endodontic protocol was performed at a high standard, following contemporary guidelines. In tooth 21, adequate intracanal bleeding was successfully induced by mechanical irritation of periapical tissues, whereas in tooth 22, despite multiple attempts, bleeding could not be achieved, and conventional endodontic treatment was performed.

Conclusion: Although both regenerative and conventional approaches resulted in clinical success and an asymptomatic status after 18 months, regenerative endodontics should be regarded as the treatment of choice in adolescents due to their unique potential for revitalization. Nevertheless, given the inherent biological variability, conventional endodontic treatment remains a reliable alternative for infection control and tooth preservation.

Keywords: regenerative endodontic procedure, maxillary incisor, dental trauma, blood clot, endodontic treatment.

OBLAST STOMATOLOGIJE: ENDODONCIJA

ANATOMSKE ZAGONETKE MEZIOBUKALNOG KORIJENA STALNOG MAKSIARNOG PRVOG MOLARA**Ema Jakubović¹, Aida Džanković², Irmira Tahmišćija², Samra Korać²**¹Nezavisni istraživač²Katedra za dentalnu patologiju s endodoncijom, Stomatološki fakultet Univerziteta u Sarajevu**SAŽETAK**

Cilj rada. Cilj istraživanja bio je analizirati korijensku kanalnu morfologiju maksilarnih prvih molara (MaxM1) primjenom kompjuterske tomografije konusnog snopa (CBCT).

Materijal i metode. U studiju je uključeno 70 CBCT snimaka (Orthophos SL, Dentsply Sirona, Njemačka) prikupljenih iz baze Stomatološkog fakulteta u Sarajevu i privatnih ordinacija. Analizirano je ukupno 100 maksilarnih prvih molara (lijevih i/ili desnih) pacijenata oba spola, starosne dobi 17–69 godina. Istraživani su broj korijenova, kanalna morfologija prema Vertuccijevoj klasifikaciji, te učestalost drugog meziobukalnog (MB2) kanala.

Rezultati. Najčešća anatomska konfiguracija MaxM1 bila je tri korijena i četiri kanala (69%). U palatinalnom i distobukalnom korijenu registrovan je Vertucci tip I u 100% slučajeva, dok je meziobukalni korijen pokazivao najveću varijabilnost, s najčešće zabilježenim tipovima I (31%), II (19%) i IV (18%). Prevalenca drugog meziobukalnog kanala (MB2) je visoka (69%). Bilateralna simetrija kod MaxM1 je primjećena u 86.67% uzoraka.

Zaključak. Rezultati naglašavaju značaj detaljne CBCT analize u planiranju i izvođenju endodontskog liječenja MaxM1.

Ključne riječi. Maksilarni prvi molar, CBCT, korijenska morfologija, meziobukalni korijen, Vertucci klasifikacija

FIELD OF DENTISTRY: ENDODONTICS

ANATOMICAL ENIGMAS OF THE MESIOBUCCAL ROOT IN THE PERMANENT MAXILLARY FIRST MOLAR**Ema Jakubović¹, Aida Džanković², Irmira Tahmišćija², Samra Korać²**¹Independent Researcher²Department of Dental Pathology and Endodontics, Faculty of Dentistry of University of Sarajevo**ABSTRACT**

Objective. The aim of this study was to analyze the root canal morphology of maxillary first molars (MaxM1) using cone-beam computed tomography (CBCT).

Materials and Methods. A total of 70 CBCT scans (Orthophos SL, Dentsply Sirona, Germany) obtained from the database of the Faculty of Dentistry in Sarajevo and private dental offices were included. The study analyzed 100 maxillary first molars (left and/or right) of patients aged 17–69 years, of both sexes. The number of roots, canal morphology according to Vertucci classifications, and the prevalence of the second mesiobuccal (MB2) canal were studied.

Results. The most common anatomical configuration of MaxM1 was three roots and four canals (69%). The palatal and distobuccal roots exhibited Vertucci type I in 100% of cases, whereas the mesiobuccal root showed the greatest variability, most frequently types I (31%), II (19%), and IV (18%). The prevalence of MB2 was high (69%). Bilateral symmetry in MaxM1 was observed in 86.67% of cases.

Conclusion. The results emphasize the importance of detailed CBCT analysis in planning and performing endodontic treatment of MaxM1.

Keywords. Maxillary first molar, CBCT, root morphology, mesiobuccal root, Vertucci classification

OBLAST STOMATOLOGIJE: ENDODONCIJA

KOMBINOVANA ENDODONTSKO-HIRURŠKA TERAPIJA PERIAPIKALNE PATOLOGIJE MANDIBULARNIH INCIZIVA SA DVA KANALA USLIJED NELIJEČENE DENTALNE TRAUME - PRIKAZ SLUČAJA

Jelena Marković¹, Kemal Hairlahović²¹Katedra za ortopediju vilica Stomatološki fakultet Univerziteta u Beogradu, Srbija^{1,2}Privatna stomatološka ordinacija „Dental Hairlahović“, Tuzla, Bosna i Hercegovina

SAŽETAK

Uvod: Neuspjeh endodontske terapije povezan je s neadekvatnim prepoznavanjem kompleksnosti endodontskog prostora i anatomskih varijacija korjenskih kanala. Savremeni dijagnostički pristupci od ključnog su značaja za precizno planiranje terapije i poboljšanje prognoze. Cilj rada je prikazati slučaj opsežne periapikalne patologije kao posljedice neliječene dentalne traume, te ukazati na značaj pravovremene dijagnostike, adekvatnog terapijskog planiranja i poznavanja anatomskih varijacija korjenskih kanala.

Materijali i metode: Prikazan je slučaj 35-godišnje pacijentice upućene radi promjene boje mandibularnog centralnog inciziva. CBCT analizom utvrđena je opsežna periapikalna lezija u regiji zuba 31, 32 i 41. Kliničkim pregledom utvrđena je negativna reakcija na testove senzibiliteta. Radiološki potvrđeno postojanje dva korjenska kanala 32 i 41, te izražena kalcifikacija pulpnog prostora zuba 31. Provedena je endodontska terapija zuba 32 i 41, dok je zbog nemogućnosti uspostavljanja prohodnosti kanala i jatrogene perforacije zub 31 indiciran za ekstrakciju uz hiruršku enukleaciju lezije.

Rezultati: Nakon provedene hemomehaničke obrade i opturacije kanala zuba 41 i 32, te hirurškog zahvata u regiji zuba 31, postignuto je uredno postoperativno cijeljenje. Kontrolni nalaz nakon dva i šest mjeseci pokazao je značajnu regresiju periapikalne lezije i znakove koštane regeneracije.

Zaključak: Rana dijagnostika i adekvatno zbrinjavanje dentalnih trauma, uz primjenu savremenih dijagnostičkih metoda i detaljno poznavanje endodontske anatomije, predstavljaju ključne faktore za uspješan terapijski ishod i prevenciju komplikacija.

Ključne riječi: dentalna trauma; mandibularni incizivi; varijacije korjenskih kanala; CBCT dijagnostika; periapikalna lezija

FIELD OF DENTISTRY: ENDODONTICS

COMBINED ENDODONTIC-SURGICAL THERAPY OF PERIAPICAL PATHOLOGY OF MANDIBULAR INCISORS WITH TWO ROOT CANALS DUE TO UNTREATED DENTAL TRAUMA – CASE REPORT

Jelena Marković¹, Kemal Hairlahović²¹Department of Orthodontics, Faculty of Dentistry of University of Belgrade, Serbia^{1,2}Private Dental Practice “Dental Hairlahović”, Tuzla, Bosnia and Herzegovina

ABSTRACT

Introduction: Failure of endodontic therapy is associated with inadequate recognition of the complexity of the endodontic space and anatomical variations of root canals. Modern diagnostic approaches are of key importance for precise treatment planning and improved prognosis. The aim of this study is to present a case of extensive periapical pathology as a consequence of untreated dental trauma, and to emphasize the importance of timely diagnosis, adequate treatment planning, and knowledge of root canal anatomical variations.

Materials and methods: A case of a 35-year-old female patient referred due to discoloration of the mandibular central incisor is presented. CBCT analysis revealed an extensive periapical lesion in the region of teeth 31, 32, and 41. Clinical examination showed a negative response to sensitivity tests. Radiological findings confirmed the presence of two root canals in teeth 32 and 41, as well as pronounced calcification of the pulp space of tooth 31. Endodontic treatment was performed on teeth 32 and 41, while due to canal patency and iatrogenic perforation, tooth 31 was indicated for extraction with surgical enucleation of the lesion.

Results: After chemo mechanical preparation and obturation of the canals of teeth 41 and 32, and surgical intervention in the region of tooth 31, uneventful postoperative healing was achieved. Follow-up after two and six months showed significant regression of the periapical lesion and signs of bone regeneration.

Conclusion: Early diagnosis and adequate management of dental trauma, along with the application of modern diagnostic methods and detailed knowledge of endodontic anatomy, are key factors for successful therapeutic outcomes and prevention of complications.

Keywords: dental trauma; mandibular incisors; root canal variations; CBCT diagnostics; periapical lesion

OBLAST STOMATOLOGIJE: ENDODONCIJA

**CBCT EVALUACIJA REGENERATIVNOG
POTENCIJALA KOSTI U GERIJATRIJSKOJ DOBI
NAKON RETRETMANA MULTIPLIH
HRONIČNIH APIKALNIH APSCESA****Madžida Halilović Mehinović¹, Edina Čolaković², Mirna
Pašić¹, Adna Begović¹, Samra Korać¹**¹Katedra za dentalnu patologiju s endodoncijom, Stomatološki
fakultet Univerziteta u Sarajevu²Specijalistička stomatološka ordinacija „RES DENTAL“, Sarajevo

SAŽETAK

Cilj ovog rada je prikazati koštanu regeneraciju apikalnih radiolucencija unutar tri mjeseca u osmoj deceniji života nakon retretmana šest zuba primjenom savremenih endodontskih protokola dezinfekcije i biokeramičkih materijala.

Prikaz slučaja: Pacijentica V.S. (73 godine) javila se zbog otoka sluznice, gnojne eksudacije i povremene nelagode u mandibuli. Klinički su uočene multiple fistule u interkaninoj regiji i most 33–43, dok su na OPG snimku registrovane periapikalne lezije, neadekvatna endodontska punjenja i neuspjela apikotomija zuba 32 i 33.

Plan terapije uključivao je endodontsku reviziju zuba 33–43 uz privremene krunice radi očuvanja funkcije i estetike. Uklonjene su stare keramičke krunice, a revizija je provedena mašinskim instrumentima uz irigaciju NaOCl i EDTA. Finalna dezinfekcija postignuta je zagrijanim NaOCl i pasivnom ultrasoničnom irigacijom. Nakon medikamentoznog uložka na bazi kalcij-hidroksida tokom tri sedmice, kanali su definitivno opturirani biokeramičkim silerom, uz dodatno MTA brtvljenje zuba 32. Kontrolni CBCT nakon tri mjeseca pokazao je regresiju svih lezija.

Zaključak: Hronološka starost pacijenta nije prepreka za regeneraciju kosti ukoliko se eliminiše izvor infekcije unutar kanala korijena. Ortogradno punjenje treba biti primarni izbor kod neuspješnog endodontskog tretmana i apikotomije.

Ključne riječi: endodontska revizija, gerijatrijska stomatologija, MTA, biokeramički siler, CBCT, PUI

FIELD OF DENTISTRY: ENDODONTICS

**CBCT EVALUATION OF BONE REGENERATIVE
POTENTIAL IN A GERIATRIC PATIENT
FOLLOWING RETREATMENT OF MULTIPLE
CHRONIC APICAL ABSCESES****Madžida Halilović Mehinović¹, Edina Čolaković², Mirna
Pašić¹, Adna Begović¹, Samra Korać¹**¹Department of Dental Pathology with Endodontics, Faculty of
Dentistry of University of Sarajevo²Specialist Dental Clinic „RES DENTAL“, Sarajevo

ABSTRACT

The aim of this paper is to provide evidence of bone regeneration of apical radiolucencies within three months in a septuagenarian patient following the retreatment of six teeth using contemporary endodontic disinfection protocols and bioceramic materials.

Case Report: Patient V.S. (73 years old) presented with mucosal swelling, purulent exudation, and occasional discomfort in the mandible. Clinical examination revealed multiple fistulas in the intercanine region and a bridge from teeth 33–43, while the OPG showed periapical lesions, inadequate endodontic fillings, and failed apicoectomy of teeth 32 and 33.

The treatment plan included endodontic retreatment of teeth 33–43 with temporary crowns to preserve function and esthetics. Old ceramic crowns were removed, and retreatment was performed using rotary instruments with NaOCl and EDTA irrigation. Final disinfection was achieved with heated NaOCl and passive ultrasonic irrigation. After a calcium hydroxide intracanal medicament for three weeks, the canals were obturated with a bioceramic sealer, with additional MTA sealing of tooth 32. Follow-up CBCT after three months showed regression of all lesions.

Conclusion: The patient's chronological age is not a barrier to bone regeneration, as long as the root canal infection is eliminated. Orthograde filling should be the primary choice in cases of failed endodontic treatment and apicoectomy.

Keywords: endodontic retreatment, geriatric dentistry, MTA, bioceramic sealer, CBCT, PUI

OBLAST STOMATOLOGIJE: ENDODONCIJA

KADA ENDODONCIJA NE IDE PO PLANU: STRATEGIJE ZA RJEŠAVANJE KLINIČKIH KOMPLIKACIJA, PRIKAZ SLUČAJA**Mirna Pašić¹, Alma Konjhodžić¹, Sanja Hadžić², Zerina Kučinar³, Adna Begović¹, Madžida Halilović Mehinović¹**¹Katedra za dentalnu patologiju s endodoncijom, Stomatološki fakultet, Univerzitet u Sarajevu²Katedra za oralnu medicinu i parodontologiju, Stomatološki fakultet, Univerzitet u Sarajevu³Katedra za preventivnu stomatologiju i pedodonciju, Stomatološki fakultet, Univerzitet u Sarajevu

SAŽETAK

Uvod: Mandibularni sjekutići predstavljaju veliki izazov sa aspekta endodontskog liječenja zuba. Trauma zuba, učestala u ovoj regiji, dodatno komplikuje prognozu inducirajući procese obliteracije korijenskog kanala.

Prikaz slučaja: Petnaestogodišnji pacijent javio se zbog boli i otoka u regiji brade i desnog obraza. Intraoralno je uočen vestibularni eritem u projekciji apeksa zuba 41 i 42. RVG snimak pokazao je periapikalnu radiolucenciju promjera 9,67 mm, uz negativan test vitaliteta. Nakon trepanacije, iz zuba 41 dobivena je gnojna eksudacija. Pri pokušaju obrade zuba 42 došlo je do obilnog krvarenja, te je pacijent upućen na dalju dijagnostiku. Novim RVG snimkom utvrđena je perforacija u koronarnom dijelu korijena. Nakon zatvaranja postojećeg pristupa, uz pomoć dentalnog mikroskopa uspješno je pronađen i obrađen kanal. Primijenjen je Ca(OH)₂, a potom i definitivno punjenje gutaperkom i epoksi silerom. Hirurškim zahvatom perforacija je zatvorena MTA materijalom.

Zaključak: Mikro-endodontski pristup uz upotrebu dentalnog mikroskopa i CBCT-a ključan je za izbjegavanje jatrogenih grešaka i sigurno lociranje kanala.

Gljučne riječi: mandibularni sjekutići, perforacija korijena, obliteracija, dentalni mikroskop, MTA.

FIELD OF DENTISTRY: ENDODONTICS

CHALLENGING ENDODONTIC CASES: STRATEGIES FOR OVERCOMING CLINICAL COMPLICATIONS, CASE REPORT**Mirna Pašić¹, Alma Konjhodžić¹, Sanja Hadžić², Zerina Kučinar³, Adna Begović¹, Madžida Halilović Mehinović¹**¹Department of Dental Pathology with Endodontics, Faculty of Dentistry, University of Sarajevo²Department of Oral Medicine and Periodontology, Faculty of Dentistry, University of Sarajevo³Department of Preventive Dentistry and Pedodontics, Faculty of Dentistry, University of Sarajevo

ABSTRACT

Introduction: Mandibular incisors represent a significant endodontic challenge due to pronounced mesiodistal root compression and a high prevalence of additional canals. Furthermore, frequent dental trauma in this region complicates the prognosis by inducing root canal obliteration.

Case Report: A 15-year-old patient presented with pain and swelling in the chin and right cheek region. Intraoral examination revealed vestibular erythema in the projection of the apices of teeth 41 and 42. An RVG radiograph demonstrated a periapical radiolucency measuring 9.67 mm, with a negative vitality test. Following trepanation, purulent exudate was obtained from tooth 41. During the attempt to instrument tooth 42, profuse bleeding occurred, and the patient was referred for further diagnostics. A subsequent RVG radiograph confirmed a perforation in the coronal part of the root. After sealing the existing access cavity, a new access was established, and with the aid of a dental microscope, the root canal was successfully located and instrumented. Calcium hydroxide was applied, followed by definitive obturation using gutta-percha and an epoxy resin-based sealer. The perforation was surgically managed and successfully sealed using MTA.

Conclusion: A micro-endodontic approach, supported by the use of a dental microscope and CBCT, is essential for preventing iatrogenic errors and ensuring accurate canal localization.

Keywords: mandibular incisors, root perforation, obliteration, dental microscope, MTA.

OBLAST STOMATOLOGIJE: MAKSILOFACIJALNA HIRURGIJA

REKONSTRUKCIJA POSTOPERATIVNIH DEFEKATA MAKSILOFACIJALNE REGIJE SLOBODNIM KOŽNIM TRANSPLANTATOM PO WOLFE-U U LOKALNOJ ANESTEZIJI: PRIKAZ SERIJE SLUČAJEVA

Dimitrije V. Kljajić¹, Nenad Milošević²¹Poliklinika Kljajić, Kruševac, Srbija²Stomatološka ordinacija „HAPPY DENTAL“, Stopanja; Srbija

SAŽETAK

Uvod: Savremeni trendovi u sekundarnim privatnim zdravstvenim ustanovama sve više teže modelu jednodnevne hirurgije. U maksilofacijalnoj hirurgiji, to podrazumijeva izvođenje kompleksnih rekonstruktivnih zahvata u lokalnoj anesteziji, čime se postiže brži oporavak pacijenta uz značajno smanjenje operativnog rizika i troškova liječenja.

Cilj rada: Prikazati efikasnost i opravdanost primjene slobodnog kožnog transplantata pune debljine (po Wolfe-u) u rekonstrukciji defekata nakon ekscizije tumora maksilofacijalne regije u uslovima lokalne anestezije.

Prikaz slučaja: Rad analizira tri pacijenta gerijatrijske populacije sa dijagnozama bazocelularnog (BCC) i planocelularnog karcinoma (PCC) u regijama čela i sljepočnice. Zbog prisutnih komorbiditeta i obima promjena, hirurški tretman je sproveden u lokalnoj anesteziji. Nakon radikalne ekscizije tumora, defekti su rekonstruisani slobodnim transplantatima uzetim sa supraklavikularne lože i nadlaktice. Kod svih pacijenata postignut je uredan postoperativni tok, uz adekvatan estetski i funkcionalni ishod. Histopatološki nalazi potvrdili su radikalnost operacija (u cjelini), a tokom kontrolnog perioda nisu uočeni recidivi ni metastatske promjene.

Zaključak: Primena slobodnih kožnih transplantata u lokalnoj anesteziji predstavlja bezbjednu i pouzdanu metodu za zbrinjavanje onkoloških pacijenata u okviru jednodnevne hirurgije. Ovakav pristup značajno štedi vrijeme, materijalna sredstva i ljudske resurse, bez kompromitovanja kvaliteta liječenja i onkoloških principa.

Ključne riječi: maksilofacijalna hirurgija, Wolfe transplantat, lokalna anestezija, onkohirurgija, jednodnevna hirurgija.

FIELD OF DENTISTRY: MAXILLOFACIAL SURGERY

RECONSTRUCTION OF POSTOPERATIVE MAXILLOFACIAL DEFECTS USING WOLFE FULL-THICKNESS SKIN GRAFTS UNDER LOCAL ANESTHESIA: A CASE SERIES

Dimitrije V. Kljajić¹, Nenad Milošević²¹Dental Polyclinic Kljajić, Kruševac, Serbia²Dental Office "HAPPY DENTAL", Stopanja, Serbia

ABSTRACT

Introduction: Contemporary trends in secondary private healthcare facilities increasingly favor the day-surgery model. In maxillofacial surgery, this involves performing complex reconstructive procedures under local anesthesia, ensuring faster patient recovery while significantly reducing operative risks and healthcare costs.

Objective: To demonstrate the efficacy and justification of using Wolfe full-thickness skin grafts for the reconstruction of defects following tumor excision in the maxillofacial region under local anesthesia.

Case Series: This paper analyzes three geriatric patients diagnosed with basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) in the frontal and temporal regions. Due to comorbidities and the extent of the lesions, surgical treatment was performed under local anesthesia. Following radical tumor excision, the defects were reconstructed using full-thickness grafts harvested from the supraclavicular fossa and the upper arm. All patients achieved a smooth postoperative recovery with adequate aesthetic and functional outcomes. Histopathological findings confirmed radical excision (in toto), and no recurrences or metastatic changes were observed during the follow-up period.

Conclusion: The application of full-thickness skin grafts under local anesthesia is a safe and reliable method for managing oncological patients within a day-surgery framework. This approach significantly saves time, material resources, and personnel, without compromising the quality of treatment or oncological principles.

Keywords: maxillofacial surgery, Wolfe graft, local anesthesia, surgical oncology, day surgery.

OBLAST STOMATOLOGIJE: MAKSILOFACIJALNA HIRURGIJA

**ŽIVOTNO UGROŽAVAJAĆE DENTOGENE
INFEKCIJE – KLINIČKI TOK I PRINCIPI
LIJEČENJA****Džejla Bećirović**

Privatna stomatološka ordinacija Lorica dent Sarajevo

SAŽETAK

Uvod: Dentogene infekcije su česte u stomatološkoj praksi, ali u određenim slučajevima mogu progredirati u životno ugrožavajuća stanja. Širenjem u duboke fascijalne prostore glave i vrata mogu dovesti do opstrukcije disajnih puteva, sepe i intrakranijalnih komplikacija, što zahtijeva hitan terapijski pristup u maksilofacijalnoj hirurgiji.

Cilj rada: Prikazati neke od životno ugrožavajućih dentogenih infekcija, njihov klinički tok, dijagnostičke izazove i osnovne principe liječenja.

Materijali i metode: Rad se zasniva na preglednoj analizi savremene literature i kliničkih karakteristika najtežih oblika dentogenih infekcija, uključujući Ludwigovu anginu, nekrotizirajući fasciitis i trombozu kavernoznog sinusa.

Rezultati: Infekcije najčešće potiču od donjih molara te se šire u submandibularne i parafaringealne prostore. Kliničku sliku karakterišu trizmus, disfagija, dispneja i febrilnost. Pravovremena dijagnoza i adekvatna terapija, uključujući inciziju i drenažu, intravensku antibiotsku terapiju i osiguranje disajnog puta, ključni su za povoljan ishod.

Zaključak: Rano prepoznavanje i pravovremeno liječenje dentogenih infekcija od presudnog su značaja za sprečavanje teških komplikacija. Kontinuirana edukacija i multidisciplinarni pristup doprinose smanjenju morbiditeta i mortaliteta.

Ključne riječi: dentogene infekcije, Ludwigova angina, maksilofacijalna hirurgija, duboki fascijalni prostori, komplikacije.

FIELD OF DENTISTRY: MAXILLOFACIAL SURGERY

**LIFE-THREATENING ODONTOGENIC INFECTIONS –
CLINICAL COURSE AND PRINCIPLES OF
TREATMENT****Džejla Bećirović**

Private dental office Lorica dent Sarajevo

ABSTRACT

Introduction: Odontogenic infections are common in dental practice, but in certain cases they may progress into life-threatening conditions. By spreading into the deep fascial spaces of the head and neck, they can lead to airway obstruction, sepsis, and intracranial complications, requiring urgent treatment in Maxillofacial Surgery.

Aim: To present some life-threatening odontogenic infections, their clinical course, diagnostic challenges, and the basic principles of treatment.

Materials and Methods: This paper is based on a review of contemporary literature and the clinical characteristics of the most severe forms of odontogenic infections, including Ludwig's Angina, Necrotizing Fasciitis, and Cavernous Sinus Thrombosis.

Results: These infections most commonly originate from the lower molars and spread into the submandibular and parapharyngeal spaces. The clinical presentation is characterized by trismus, dysphagia, dyspnea, and fever. Timely diagnosis and adequate therapy, including incision and drainage, intravenous antibiotic therapy, and airway management, are crucial for a favorable outcome.

Conclusion: Early recognition and timely treatment of odontogenic infections are essential for preventing severe complications. Continuous education and a multidisciplinary approach contribute to reducing morbidity and mortality.

Keywords: odontogenic infections, Ludwig's angina, maxillofacial surgery, deep fascial spaces, complications.

OBLAST STOMATOLOGIJE: OPŠTA STOMATOLOŠKA PRAKSA

PROCJENA ZNANJA, STAVOVA I PRAKSE PRIMJENE UMJETNE INTELIGENCIJE U STOMATOLOGIJI MEĐU STUDENTIMA STOMATOLOŠKOG FAKULTETA UNIVERZITETA U SARAJEVU

Adnan Imamović¹, Elmedin Bajrić²¹student 5. godine, Stomatološki fakultet Univerziteta u Sarajevu²Katedra za preventivnu stomatologiju i pedodonciju,
Stomatološki fakultet Univerziteta u Sarajevu

SAŽETAK

Uvod: Savremeni razvoj digitalnih tehnologija i umjetne inteligencije (AI) značajno transformiše dijagnostičke i terapijske protokole u stomatologiji. Efikasna integracija ovih sistema primarno zavisi od znanja i stavova budućih stomatologa. Cilj istraživanja je procijeniti znanje, stavove i praksu primjene AI alata među studentima završnih godina Stomatološkog fakulteta Univerziteta u Sarajevu.

Ispitanici i metode: Presječna studija provedena na Stomatološkom fakultetu Univerziteta u Sarajevu, uz informirani pristanak ispitanika. Istraživanje je obuhvatilo ukupno 96 studenata, oba spola, popunjavanjem online strukturiranog upitnika od ukupno 36 pitanja, prethodno zasnovanog na validiranim radovima. Upitnik je analizirao opće demografske podatke, znanje o AI, stavove o kliničkoj primjeni AI i specifičnu upotrebu AI alata u edukaciji.

Rezultati i diskusija istraživanja: ispitanici su pokazali solidno predznanje o upotrebi AI u stomatologiji, koje su većinom sticali iz neformalnih izvora informacija. Iskazani su pozitivni stavovi o upotrebi AI u različitim specijalističkim granama stomatologije. Ispitanici poprilično koriste ChatGPT i druge AI alate u svakodnevnom edukativnim i socijalnim aktivnostima. Navedeni rezultati su u opsegu nalaza recentnih istraživanja drugih autora na zadatu temu.

Zaključci: U obrazovnom segmentu potrebno je posvetiti pažnju na pravilnoj i usmjerenoj edukaciji studenata po ovom pitanju, sa kritičkim pristupom stomatologije zasnovane na dokazima.

Ključne riječi: umjetna inteligencija, studenti stomatologije, klinička primjena, znanje, stavovi i praksa

FIELD OF DENTISTRY: GENERAL DENTAL PRACTICE

ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING THE USE OF ARTIFICIAL INTELLIGENCE IN DENTISTRY AMONG STUDENTS OF THE FACULTY OF DENTISTRY OF UNIVERSITY OF SARAJEVO

Adnan Imamović¹, Elmedin Bajrić²¹15th-year student, Faculty of Dentistry of University of Sarajevo²Department for Preventive and Pediatric Dentistry, Faculty of
Dentistry of University of Sarajevo

ABSTRACT

Introduction: The development of digital technologies and Artificial Intelligence (AI) is significantly transforming diagnostic and therapeutic protocols in dentistry. The effective integration of these systems depends on the knowledge and attitudes of future dentists. The aim of this study was to assess the knowledge, attitudes, and practices related to the use of AI tools among final-year students of the Faculty of Dentistry at the University of Sarajevo.

Participants and Methods: This cross-sectional study was conducted at the Faculty of Dentistry, University of Sarajevo, with the informed consent of the participating students. The research included a total of 96 students of both sexes. Data were collected using a structured online questionnaire consisting of 36 questions, previously based on validated studies. The questionnaire analyzed general demographic data, knowledge of AI, attitudes toward the clinical application of AI, and the specific use of AI tools in education.

Results and Discussion: The participating demonstrated a solid level of prior knowledge about the use of AI in dentistry, which they mostly acquired from informal sources of information. Generally positive attitudes toward the use of AI in various dental specialties were reported. These results are consistent with findings from recent studies by other authors on the same topic.

Conclusion: Within the educational framework of the faculty, greater attention should be devoted to proper and structured student education on this topic, with a critical approach based on evidence-based dentistry.

Keywords: artificial intelligence, dental students, clinical application, knowledge, attitudes, and practice.

OBLAST STOMATOLOGIJE: ORALNA HIRURGIJA

RAZLIKE IZMEĐU PREPORUČENIH SMJERNICA I KLINIČKE REALNOSTI U PREVENCIJI I LIJEČENJU MRONJ-A**Anela Hardaga- Muzurović¹, Sadeta Šečić²**¹Klinika za oralnu hirurgiju, Univerzitet u Sarajevu - Stomatološki klinički centar²Katedra za oralnu hirurgiju sa dentalnom implantologijom, Univerzitet u Sarajevu - Stomatološki fakultet**SAŽETAK**

Uvod: Medikamentima uzrokovana osteonekroza viličnih kostiju (MRONJ) predstavlja tešku posljedičnu komplikaciju, često neizlječivu, koja najčešće nastaje kod onkoloških pacijenata na antiresorptivnoj terapiji. Njihova primjena u svakodnevnoj kliničkoj praksi često je ograničena zbog heterogenosti pacijenata, terapijskih protokola i samog ustroja zdravstvenog sistema. Cilj ovog rada je analizirati razlike i odstupanja između postojećih preventivnih smjernica i stvarnih kliničkih okolnosti u oralnohirurškoj praksi, s posebnim osvrtom na procjenu rizika i donošenje terapijskih odluka prije invazivnih zahvata.

Materijali i metode: Rad je baziran na analizi relevantne literature pregledane putem PubMed i Scopus naučnih baza podataka, uz fokus na strategije prevencije i savremene međunarodne smjernice liječenja MRONJ-a. Urađena je komparativna analiza preporučenih protokola i kliničkih izazova s kojima se susreću oralni hirurzi u svakodnevnom radu.

Rezultati: Analiza ukazuje na značajne razlike između teorijskih preporuka i kliničke primjenjivosti, naročito u pogledu procjene individualnog rizika, trajanja prekida terapije (drug holiday), indikacija za ekstrakciju zuba te interdisciplinarnu saradnje oralnog hirurga i onkologa. Nedostatak standardiziranog modela procjene rizika doprinosi varijabilnost kliničkih odluka.

Zaključak: Postojeće smjernice predstavljaju važan okvir za prevenciju MRONJ-a, ali ne odražavaju u potpunosti kompleksnost kliničke realnosti. Razvoj praktičnih, individualiziranih i kliničkih primjenjivih protokola za procjenu rizika mogao bi unaprijediti donošenje terapijskih odluka i smanjiti incidenciju MRONJ-a u svakodnevnoj kliničkoj praksi.

Ključne riječi: MRONJ, bisfosfonati, prevencija, kliničke smjernice, procjena rizika.

FIELD OF DENTISTRY: ORAL SURGERY

DIFFERENCES BETWEEN RECOMMENDED GUIDELINES AND CLINICAL REALITY IN THE PREVENTION AND MANAGEMENT OF MRONJ**Anela Hardaga- Muzurović¹, Sadeta Šečić²**¹Oral Surgery Clinic, University of Sarajevo- Dental Clinical Center²Department of Oral Surgery with Dental Implantology, University of Sarajevo - Faculty of Dentistry**ABSTRACT**

Introduction: Medication-related osteonecrosis of the jaw (MRONJ) represents a severe and often incurable complication that most commonly occurs in oncological patients receiving antiresorptive therapy. Their implementation in everyday clinical practice is often limited due to the heterogeneity of patients, therapeutic protocols and the structure of the healthcare system itself. The aim of this paper is to analyze the differences and deviations between existing preventive guidelines and real clinical circumstances in oral surgery practice, with particular emphasis on risk assessment and therapeutic decision-making prior to invasive procedures.

Materials and Methods: The study is based on the analysis of relevant literature reviewed through the PubMed and Scopus scientific databases, with a focus on prevention strategies and contemporary international guidelines for the treatment of MRONJ. A comparative analysis of recommended protocols and clinical challenges encountered by oral surgeons in everyday practice was performed.

Results: The analysis indicates significant differences between theoretical recommendations and clinical applicability, particularly regarding the assessment of individual risk, the duration of therapy interruption, indications for tooth extraction, and interdisciplinary collaboration between oral surgeons and oncologists. The lack of a standardized risk assessment model contributes to variability in clinical decision-making.

Conclusion: Existing guidelines represent an important framework for the prevention of MRONJ, but they do not fully reflect the complexity of clinical reality. The development of practical, individualized and clinically applicable protocols for risk assessment could improve therapeutic decision-making and reduce the incidence of MRONJ in everyday clinical practice.

Keywords: MRONJ, bisphosphonates, prevention, clinical guidelines, risk assessment.

OBLAST STOMATOLOGIJE: ORALNA HIRURGIJA

HEILOPLASTIKA REDUNDANTNE SLUZNICE DONJE USNE**Monika Šunjić¹, Ružica Zovko^{1,2}, Inge Šarac³, Stipo Cvitanović^{1,4}, Zdenko Šarac^{1,3}**¹Medicinski fakultet Sveučilišta u Mostaru²Dom zdravlja Mostar³Stomatološka ordinacija dr. Šarac Mostar⁴Dom zdravlja Prozor-Rama**SAŽETAK**

Uvod: Redundantna sluznica usne (mucosa labii redundans) je patološko stanje karakterizirano povećanjem količine i površine sluzničnog tkiva uslijed hiperplazije submukoznog vezivnog tkiva, što rezultira formiranjem suvišnih, često naboranih mukoznih struktura vidljivih pri funkcionalnim potezima usne. Mogući etiološki čimbenik je kronična mehanička iritacija.

Materijali i metode: Kirurški zahvat se izvodi u lokalnoj anesteziji, primjenom standardnih instrumenata za eksciziju mekotkivnih lezija. Ekscizija lezije provodi se skalpelom uz maksimalno očuvanje okolnih anatomskih struktura. Rana cijeli sekundarno zbog prilagodbe epitelizacije, tkivnih slojeva i estetskih zahtjeva zahvata (vermilionimska zona). Dobiveni preparat se upućuje na patohistološku analizu. Preliminarna klinička dijagnoza upućuje na hiperplaziju sluznice.

Rezultati: Hiperplastične lezije sluznice usne, uključujući klinički prezentiranu redundantnu sluznicu, najčešće nastaju kao posljedica kronične mehaničke iritacije, mogu dugo perzistirati bez značajne progresije. Unatoč benignom karakteru, njihova lokalizacija u estetski eksponiranim regijama zahtijeva pažljivo kirurško planiranje i preciznu izvedbu zahvata.

Zaključak: Kirurška ekscizija skalpelom može predstavljati metodu izbora u ovakvim slučajevima zbog bolje kontrole resekcijskih rubova, minimalnog oštećenja okolnog tkiva i povoljnijeg postoperativnog tijeka u odnosu na termokauter.

Ključne riječi: heiloplastika, ekscizija, hiperplazija

FIELD OF DENTISTRY: ORAL SURGERY

CHEILOPLASTY OF REDUNDANT LOWER LIP MUCOSA**Monika Šunjić¹, Ružica Zovko^{1,2}, Inge Šarac³, Stipo Cvitanović^{1,4}, Zdenko Šarac^{1,3}**¹Faculty of Medicine, University of Mostar²Primary Health Care Center Mostar³Dental Practice Dr. Šarac Mostar⁴Primary Health Care Center Prozor-Rama**ABSTRACT**

Introduction: Redundant labial mucosa (mucosa labii redundans) is a pathological condition characterized by an increase in the quantity and surface area of the lip mucosal tissue due to hyperplasia of the submucosal connective tissue, resulting in the formation of excess, often folded mucosal structures visible during functional movements of the lip. A possible etiological factor was chronic mechanical irritation.

Materials and methods: The surgical procedure was performed under local anesthesia using standard instruments for soft tissue excision. Excision of the lesion was carried out with a scalpel, with maximal preservation of surrounding anatomical structures. The wound healed by secondary intention to allow proper epithelialization, tissue adaptation, and to meet aesthetic requirements (vermilion border). The preliminary clinical diagnosis suggested mucosal hyperplasia.

Results: Hyperplastic lesions of the lip mucosa, clinically presenting as redundant mucosa, most commonly arise as a result of chronic mechanical irritation and may persist for extended periods without significant progression.

Despite their benign nature, their location in aesthetically exposed regions requires careful surgical planning and precise execution.

Conclusion: Surgical excision with a scalpel may represent the method of choice in such cases due to better control of resection margins, minimal trauma to surrounding tissues, and a more favorable postoperative course compared to electrocautery.

Keywords: cheiloplasty, excision, hyperplasia

OBLAST STOMATOLOGIJE: ORALNA MEDICINA

PEMPHIGUS VULGARIS: ZNAČAJ STOMATOLOŠKOG PREGLEDA U FAZI REMISIJE – PRIKAZ SLUČAJA

Lejla Reizbegović Osmanović, Džejla Bećirović

Privatna stomatološka ordinacija Lorica dent Sarajevo

SAŽETAK

Uvod: Pemphigus vulgaris je hronična autoimuna bulozna bolest koja zahvata kožu i oralnu sluznicu, pri čemu oralne manifestacije često imaju važnu dijagnostičku ulogu.

Cilj istraživanja: Cilj rada je prikazati kliničke karakteristike oralnih promjena kod pacijentice sa Pemphigus vulgaris u fazi remisije, te naglasiti značaj stomatološkog pregleda u praćenju bolesti.

Materijal i metode: Prikaz slučaja pacijentice sa ranije dijagnostikovanom Pemphigus vulgaris koja se javlja na stomatološki pregled u fazi remisije. Analizirani su anamnestički podaci, medicinska dokumentacija i klinički nalaz oralne sluznice.

Rezultati: Prema anamnestičkim podacima, bolest je započela pojavom bula i erozija na koži, nakon čega dolazi do zahvatanja oralne sluznice sa bolnim ulceracijama. Inicijalna terapija sistemskim kortikosteroidima nije dala zadovoljavajući odgovor, te je uvedena biološka terapija koja je dovela do remisije. Kliničkim regledom uočeno je ožiljno, zadebljano tkivo na mjestima prethodnih ulceracija, bez prisustva aktivnih lezija.

Zaključak: Rad naglašava značaj stomatologa u prepoznavanju aktivnih i rezidualnih promjena oralne sluznice kod Pemphigus vulgaris, kao i važnost diferencijalne dijagnoze u odnosu na oralni lichen planus i pemfigoid mukozne membrane. Interdisciplinarna saradnja i kontinuirano praćenje pacijenata ključni su za uspješno vođenje bolesti.

Ključne riječi: pemphigus vulgaris, oralna sluznica, autoimune bolesti, diferencijalna dijagnoza, stomatološki pregled.

FIELD OF DENTISTRY: ORAL MEDICINE

PEMPHIGUS VULGARIS: THE IMPORTANCE OF DENTAL EXAMINATION IN THE REMISSION PHASE- A CASE REPORT

Lejla Reizbegović Osmanović, Džejla Bećirović

Private dental office Lorica dent Sarajevo

ABSTRACT

Introduction: Pemphigus vulgaris is a chronic autoimmune bullous disorder affecting the skin and oral mucosa, with oral manifestations often playing a pivotal role in early diagnosis.

Objective: To present the clinical features of oral lesions in a patient with Pemphigus vulgaris during remission and to emphasize the role of dental examination in disease monitoring.

Materials and methods: This paper presents a case report of a patient with a previously established diagnosis of Pemphigus vulgaris who attended a dental examination during the remission phase. Medical history, relevant documentation, and clinical findings of the oral mucosa were evaluated.

Results: According to the patient's history, the disease initially presented with bullae and erosions on the skin, followed by involvement of the oral mucosa characterized by painful ulcerations. Initial treatment with systemic corticosteroids yielded an inadequate therapeutic response; therefore, biologic therapy was introduced, resulting in remission. Clinical intraoral examination revealed fibrotic and thickened tissue at sites of previous ulcerations, without evidence of active lesions.

Conclusion: This case highlights the significant role of the dentist in recognizing both active and residual oral mucosal changes in Pemphigus vulgaris, as well as the importance of differential diagnosis in relation to oral lichen planus and mucous membrane pemphigoid. Interdisciplinary collaboration and continuous follow-up are essential for optimal disease management.

Keywords: pemphigus vulgaris, oral mucosa, autoimmune diseases, differential diagnosis, dental examination.

OBLAST STOMATOLOGIJE: ORTODONCIJA

ANALIZA UČESTALOSTI TRANSVERZALNIH OKLUZALNIH ANOMALIJA

Matea Karačić¹, Lucija Bilac², Ines Musa Trolić³¹Privatna stomatološka ordinacija²Poliklinika Musa Mostar³Studij dentalne medicine, Medicinski fakultet Sveučilišta u Mostaru

SAŽETAK

Uvod: Transverzalne malokluzije predstavljaju poremećaje odnosa gornjih i donjih stražnjih zuba, pri čemu dolazi do nepravilne okluzije. Obuhvataju unilateralni i bilateralni križni zagriz te škarasti zagriz. Križni zagriz karakterizira obrnut odnos bukalnih i lingvalnih kvržica, dok je škarasti zagriz poseban oblik bez tuberkulo-fisurnog kontakta, uz mimoilaženje zuba u bukalnom ili lingvalnom smjeru.

Materijali i metode: Uz odobrenje Poliklinike Musa, analizirana je baza intraoralnih skenova dobijenih uređajem Primescan (Dentsply Sirona, Njemačka). U periodu od 01.01.2021. do 01.01.2025. godine izdvojeno je 106 pacijenata s transverzalnim okluzalnim anomalijama od ukupno 508 pregledanih. Pacijenti su analizirani prema spolu, vrsti anomalije, te jednostranoj ili obostranoj pojavnosti, uključujući lokalizaciju po kvadrantima. Podaci su obrađeni u programu Microsoft Excel.

Rezultati: Istraživanje je obuhvaćalo 508 pacijenata Poliklinike Musa koji su snimani intraoralnim skenerom. 106 pacijenata je imalo neku vrstu transverzalne okluzalne anomalije. Dakle, učestalost transverzalnih okluzalnih anomalija u pregledanih ortodontskih pacijenata je 20,87 %.

Zaključak: Transverzalne okluzalne anomalije prisutne su kod približno petine ortodontskih pacijenata. Pravovremena dijagnoza i adekvatna terapija od ključnog su značaja za uspješno ortodontsko liječenje.

Ključne riječi: malokluzija, transverzalne okluzalne anomalije, križni zagriz, škarasti zagriz, ortodoncija

FIELD OF DENTISTRY: ORTODONTICS

ANALYSIS OF THE PREVALENCE OF TRANSVERSE OCCLUSAL ANOMALIES

Matea Karačić¹, Lucija Bilac², Ines Musa Trolić³¹Private Dental Practice²Musa Polyclinic Mostar³Study of Dental Medicine, Faculty of Medicine of University of Mostar

ABSTRACT

Introduction: Transverse malocclusions represent disturbances in the relationship between the upper and lower posterior teeth, resulting in improper occlusion. They include unilateral and bilateral crossbite as well as scissor bite. Crossbite is characterized by an inverted relationship between buccal and lingual cusps, whereas scissor bite represents a specific form without tubercle-fossa contact, with teeth overlapping in a buccal or lingual direction.

Materials and Methods: With the approval of Musa Polyclinic, a database of intraoral scans obtained using the Primescan device (Dentsply Sirona, Germany) was analyzed. In the period from January 1, 2021, to January 1, 2025, 106 patients with transverse occlusal anomalies were identified out of 508 examined patients. Patients were analyzed according to gender, type of anomaly, and unilateral or bilateral occurrence, including localization by quadrant. Data were processed using Microsoft Excel.

Results: The study included 508 patients examined with an intraoral scanner, of whom 106 presented with transverse occlusal anomalies, representing a prevalence of 20.87%.

Conclusion: Transverse occlusal anomalies are present in approximately one-fifth of orthodontic patients. Early diagnosis and appropriate therapy are essential for successful orthodontic treatment.

Keywords: malocclusion, transverse occlusal anomalies, crossbite, scissor bite, orthodontics

OBLAST STOMATOLOGIJE: ORTODONCIJA

POVEZANOST MALOKLUZIJA I POSTURE GLAVE I VRATA

Zana Fetić, Neira Bašagić, Vildana Džemidžić, Alisa Tiro

Katedra za ortodonciju Univerzitet u Sarajevu-Stomatološki fakultet

SAŽETAK

Uvod: Povezanost između malokluzije i tjelesne posture sve je češći predmet istraživanja zbog anatomske i funkcionalne povezanosti stomatognatnog sistema sa kraniocervikalnim segmentom i sistemom za kontrolu držanja tijela. Iako brojna istraživanja ukazuju na moguću povezanost između okluzijskih poremećaja i posturalnih odstupanja, klinički značaj i priroda ove veze još uvijek nisu u potpunosti razjašnjeni. Dob 10-12 godina je optimalni period za ortodontski tretman u kojem se treba razmatrati postura glave i vrata.

Cilj: Cilj ove studije jeste analizirati povezanost različitih tipova malokluzija i posture glave i vrata.

Materijal i metode: Analiza je obuhvatila uzorak od 40 lateralnih kefalogram snimaka pacijenata kojima je potreban ortodontski tretman. Dvadeset dječaka i dvadeset djevojčica dobi od 10 do 14 godina snimani su u prirodnom položaju glave. Snimci su zadovoljavajuće radiografske kvalitete, optimalnog kontrasta, oštirine i detalja. Na lateralnom kefalogramu mjereni su ugao ANB (definira anteroposteriorne odnose gornje i donje vilice), ugao baza (Mxp- Mdp) i visina lica (SGo/ NMe x 100). Pored standardne analize lateralnog kefalogram snimka urađeno je i mjerenje kraniocervikalnih NSL/OPT i NSL/CVT uglova, koji nam govore o povezanosti položaja glave i vratnih kralježaka.

Zaključak: Povezanost različitih tipova malokluzija i posture glave i vrata su važni za dijagnostički protokol, a time i za planiranje ortodontske terapije.

Ključne riječi: ANB ugao, visina lica, malokluzija, postura glave i vrata, lateralni kefalogram

FIELD OF DENTISTRY: ORTODONTICS

CORRELATION BETWEEN MALOCCLUSIONS AND HEAD AND NECK POSTURE

Zana Fetić, Neira Bašagić, Vildana Džemidžić, Alisa Tiro

Department of Orthodontics, University of Sarajevo-Faculty of Dentistry

ABSTRACT

Introduction: The relationship between malocclusion and body posture is becoming a subject of research due to the anatomical and functional connection between the stomatognathic system, the craniocervical region, and the postural control system. Although numerous studies suggest a possible association between occlusal disorders and postural deviations, the clinical significance and nature of this relationship have not yet been fully clarified. The age of 10–12 years represents an optimal period for orthodontic treatment during which head and neck posture should be considered.

Objective: To assess the correlation between different types of malocclusions and head and neck posture.

Materials and Methods: The analysis included a sample of 40 lateral cephalograms of patients requiring orthodontic treatment. Twenty boys and twenty girls aged 10 to 14 were recorded in a natural head position. The radiographs were of satisfactory quality, with optimal contrast, sharpness, and detail. On the lateral cephalogram, the ANB angle (anteroposterior relationship of the maxilla and mandible), the base angle (MxP–MdP), and facial height (SGo/NMe x 100) were measured. In addition to the standard lateral cephalometric analysis, measurements of the craniocervical angles NSL/OPT and NSL/CVT were performed, indicating the relationship between head position and cervical vertebrae.

Conclusion: The relationship between different types of malocclusions and head and neck posture is important for the diagnostic protocol and orthodontic therapy.

Keywords: ANB angle, facial height, malocclusion, head and neck posture, lateral cephalogram

OBLAST STOMATOLOGIJE: PARODONTOLOGIJA

MHEALTH MONITORING ORALNE HIGIJENE I HIGIJENSKIH NAVIKA KOD ODRASLIH PACIJENATA SA GINGIVITISOM PUTEM MOBILNE APLIKACIJE „NUTRI-DENT“**Adis Salihefendić**

Privatna stomatološka ordinacija "A-DENT", Gračanica

SAŽETAK

Uvod: Savremena preventivna stomatologija sve više se oslanja na kontinuirani digitalni monitoring umjesto jednokratne edukacije pacijenata, s ciljem dugoročnog poboljšanja higijenskih navika i prevencije oralnih bolesti. Gingivitis, kao reverzibilno inflamatorno stanje koje brzo reaguje na promjene oralne higijene u periodu od 7 do 28 dana, predstavlja pogodan i klinički relevantan model za procjenu efekata digitalne adherencije.

Cilj studije bio je procijeniti učestalost provođenja, nivo adherencije i kliničke promjene odraslih pacijenata korištenjem mHealth prototip-aplikacije Nutri-Dent, verzije 0.1.1.

Metodologija: U istraživanju je učestvovalo 30 odraslih ispitanika starosti 25–45 godina, podijeljenih u dvije grupe: grupa sa gingivitisom (n=15) i grupa sa zdravom gingivom (n=15). Tokom perioda od 28 dana ispitanici su koristili pre-alpha verziju aplikacije Nutri-Dent, koja je uključivala jutarnje i večernje podsjetnike, kao i sistem potvrde zadanih postupaka oralne higijene uz praćenje u realnom vremenu od strane stomatologa. Adherencija je kvantifikovana primjenom digitalnog indeksa higijene (DIH).

Rezultati: Kod pacijenata sa gingivitisom bilježi se veći relativni porast DIH vrijednosti, uz izražen pad motivacije i učestalije preskakanje večernje oralne higijene. Primjena interdentalne četkice bile su najčešće preskakana radnja (41%). Nakon 28 dana zabilježeno je značajno smanjenje PI (~50%), GI (~50%) i BOP (~19%), bez dodatnih terapijskih intervencija ili korekcije ishrane.

Zaključak: Digitalni monitoring oralne higijene putem aplikacije Nutri-Dent pokazao je značajan potencijal u poboljšanju higijenskih navika i kliničkih parametara, potvrđujući vrijednost kontinuirane mHealth podrške u savremenoj prevenciji gingivitisa.

Ključne riječi: digitalni monitoring, oralna higijena, gingivitis, mHealth, adherencija

FIELD OF DENTISTRY: PERIODONTOLOGY

MHEALTH MONITORING OF ORAL HYGIENE AND HYGIENIC HABITS IN ADULT PATIENTS WITH GINGIVITIS USING THE MOBILE APPLICATION NUTRI-DENT**Adis Salihefendić**

Private dental office "A-DENT", Gračanica

ABSTRACT

Introduction: Contemporary preventive dentistry increasingly relies on continuous digital monitoring rather than one-time patient education to improve daily oral-hygiene habits and prevent oral diseases. Gingivitis is a reversible inflammatory condition that responds rapidly to changes in oral hygiene within 7–28 days, making it a suitable model to evaluate digital adherence support.

Aim: This study assessed procedure frequency, adherence, and clinical changes in adults using the mHealth prototype Nutri-Dent (v0.1.1).

Methodology: Thirty participants aged 25–45 years were allocated to two groups: gingivitis (n=15) and a healthy gingiva group (n=15). Over 28 days, participants used a pre-alpha version of Nutri-Dent that delivered morning and evening reminders and required confirmation of prescribed hygiene steps (toothbrushing, interdental cleaning), enabling real-time monitoring by a dentist. Adherence and procedure completion were quantified using the Digital Hygiene Index (DHI).

Results: Patients with gingivitis demonstrated a greater relative increase in DHI values during the observation period; however, motivation declined over time, with more frequent omission of evening routines compared with morning routines. Interdental brush use was the most frequently omitted step (41%). After 28 days, clinically meaningful improvements were observed without additional therapeutic interventions or dietary modifications: Plaque Index (PI) and Gingival Index (GI) decreased by approximately 50% each, while Bleeding on Probing (BOP) decreased by approximately 19%.

Conclusion: Digital monitoring of oral hygiene through Nutri-Dent showed significant potential to improve hygienic habits and key clinical parameters, supporting the value of continuous mHealth assistance in contemporary gingivitis prevention.

Keywords: digital monitoring, oral hygiene, gingivitis, mHealth, adherence

OBLAST STOMATOLOGIJE: PARODONTOLOGIJA

**UTJECAJ PRAVOVREMENE TERAPIJE
PARODONTNE BOLESTI NA IZBOR PROTETSKE
REHABILITACIJE****Selma Hasanbegović**

Privatna stomatološka ordinacija "dr. Amra Lutvikadić", Sarajevo

SAŽETAK

Uvod: Parodontna bolest je značajan klinički i javnozdravstveni problem današnjice i jedna od najčešćih hroničnih bolesti savremenog doba. To je hronična inflamatorna bolest potpunog aparata zuba koja dovodi do formiranja parodontnih džepova, gubitka kliničkog pripoja i u konačnici, gubitka zuba ukoliko se ne prepozna i ne liječi na vrijeme.

Materijali i metode: U radu su prikazana dva klinička slučaja parodontne bolesti sa ciljem procjene ishoda različitih terapijskih postupaka. Analiza je obuhvatila dva pacijenta gdje jedan pacijent nije bio podvrgnut terapiji, dok je drugi pacijent bio terapijski tretiran. Odabir pacijenata zasnivao se na kliničkog pregleda i prisustva karakterističnih znakova parodontne bolesti, uključujući gingivalnu inflamaciju, prisustvo parodontnih džepova, gubitak kliničkog pripoja te procjenu pokretljivosti zuba. U obzir su uzeti anamnestički podaci, kao što su navike oralne higijene i prethodne stomatološke terapije. Odabrani slučajevi omogućili su direktnu kliničku evaluaciju utjecaja terapije na daljnji protetski plan i ishod liječenja.

Rezultati: Uočene su značajne razlike u ishodima. Pravovremeno liječen pacijent uspješno je rehabilitiran implantološkom terapijom uz stabilan funkcionalni i estetski rezultat. Neliječen pacijent pretrpio je gubitak zuba, što je zahtijevalo kompleksnu protetsku rehabilitaciju (totalna proteza i kombinovani rad).

Zaključak: Rano dijagnosticiranje i pravovremeno liječenje parodontne bolesti omogućavaju očuvanje zuba i primjenu savremenih terapijskih rješenja, dok odgađanje terapije dovodi do gubitka zuba i složenije rehabilitacije.

Ključne riječi: parodontna bolest, protetska rehabilitacija, gubitak zuba, terapija, oralno zdravlje

FIELD OF DENTISTRY: PERIODONTOLOGY

**THE IMPACT OF TIMELY PERIODONTAL DISEASE
THERAPY ON THE CHOICE OF PROSTHETIC
REHABILITATION****Selma Hasanbegović**

Private dental office "dr. Amra Lutvikadić", Sarajevo

ABSTRACT

Introduction: Periodontal disease is a chronic inflammatory disease of the supporting apparatus of the tooth characterized by progressive destruction of the gingiva, periodontal ligament and alveolar bone. The disease leads to the formation of periodontal pockets, loss of clinical attachment and ultimately, tooth loss if not recognized and treated in a timely manner.

Materials and Methods: Two clinical cases of periodontal disease were analyzed to assess treatment outcomes. One patient remained untreated, while the other received periodontal therapy. Patient selection was based on clinical findings, including gingival inflammation, periodontal pockets, clinical attachment loss, and tooth mobility. Anamnestic data, such as oral hygiene habits and previous dental treatments, were taken into account. Selected cases enabled evaluation of the impact of therapy on prosthetic planning and treatment outcomes.

Results: Significant differences in treatment outcomes were observed. Early periodontal therapy in one patient enabled implant-supported rehabilitation with stable functional and aesthetic results. In contrast, untreated periodontitis in the second patient led to substantial tooth loss, requiring complex prosthetic rehabilitation. These findings highlight the importance of early diagnosis and timely treatment.

Conclusion: Timely periodontal therapy supports tooth preservation and modern treatment options, whereas delayed intervention leads to tooth loss and more complex rehabilitation. Early diagnosis, individualized treatment planning, and regular dental check-ups are essential for long-term oral health.

Keywords: periodontal disease, prosthetic rehabilitation, tooth loss, therapy, oral health

OBLAST STOMATOLOGIJE: PREVENTIVNA STOMATOLOGIJA

BIHEVIORALNI FAKTORI POVEZANI SA KORIŠTENJEM BOČICE/FLAŠICE I NJIHOVA VAŽNOST ZA ORALNO ZDRAVLJE DJECE**Belkisa Hodžić¹, Elmedin Bajrić², Selam Omerkić³, Jasmin Habibović¹, Almir Jagodić¹**¹JZU Dom zdravlja Živinice²Stomatološki fakultet Univerziteta u Sarajevu³Stomatološka ordinacija Dental care Tuzla**SAŽETAK**

Uvod: Karijes u ranom djetinjstvu je često stanje, a hranjenje na bočicu/flašicu zaslađenim napitcima smatra se faktorom rizika za njegov razvoj. Dugotrajna upotreba bočice/flašice, u kombinaciji sa neadekvatnom oralnom higijenom, dodatno povećava rizik od karijesa kod djece.

Cilj istraživanja: Ispitati obrasce hranjenja na bočicu/flašicu, uključujući trajanje, sadržaj i dnevne navike, te njihov utjecaj na oralno zdravlje šestogodišnje djece na području Grada Živinice.

Materijali i metode: Istraživanje je obuhvatilo 307 šestogodišnje djece koja su dolazila na rutinske stomatološke preglede u JZU Dom zdravlja Živinice. Studija je provedena uz odobrenje Etičkog komiteta JZU Dom zdravlja Živinice. Tokom pregleda djece roditelji su davali odgovore na anketni upitnik koji je obuhvatao upotrebu bočice, trajanje, sadržaj i dnevne obrasce korištenja. Podaci su analizirani deskriptivno i prikazani u postocima.

Rezultati: Gotovo 60% djece koristilo je bočicu/flašicu. Korištenje bočice nakon prve godine života uočeno je kod gotovo polovice djece (do 1 godine 13%, 2 godine 19,9%, 3 godine 14,7%, više od 3 godine 12,1%). Sadržaj bočica uključivao je sokove u 12,6% slučajeva i druge zaslađene napitke u 3,1%. Dnevni obrasci korištenja pokazali su da je 14,7% djece stalno koristilo bočicu tokom dana, 9,4% stalno po noći, a 22,8% povremeno tokom dana.

Zaključak: Na temelju dobivenih rezultata istraživanja, hranjenje na bočicu ostaje uobičajena navika među djecom u Živinicama. Dugotrajna upotreba i konzumacija zaslađenih napitaka može povećati rizik od ranog dječijeg karijesa. Rezultati istraživanja naglašavaju potrebu za ciljanom edukacijom roditelja i preventivnim mjerama za zaštitu i poboljšanje oralnog zdravlja.

Glavne riječi: prehrabne navike, šestogodišnjaci, karijes u ranom djetinjstvu

FIELD OF DENTISTRY: PREVENTIVE DENTISTRY

BEHAVIORAL FACTORS ASSOCIATED WITH BOTTLE FEEDING AND THEIR IMPORTANCE FOR CHILDREN'S ORAL HEALTH**Belkisa Hodžić¹, Elmedin Bajrić², Selam Omerkić³, Jasmin Habibović¹, Almir Jagodić¹**¹Public Health Institution Health Center Živinice²Faculty of Dentistry, University of Sarajevo³Dental Practice Dental Care Tuzla**ABSTRACT**

Introduction: Early childhood caries (ECC) is a common condition, and bottle-feeding with sweetened drinks is considered a risk factor for its development. Prolonged bottle use, combined with inadequate oral hygiene, further increases the likelihood of ECC in children.

Aim: To examine bottle-feeding patterns, including duration, contents, and daily habits, and their impact on oral health in six-year-old children in the Živinice area.

Materials and Methods: A cross-sectional study included 307 six-year-old children attending routine dental examinations at the Primary Healthcare Center Živinice. The study was conducted with approval from the Ethics Committee of JZU Primary Healthcare Center Živinice. Parents completed a structured questionnaire covering bottle use, duration, contents, and daily usage patterns. Data were analyzed descriptively and presented in percentages.

Results: Nearly 60% of children had used a bottle. Bottle use after the first year of life was observed in almost half of the children (up to 1 year 13%, 2 years 19.9%, 3 years 14.7%, more than 3 years 12.1%). The contents of the bottles included juices in 12.6% of cases and other sweetened drinks in 3.1%. Daily usage patterns showed that 14.7% of children used the bottle constantly during the day, 9.4% constantly at night, and 22.8% occasionally during the day.

Conclusion: Bottle-feeding remains a common habit among children in Živinice. Prolonged use and consumption of sweetened drinks may increase the risk of ECC. The findings emphasize the need for targeted parental education and preventive measures to protect and improve oral health.

Keywords: feeding habits, six-year-olds, early childhood caries

OBLAST STOMATOLOGIJE: PREVENTIVNA STOMATOLOGIJA

**VAŽNOST PREVENTIVNE STOMATOLOŠKE
PRIPREME KOD PACIJENATA PRIJE TERAPIJE
BIFOSFONATIMA****Marijana Lasić¹, Josip Kapetanović²**¹ Studentica 5. godine, Medicinski fakultet Sveučilišta u Mostaru² Medicinski fakultet Sveučilišta u Mostaru**SAŽETAK**

Uvod: Bifosfonati se široko koriste u liječenju malignih bolesti. Iako učinkoviti, povezani su s razvojem osteonekroze čeljusti uzrokovane lijekovima (MRONJ). Rizik razvoja MRONJ značajno se povećava kod invazivnih stomatoloških zahvata, prisutnosti infekcije i lošeg oralnog zdravlja prije početka terapije.

Prikaz slučaja: Pacijentica s dijagnosticiranim karcinomom dojke bila je na terapiji bifosfonatima. Upućena je od strane onkologa zbog bolova u području čeljusti. Nije provedena adekvatna stomatološka priprema prije početka terapije, što je dovelo do razvoja komplikacija i potrebe za kirurškim zahvatom, kao i prekida onkološke terapije. Kao manje invazivna alternativa klasičnoj ekstrakciji kod rizičnih pacijenata indicirana je krunektomija, s ciljem smanjenja rizika od razvoja ili progresije MRONJ.

Materijali i metode: Kliničkim pregledom utvrđena je prisutnost purulentne eksudacije te izražena mobilnost dotrajalog fiksno protetskog rada (mosta), čime je indicirana klinička sumnja na MRONJ. Terapijski protokol uključivao je primjenu antibiotika prema smjernicama za MRONJ, provođenje krunektomije kao poštudne alternative ekstrakciji te kirurško uklanjanje nekrotičnih sekvastara.

Rezultat: Nakon tri mjeseca postignuto je stabilno kliničko stanje, te je provedena protetska rehabilitacija. Zbog težine nastale komplikacije bio je nužan privremeni prekid onkološke terapije bifosfonatima.

Zaključak: Pravovremena stomatološka priprema pacijenata prije uvođenja bifosfonata ključna je za prevenciju MRONJ. Ovaj slučaj naglašava važnost interdisciplinarnе suradnje između stomatologa i onkologa kako bi se spriječile komplikacije i izbjegao prekid terapije.

Ključne riječi: bifosfonati, preventiva, MRONJ, onkološki pacijenti.

FIELD OF DENTISTRY: PREVENTIVE DENTISTRY

**THE IMPORTANCE OF PREVENTIVE DENTAL
PREPARATION IN PATIENTS BEFORE
BISPHOSPHONATE THERAPY****Marijana Lasić¹, Josip Kapetanović²**¹ 5th-year student, Faculty of Medicine, University of Mostar² Faculty of Medicine, University of Mostar**ABSTRACT**

Introduction: Bisphosphonates are widely used in the treatment of malignant diseases. Although effective, they are associated with the development of medication-related osteonecrosis of the jaw (MRONJ). The risk of developing MRONJ significantly increases with invasive dental procedures, the presence of infection, and poor oral health prior to the initiation of therapy.

Case report: A patient diagnosed with breast cancer was undergoing bisphosphonate therapy. She was referred by an oncologist due to pain in the jaw region. Adequate dental preparation was not performed prior to the initiation of therapy, which led to the development of complications, the need for surgical intervention, and interruption of oncological treatment. As a less invasive alternative to conventional extraction in high-risk patients, coronectomy was indicated in order to reduce the risk of development or progression of MRONJ.

Materials and methods: Clinical examination revealed the presence of purulent exudation and pronounced mobility of a deteriorated fixed prosthetic restoration (bridge), raising clinical suspicion of MRONJ. The therapeutic protocol included the administration of antibiotics according to MRONJ guidelines, performing coronectomy as a conservative alternative to extraction, and surgical removal of necrotic sequestra.

Results: After three months, a stable clinical condition was achieved, followed by prosthetic rehabilitation. Due to the severity of the complication, a temporary interruption of bisphosphonate oncological therapy was necessary.

Conclusion: This case highlights the importance of interdisciplinary collaboration between dentists and oncologists in order to prevent complications and avoid interruption of oncological treatment.

Keywords: bisphosphonates, prevention, MRONJ, oncology patients.

OBLAST STOMATOLOGIJE: STOMATOLOŠKA PROTETIKA

MULTIDISCIPLINARNO RJEŠENJE ANODONCIJE STALNIH LATERALNIH SJEKUTIĆA

Ida Mulić

Klinika za stomatološku protetiku, Stomatološki klinički centar, Univerzitet u Sarajevu

SAŽETAK

Uvod: Anodoncija stalnih lateralnih sjekutića česta je razvojna anomalija koja značajno utiče na okluziju, fonaciju i estetiku osmijeha. Najčešće se javlja u gornjoj vilici, uz dijestemu i poremećaj rasporeda zuba, što može izazvati funkcionalne i estetske probleme. Pravovremena dijagnostika i planiranje terapije ključni su za optimalan ishod.

Cilj: Cilj rada je prikazati moguća terapijska rješenja, njihove prednosti i nedostatke, te naglasiti važnost multidisciplinarnog pristupa u dijagnostici i terapiji anodoncije, uključujući ortodontski i protetski plan.

Materijal i metode: Prikazan je klinički slučaj pacijentice s anodoncijom stalnih lateralnih sjekutića i perzistencijom mliječnog desnog lateralnog sjekutića. Nakon detaljne kliničke, funkcionalne i radiološke analize, te konzultacija sa specijalistom ortodoncije, planirana je ortodontska terapija radi otvaranja prostora za lijevi lateralni sjekutić, nakon čega je izvedena protetska rehabilitacija. Analizirani su raspored zuba, okluzija i estetski parametri. Terapijski plan izrađen je u saradnji ortodonta i protetičara, uključujući ortodontsku pripremu i protetsko planiranje.

Rezultat: Primijenjena terapija dovela je do značajnog poboljšanja funkcije i estetike osmijeha. Postignuta je harmonija osmijeha, stabilni okluzalni odnosi i visoko zadovoljstvo pacijentice.

Zaključak: Anodoncija lateralnih sjekutića predstavlja kompleksan klinički izazov koji zahtijeva multidisciplinarni pristup. Integracijom ortodontske terapije i protetske rehabilitacije moguće je postići visoke estetske standarde, funkcionalnu efikasnost i harmonizaciju okluzije.

Ključne riječi: Anodoncija lateralnih sjekutića, hipodoncija, multidisciplinarni pristup, ortodoncija, estetska rehabilitacija

FIELD OF DENTISTRY: DENTAL PROSTHODONTICS

MULTIDISCIPLINARY MANAGEMENT OF CONGENITAL ABSENCE OF PERMANENT LATERAL INCISORS

Ida Mulić

Clinic for Prosthodontics, Dental Clinical Center, University of Sarajevo

ABSTRACT

Introduction: Congenital absence of permanent lateral incisors is a common developmental anomaly that significantly affects occlusion, phonation, and smile aesthetics. It most frequently occurs in the maxilla, often accompanied by diastema and abnormal tooth arrangement, leading to functional and esthetic concerns. Timely diagnosis and treatment planning are essential for optimal outcomes.

Objective: The aim of this study is to present possible treatment options, their advantages and limitations, and to emphasize the importance of a multidisciplinary approach in the diagnosis and management of congenital lateral incisor agenesis, including both orthodontic and prosthetic planning.

Materials and Methods: A clinical case of a patient with congenital absence of permanent lateral incisors and persistence of the primary right lateral incisor is presented. Following a detailed clinical, functional, and radiological assessment, and consultation with an orthodontic specialist, orthodontic therapy was planned to create space for the left lateral incisor, followed by prosthetic rehabilitation. The treatment plan was developed in collaboration between the orthodontist and prosthodontist, including orthodontic preparation and prosthetic planning.

Results: The applied treatment resulted in significant improvement in both function and smile aesthetics. Harmonious smile, stable occlusal relationships, and patient satisfaction were achieved.

Conclusion: Congenital absence of lateral incisors presents a complex clinical challenge requiring a multidisciplinary approach. Integration of orthodontic therapy and prosthetic rehabilitation enables the achievement of high esthetic standards, functional efficiency, and occlusal harmony.

Keywords: Congenital lateral incisor agenesis, hypodontia, multidisciplinary approach, orthodontics

OBLAST STOMATOLOGIJE: STOMATOLOŠKA PROTETIKA

PROTETSKA REHABILITACIJA PACIJENATA SA KOMPLEKSNIM OKLUZALNIM POREMEĆAJIMA – PRIKAZ KLINIČKIH SLUČAJEVA**Lejla Hodžić**

Privatna stomatološka ordinacija "dr. Hodžić" Sarajevo

SAŽETAK

Uvod: Kompleksni okluzalni poremećaji, kao što su pseudoprogenija, obrnut zagriz u frontalnoj regiji, prinudna okluzija, atricija zuba te asimetrija i devijacija mandibule, mogu dovesti do značajnih funkcionalnih i estetskih problema. Ova stanja često uzrokuju poremećaje mastikacije, progresivno trošenje zuba, disbalans stomatognatog sistema, kao i razvoj karijesa i parodontoloških oboljenja.

Cilj rada: Cilj ovog rada je prikazati protetske terapijske mogućnosti u rehabilitaciji pacijenata sa kompleksnim okluzalnim poremećajima kroz prikaz kliničkih slučajeva iz svakodnevne prakse.

Materijali i metode: U radu su prikazana tri pacijenta sa različitim kombinacijama okluzalnih anomalija, uključujući pseudoprogeniju, obrnut zagriz u frontalnoj regiji, izraženu atriciju i prinudnu okluziju. Nakon detaljne kliničke i funkcionalne analize, planirana je protetska terapija s ciljem rekonstrukcije okluzije i artikulacije, uspostavljanja stabilnih međuviličnih odnosa te poboljšanja funkcije žvakanja i estetike.

Rezultati: Nakon provedene terapije postignuta je stabilna okluzija i artikulacija, poboljšana funkcija stomatognatog sistema te značajno unaprijeđena estetika osmijeha kod svih prikazanih pacijenata.

Zaključak: Protetska rehabilitacija predstavlja efikasan i pouzdan terapijski pristup u rješavanju kompleksnih okluzalnih poremećaja kod odraslih pacijenata, omogućavajući funkcionalnu stabilnost i estetsku rekonstrukciju.

Ključne riječi: okluzija, pseudoprogenija, atricija, artikulacija, međuvilični odnosi

FIELD OF DENTISTRY: DENTAL PROSTHODONTICS

PROSTHETIC REHABILITATION OF PATIENTS WITH COMPLEX OCCLUSAL DISORDERS: A PRESENTATION OF CLINICAL CASES**Lejla Hodžić**

Private dental office "dr. Hodžić" Sarajevo

ABSTRACT

Introduction: Complex occlusal disorders, such as pseudoprogathism, anterior crossbite, forced occlusion, tooth attrition, as well as mandibular asymmetry and deviation, can lead to significant functional and aesthetic problems. These conditions often result in impaired mastication, progressive tooth wear, imbalance of the stomatognathic system, and the development of caries and periodontal diseases.

Aim: The aim of this study is to present prosthetic treatment possibilities in the rehabilitation of patients with complex occlusal disorders through a series of clinical cases from everyday practice.

Materials and Methods: This paper presents three patients with different combinations of occlusal anomalies, including pseudoprogathism, anterior crossbite, severe attrition, and forced occlusion. Following a detailed clinical and functional analysis, prosthetic therapy was planned with the aim of occlusal reconstruction, establishment of stable intermaxillary relationships, and improvement of masticatory function and aesthetics.

Results: After the completed therapy, stable occlusion and articulation were achieved, along with improved function of the stomatognathic system and significantly enhanced smile aesthetics in all presented patients.

Conclusion: Prosthetic rehabilitation represents an effective and reliable therapeutic approach in the management of complex occlusal disorders in adult patients, enabling functional stability and aesthetic reconstruction.

Keywords: occlusion, pseudoprogathism, attrition, articulation, intermaxillary relationships

OBLAST STOMATOLOGIJE: DENTALNA IMPLANTOLOGIJA

**IMPLANTOPROTETSKA REHABILITACIJA
JEDNOG INCIZIVA**Inge Šarac¹, Iva Čale², Zdenko Šarac³, Andrea Pandža³¹Stomatološka ordinacija Šarac Mostar²Dom zdravlja Grude³Studij dentalne medicine, Medicinski fakultet,
Sveučilište u Mostaru**SAŽETAK**

Uvod: Rehabilitacija dentalnim implantatima predvidljiva je terapijska opcija, no uspjeh ovisi o kirurškom i protetskom planiranju te očuvanju periimplantnih tkiva. U estetskoj zoni, kod pojedinačnog inciziva, izazovi uključuju postizanje optimalne pozicije implantata i stabilnosti mekih tkiva. Nepravilno pozicioniranje, u bukopalatinalnom smjeru, može dovesti do recesije mekih tkiva i estetskih komplikacija, dok protetski čimbenici utječu na marginalni gubitak kosti i dugoročnu stabilnost. Stoga je nužan individualiziran pristup temeljen na kliničkim i radiološkim nalazima.

Materijali i metode: Prikazana su dva slučaja implantoprotetske rehabilitacije inciziva u estetskoj zoni. Prvi pacijent izgubio je gornji centralni inciziv uslijed traume, uz prisutan impaktirani očnjak s indikacijom za alveolotomiju postavljenom od strane specijaliste za ortodontiju. Nakon alveolotomije i cijeljenja, postavljen je implantat, a po završetku oseointegracije izrađena je implantoprotetska nadoknada. Druga pacijentica izgubila je donji inciziv zbog uznapredovalog parodontitisa te je bila sistemski kompromitirana (trombocitopenija). Nakon konzultacije sa specijalistom interne medicine, postavljen je implantat s gingivaformerom, a nakon oseointegracije izrađena definitivna nadoknada.

Rezultati: U oba slučaja postignuta je uspješna oseointegracija bez komplikacija. Periimplantna tkiva bila su stabilna uz očuvanu morfologiju i zadovoljavajući estetski rezultat.

Unatoč postoperativnom defektu alveolarnog grebena i kompleksnoj medicinskoj anamnezi, pažljivim planiranjem postignuti su stabilni funkcijski i estetski ishodi.

Zaključak: Implantoprotetska rehabilitacija u estetskoj zoni može biti uspješna i kod kompromitiranih pacijenata uz pažljivo, interdisciplinarno planiranje i individualizirani pristup, omogućujući stabilne funkcijske i estetske ishode.

Glavne riječi: inciziv, oseointegracija, periimplantitis.

FIELD OF DENTISTRY: DENTAL IMPLANTOLOGY

**IMPLANT-PROSTHETIC REHABILITATION OF A
SINGLE INCISOR**Inge Šarac¹, Iva Čale², Zdenko Šarac³, Andrea Pandža³¹Šarac Dental Office Mostar²Health Care Center Grude³Study of Dental Medicine Faculty of Medicine,
University of Mostar**ABSTRACT**

Introduction: Rehabilitation with dental implants is a predictable therapeutic option; however, its success depends on proper surgical and prosthetic planning and preservation of peri-implant tissues. Improper positioning may lead to soft tissue recession and aesthetic complications, while prosthetic factors influence marginal bone loss and long-term stability. Therefore, an individualized approach based on clinical and radiological findings is essential.

Materials and methods: Two cases of implant-prosthetic rehabilitation of incisors in the aesthetic zone are presented. The first patient lost an upper central incisor due to trauma, with a concomitant impacted canine indicated for alveolotomy by an orthodontic specialist. Following alveolotomy and healing, an implant was placed, and after osseointegration, an implant-supported prosthetic restoration was fabricated. The second patient lost a lower incisor due to advanced periodontitis and was systemically compromised. After consultation with an internal medicine specialist, an implant with a gingiva former was placed, and following osseointegration, a definitive restoration was fabricated.

Results: Successful osseointegration without complications was achieved in both cases. Peri-implant tissues remained stable, preserving morphology and aesthetics. Despite an postoperative alveolar ridge defect and a burdened medical history, careful planning resulted in stable functional and aesthetic outcomes.

Conclusion: Implant-prosthetic rehabilitation in the aesthetic zone can succeed even in compromised patients, provided careful interdisciplinary planning and an individualized approach are applied, enabling stable functional and aesthetic outcomes.

Keywords: incisor, osseointegration, peri-implantitis

OBLAST STOMATOLOGIJE: DJEČJA STOMATOLOGIJA

TRADICIONALNA BILATERALNA EKSTRAKCIJA DONJIH PRVIH STALNIH CENTALNIH INCIZIVUSA KOD DJEČJE POPULACIJE IZ MAASAI PLEMENA IZ TANZANIJE

Edisa Šiljak-Rašidović

Javna ustanova Dom zdravlja Kantona Sarajevo

SAŽETAK

Uvod: Prilikom odmora na Zanzibaru, Tanzanija, komunicirajući sa pripadnicima Maasai plemena, primijetila sam bilateralni nedostatak donjih stalnih centralnih incizivusa. Prinudne ekstrakcije pomenutih zuba se izvode oštrim i nesterilnim predmetima kod djece u uzrastu od 6 do 12 godina. Imaju duboke historijske, kulturološke i funkcionalne korijene, a razumijevanje istog zahtijeva interdisciplinarni pristup koji uključuje stomatologiju, medicinsku antropologiju i javno zdravstvo Maasai zajednice poznate po očuvanju svoje tradicije. Najčešće se povezuje sa pojavom trizmusa (npr. kod tetanusa) kada je oralni unos hrane bio otežan ili onemogućen. Narodni preparati za koje se vjeruje da imaju miotonolitičko dejstvo za ublažavanje spazma žvačnih mišića se apliciraju kroz nasilno nastali kavum.

Materijali i metode: Prikazati prinudne ekstrakcije pomenutih zuba u dječjem uzrastu kod odraslih osoba iz Maasai plemena i njihov negativan uticaj na estetski, psiho-socijalni i funkcionalni momenat (ortodontski problemi uključujući migraciju susjednih zuba, poteškoće u izgovoru, poremećaj u temporomandibularnom zglobu, fraktura gonjih stalnih incizivusa, infekcije, krvarenja, traume, smanjeno samopouzdanje, itd.).

Rezultati: Klinički nalazi pregledanih ukazuju na značajne negativne posljedice po oralno zdravlje, funkciju i kvalitet života.

Zaključak: U savremenim uslovima gdje su dostupni antibiotici i medicinska njega, ova praksa gubi svoju funkcionalnu opravdanost, ali opstaje zbog tradicije kroz generacije. Rješenje ovog problema je edukacija, preventiva i poštovanje identiteta Maasai zajednice.

Ključne riječi: Maasai, ekstrakcija, tradicija, incizivusi, trismus

FIELD OF DENTISTRY: PEDIATRIC DENTISTRY

TRADITIONAL BILATERAL EXTRACTION OF LOWER PERMANENT CENTRAL INCISORS IN THE PEDIATRIC POPULATION OF THE MAASAI TRIBE IN TANZANIA

Edisa Šiljak-Rašidović

Public Institution Health Care Center of Sarajevo Canton

ABSTRACT

Introduction: During a vacation in Zanzibar, Tanzania, while communicating with members of the Maasai tribe, I observed a bilateral absence of lower permanent central incisors. Forced extractions of these teeth are performed using sharp and non-sterile instruments in children aged 6 to 12 years. This practice has deep historical, cultural, and functional roots, and its understanding requires an interdisciplinary approach involving dentistry, medical anthropology, and public health, particularly within the Maasai community known for preserving its traditions. It is most commonly associated with the occurrence of trismus (e.g., in tetanus), when oral food intake was difficult or impossible. Traditional remedies believed to have myotonolytic effects for relieving masticatory muscle spasms are applied through the forcibly created oral cavity.

Materials and Methods: The aim is to present forced extractions of the mentioned teeth performed during childhood, observed in adult members of the Maasai tribe, and their negative impact on aesthetic, psychosocial, and functional aspects (orthodontic problems including migration of adjacent teeth, speech difficulties, temporomandibular joint disorders, fractures of upper permanent incisors, infections, bleeding, reduced self-confidence, etc.).

Results: Clinical findings indicate significant negative consequences for oral health, function, and overall quality of life.

Conclusion: In modern conditions, where antibiotics and medical care are available, this practice has lost its functional justification, but it persists due to tradition passed through generations. The solution lies in education, prevention, and respect for the identity of the Maasai community.

Keywords: Maasai, extraction, tradition, incisors, trismus

OBLAST STOMATOLOGIJE: ENDODONCIJA

KLINIČKA I RADIOLOŠKA EVALUACIJA ZUBA NAKON DUGOTRAJNE PRIMJENE SREDSTVA ZA NEKROTIZACIJU PULPE - PRIKAZ SLUČAJA**Ineta Šehović¹, Selma Ćosović², Adisa Goga Filipović³, Merisa Repeša Komarica⁴, Džejma Suljić Hujčić⁵**¹Klinika za dentalnu patologiju i endodonciju, Stomatološki klinički centar Univerziteta u Sarajevu²Prijemna ambulanta, Stomatološki klinički centar Univerziteta u Sarajevu³JU Dom zdravlja sa stacionarom Kakanj, ambulanta opšte stomatologije⁴Rendgen kabinet, Stomatološki klinički centar Univerziteta u Sarajevu⁵Klinika za Oralnu medicinu i paradontologiju, Stomatološki klinički centar Univerziteta u Sarajevu

SAŽETAK

Uvod: Sredstva za nekrotizaciju pulpe koriste se u slučajevima akutnog simptomatskog pulpitisa, alergija na lokalni anestetik ili uslijed nedostatka vremena za vitalnu ekstripaciju pulpe. Toksična su i ispoljavaju neselektivno djelovanje. Osim na pulpu djeluju i na okolna tkiva s kojima dođu u kontakt direktno ili difuzijom kroz dentinske tubule.

Materijal i metode: Pacijentica S.Z. javlja se na Kliniku za dentalnu patologiju i endodonciju na kontrolni pregled. Kliničkim pregledom ustanovljen je GJC ispun na okuzalnoj površini zuba 37. Uvidom u medicinsku dokumentaciju ustanovljeno je da se pacijentica prije četiri godine javila na našu kliniku pod bolom kada je na zubu 37, urađena trepanacija, aplicirano sredstvo za nekrotizaciju i GJC ispun, te dogovoren termin za nastavak liječenja, nakon kojeg pacijentica nije imala kliničkih simptoma. Pacijentica se upućuje na RVG snimak. Analizom istog ustanovljena je opsežna destrukcija kosti i prisutan hronični apikalni parodontitis. S obzirom na starost pacijentice, asimptomatski period i njenu motivisanost odlučujemo se na endodontski tretman, uz predhodnu informisanost pacijentice o stanju zuba i kosti, te mogućnosti neuspjeha endodontskog tretmana.

Zaključak: Savremeni pristup u endodonciji podrazumjeva izbjegavanje upotrebe sredstva za nekrotizaciju, te primjenu sigurnih i biokompatibilnih materijala.

Ključne riječi: Sredstva za nekrotizaciju, GJC ispun, endodontski tretman, RVG snimak.

FIELD OF DENTISTRY: ENDODONTICS

CLINICAL AND RADIOGRAPHIC EVALUATION OF TEETH FOLLOWING PROLONGED USE OF PULP DEVITALIZING AGENTS – A CASE REPORT**Ineta Šehović¹, Selma Ćosović², Adisa Goga Filipović³, Merisa Repeša Komarica⁴, Džejma Suljić Hujčić⁵**¹Clinic for Dental Pathology and Endodontics, Dental Clinical Center, University of Sarajevo²Pre-admission Clinic, Dental Clinical Center, University of Sarajevo³Public Institution Health Center Kakanj: Inpatient Clinic, General Dental Outpatient Clinic⁴Dental Radiology Unit, Dental Clinical Center, University of Sarajevo⁵Clinic for Oral Medicine and Periodontology, Dental Clinical Center, University of Sarajevo

ABSTRACT

Introduction: Pulp devitalizing agents are used in cases of acute symptomatic pulpitis, allergy to local anesthetics, or when there is insufficient time for vital pulp extirpation. They are toxic and exhibit non-selective action. In addition to affecting the pulp, they also impact surrounding tissues through direct contact or diffusion via dentinal tubules.

Material and methods: A 28-year-old female patient (S.Z.) presented for a follow-up examination at the Clinic for Dental Pathology and Endodontics. Clinical examination revealed a glass ionomer cement (GIC) restoration on the occlusal surface of tooth 37. Review of the medical records indicated that four years earlier, the patient had presented to our clinic with pain, at which point trepanation of tooth 37 was performed, a pulp devitalizing agent was administered, and a GIC restoration was placed. Radiographic analysis revealed extensive bone destruction and the presence of chronic apical periodontitis. We decided to proceed with endodontic treatment, after informing the patient about the condition of the tooth and surrounding bone, as well as the potential for endodontic treatment failure.

Conclusion: A modern approach in endodontics involves avoiding the use of devitalizing agents and using safe and biocompatible materials.

Keywords: Pulp devitalizing agents, GIC restoration, endodontic treatment, RVG imaging.

FIELD OF DENTISTRY: ENDODONCIJA

USPJEŠNOST NEKIRURŠKE ENDODONTSKE TERAPIJE U LIJEČENJU PERIAPIKALNIH LEZIJA - PRIKAZ SLUČAJA**Lorena Raspudić, Nemanja Bjeloglav, Davor Planinić, Nevena Bjeloglav, Bojan Starović**

Stomatološka ordinacija "Dr. Davor Planinić" Međugorje

SAŽETAK

Uvod: Nekirurška endodontska terapija predstavlja osnovni pristup liječenju periapikalnih lezija, usmjeren na eliminaciju intrakanalne infekcije i omogućavanje cijeljenja periapikalnih tkiva. Suvremena analiziranja istražuju stopu uspješnosti ovakvog terapijskog pristupa, čak i kod većih periapikalnih lezija. Kliničke smjernice dodatno naglašavaju važnost pravilne dijagnostike i provedbe terapije u skladu s biološkim principima endodoncije.

Materijali i metode: Pacijentica, 25 godina, javlja se povodom rutinskog pregleda. Zubi 21, 22 i 23 negativni na testove vitaliteta, bez subjektivne boli. Radiološkim nalazom utvrđeno postojanje periapikalne lezije dimenzija 17.2 mm i 9.5 mm. Tijekom prve posjete provedena je kemomehanička obrada korijenskih kanala uz irigaciju 2.5% NaOCl, a kao interseanski medikament korišten je $\text{Ca}(\text{OH})_2$. Druga posjeta obuhvatila završnu opturaciju gutaperkom i silerom na bazi smole (AH+).

Rezultati: Kontrolni snimak 19.06.2024. pokazao je potpuno povlačenje periapikalnih lezija, što potvrđuje uspješnost nekirurške endodontske terapije.

Zaključak: Veličina lezija (9.5–17.2 mm) nije presudan prognostički faktor. Uspjeh terapije ovisi prvenstveno o adekvatnoj eliminaciji intrakanalne infekcije, a ne o samoj veličini lezije. Kombinacija kemomehaničke obrade, irigacije NaOCl, intrakanalne medikacije $\text{Ca}(\text{OH})_2$ i definitivne opturacije omogućuje uklanjanje etiološkog faktora i stvaranje uvjeta za periapikalno cijeljenje. Pravovremena i adekvatno provedena endodontska terapija može biti put do uspjeha bez potrebe za kirurškim zahvatom. Sukladno tome, nekirurški pristup treba smatrati terapijom prvog izbora, čak i slučajevima opsežnih periapikalnih promjena.

Ključne riječi: periapikalna lezija, nekirurška endodontska terapija, kemomehanička obrada.

FIELD OF DENTISTRY: ENDODONTICS

SUCCESS OF NON-SURGICAL ENDODONTIC THERAPY IN THE MANAGEMENT OF PERIAPICAL LESIONS – CASE REPORT**Lorena Raspudić, Nemanja Bjeloglav, Davor Planinić, Nevena Bjeloglav, Bojan Starović**

Dental office "Dr. Davor Planinić" Međugorje

ABSTRACT

Introduction: Nonsurgical endodontic therapy is the primary approach to treating periapical lesions, aimed at eliminating intracanal infection and facilitating healing of the periapical tissues. Recent studies have treated the success rate of this therapeutic approach, even in larger periapical lesions. Clinical guidelines further emphasize the importance of proper diagnosis and implementation of therapy in accordance with the biological principles of endodontics.

Materials and methods: A 25-year-old female patient presented for a routine examination. Teeth 21, 22, and 23 were non-vital and asymptomatic. Radiographic evaluation revealed a large periapical lesion measuring 9.5–17.2 mm. During the first visit, chemomechanical preparation was performed using 2.5% sodium hypochlorite irrigation, and calcium hydroxide was placed as an intracanal medicament. At the second visit, definitive obturation was completed using gutta-percha and a resin-based sealer (AH+).

Results: Follow-up radiographic assessment on June 19, 2024, demonstrated complete resolution of the periapical lesion, indicating successful healing.

Conclusion: The size of the lesions (9.5–17.2 mm) is not a decisive prognostic factor. The success of the therapy depends primarily on the adequate elimination of the intracanal infection, and not on the size of the lesion itself. The combination of chemomechanical treatment, NaOCl irrigation, intracanal $\text{Ca}(\text{OH})_2$ medication and definitive obturation enables the removal of the etiological factor and the creation of conditions for periapical healing. Timely and adequately performed endodontic therapy can be the path to success without the need for surgery. Accordingly, a nonsurgical approach should be considered the therapy of first choice, even in cases of extensive periapical changes.

Keywords: periapical lesion, non-surgical endodontic therapy, chemomechanical preparation.

FIELD OF DENTISTRY: ORALNA HIRURGIJA

LIJEČENJE ALVEOLARNOG OSTEITISA PRIMJENOM PRF-A: SAVREMENI TERAPIJSKI PRISTUP ZA OPTIMIZACIJU KLINIČKE EFIKASNOSTI

Amina Vejselović¹, Anela Hardaga-Muzurović²¹Nezavisni istraživač²Klinika za oralnu hirurgiju,
Stomatološki klinički centar Univerziteta u Sarajevu

SAŽETAK

Uvod: Alveolarni osteitis (AO) predstavlja postekstrakcionu komplikaciju koju karakterizira poremećaj cijeljenja rane pri čemu dolazi do dezintegracije krvnog ugruška. Trombocitima obogaćen fibrin (PRF) je autologni biološki materijal koji sadrži visoku koncentraciju trombocita i omogućava kontrolisano, sporo i kontinuirano oslobađanje njihovih faktora rasta čije djelovanje ubrzava regeneraciju tkiva i optimizira kliničku efikasnost. Cilj ovog rada je prikazati mogućnost primjene i efikasnost PRF-a kao jedne od metoda u liječenju alveolarnog osteitisa.

Materijali i metode: Rad je zasnovan na analizi relevantne literature elektronskih naučnih baza podataka: PubMed, Science Direct i Google Scholar. Ukupno je pregledano 79 članaka, dok je 20 članaka uključeno u rad. U rad su uključeni i primjeri iz vlastite kliničke prakse.

Rezultati: U brojnim naučnim istraživanjima i kliničkim studijama pokazana je efikasnost primjene PRF-a u liječenju alveolarnog osteitisa koja se ogleda u ranom ublažavanju boli, smanjenju inflamacije, poboljšanom cijeljenju rane kao i sprječavanju sekundarnih komplikacija povezanih sa otežanim zarastanjem rane. Dokazano je da upotreba PRF-a u postekstrakcionoj alveoli može prevenirati razvoj i značajno smanjiti učestalost pojave alveolarnog osteitisa.

Zaključak: Terapijski pristup primjene PRF-a u liječenju alveolarnog osteitisa može značajno povećati lokalnu koncentraciju faktora rasta u alveoli te tako omogućiti optimalno cijeljenje rane. Mnoga istraživanja potvrđuju efikasnost ovog terapijskog pristupa i navode upotrebu PRF-a kao jednog od terapijskih izbora u prevenciji i liječenju alveolarnog osteitisa.

Ključne riječi: alveolarni osteitis, trombocitima obogaćen fibrin, liječenje

FIELD OF DENTISTRY: ORAL SURGERY

TREATMENT OF ALVEOLAR OSTEITIS USING PRF: A MODERN THERAPEUTIC APPROACH FOR OPTIMIZING CLINICAL EFFICIENCY

Amina Vejselović¹, Anela Hardaga-Muzurović²¹Independent researcher²Clinic for Oral Surgery,
Dental Clinical Center of University of Sarajevo

ABSTRACT

Introduction: Alveolar osteitis (AO) is a post-extraction complication characterized by impaired wound healing leading to disintegration of blood clot. Platelet-rich fibrin (PRF) is an autologous biological material containing high concentration of platelets thus enabling controlled, slow and continuous release of their growth factors, the activity of which accelerates tissue regeneration and optimizes clinical efficacy. The aim of this study is to demonstrate possibility of application and effectiveness of PRF as one of the methods in treatment of alveolar osteitis.

Materials and methods: The study is based on analysis of relevant literature from electronic scientific databases: PubMed, Science Direct and Google Scholar. A total of 79 articles were reviewed, while 20 articles were included in study. Examples from clinical practice are also included in study.

Results: Many scientific research and clinical studies have demonstrated effectiveness of PRF in treatment of alveolar osteitis, reflected in early pain relief, reduced inflammation, improved wound healing as well as prevention of secondary complications associated with poor wound healing. It has been proven that the use of PRF in the post-extraction alveolus can prevent development and significantly reduce incidence of alveolar osteitis.

Conclusion: Treatment approach of using PRF in treatment of alveolar osteitis can significantly increase local concentration of growth factors in alveolus and thus enable optimal wound healing. Many studies confirm effectiveness of this treatment approach and support the use of PRF as one of the therapeutic options for prevention and treatment of alveolar osteitis.

Keywords: alveolar osteitis, platelet-rich fibrin, treatment

FIELD OF DENTISTRY: ORALNA MEDICINA

NEVIDLJIVI NEPRIJATELJ: DISBIOZA ORALNOG MIKROBIOMA I UTICAJ NA ORALNO I SISTEMSKO ZDRAVLJEBelma Muhamedagić¹, Lejla Muhamedagić²¹Fakultet za nauku i tehnologiju Sarajevo²Javna ustanova Dom zdravlja Kantona Sarajevo**SAŽETAK**

Uvod: Oralni mikrobiom je zajednica mikroorganizama koja naseljava usnu šupljinu i igra ključnu ulogu u održavanju oralnog i sistemskog zdravlja. Poremećaj ravnoteže mikrobioma, poznat kao disbioza, povezan je sa razvojem karijesa, gingivitisa, parodontitisa i drugih oboljenja usne šupljine. Disbioza također može uticati na sistemska oboljenja putem inflamatornih i imunoloških mehanizama.

Materijal i metode: U radu je izvršen pregled relevantne naučne literature, gdje su analizirani podaci o promjenama sastava oralnog mikrobioma, dominantnim patogenim vrstama, te njihovoj povezanosti sa oboljenjima usne šupljine i sistemskih oboljenjima.

Rezultati: Studije su pokazale da poremećaj ravnoteže mikrobioma karakteriše rast potencijalno patogenih bakterija, što povećava rizik od karijesa, gingivitisa, parodontitisa, oralne kandidijaze i halitoze. Oralna disbioza može potaknuti sistemsku upalu, aktivirati imunološki odgovor i uticati na razvoj hroničnih oboljenja, uključujući kardiovaskularnih poremećaje, dijabetes, metabolički sindrom, respiratorne infekcije, hronične upalne bolesti i neka maligna oboljenja.

Zaključak: Očuvanje oralnog i sistemskog zdravlja zahtijeva pažljivo održavanje oralnog mikrobioma kroz pravilnu oralnu higijenu, redovne stomatološke preglede, izbalansiranu ishranu, te racionalnu primjenu antibiotika. Integrirani pristup očuvanju oralnog i sistemskog zdravlja postaje sve važniji, pri čemu probiotski i prebiotski pristupi sve više privlače pažnju zbog svoje uloge u obnavljanju mikrobioma usne šupljine i prevenciji napredovanja bolesti.

Ključne riječi: oralni mikrobiom, disbioza, karijes, parodontitis, sistemska oboljenja

FIELD OF DENTISTRY: ORAL MEDICINE

INVISIBLE ENEMY: DYSBIOSIS OF THE ORAL MICROBIOME AND ITS IMPACT ON ORAL AND SYSTEMIC HEALTHBelma Muhamedagić¹, Lejla Muhamedagić²¹Sarajevo School of Science and Technology²Public Institution Health Care Center of Sarajevo Canton**ABSTRACT**

Introduction: The Oral microbiome is a complex community of microorganisms that inhabit the oral cavity and plays a crucial role in maintaining both oral and systemic health. Disruption of this balance, known as dysbiosis, is associated with the development of dental caries, gingivitis, periodontitis, and other oral diseases. Additionally, dysbiosis may influence systemic conditions through inflammatory and immunological mechanisms.

Material and Methods: This paper presents a review of relevant scientific literature, analysing data on changes in the composition of the oral microbiome, dominant pathogenic species, and their association with oral and systemic diseases.

Results: Studies have shown that microbiome imbalance is characterized by the overgrowth of potentially pathogenic bacteria, increasing the risk of dental caries, gingivitis, periodontitis, oral candidiasis, and halitosis. Oral dysbiosis may trigger systemic inflammation, activate immune responses, and contribute to the development of chronic conditions, including cardiovascular disorders, diabetes, metabolic syndrome, respiratory infections, chronic inflammatory diseases, and certain cancer.

Conclusion: Maintaining oral and systemic health requires careful preservation of the oral microbiome through proper oral hygiene, regular dental check-ups, a balanced diet, and rational use of the antibiotics. An integrated approach to preserve oral and systemic health is becoming increasingly important, with probiotic and prebiotic strategies gaining attention for their role in restoring the oral microbiome and preventing disease progression.

Keywords: oral microbiome, dysbiosis, dental caries, periodontitis, systemic disease

FIELD OF DENTISTRY: ORTODONCIJA

VARIJACIJE U VELIČINI ZUBA KOD PACIJENATA SA NESINDROMSKOM HIPODONCIJOMAdna Kobašlija Oruč¹, Lejla Musić², Alisa Tiro¹, Vildana Džemidžić¹¹Katedra za ortodonciju,

Stomatološki fakultet Univerziteta u Sarajevu

²Privatna stomatološka ordinacija "MS-Dent" Žepče**SAŽETAK**

Cilj: Cilj ovog istraživanja bio je evaluirati mezidostalne dimenzije zuba na modelima ortodontskih pacijenata sa hipodoncijom te ih uporediti sa modelima ortodontskih pacijenata bez hipodoncije korištenjem digitalnih modela.

Materijali i metode: Istraživanje je obuhvatilo 40 modela pacijenata. Uzorak je podijeljen u dvije grupe: 20 modela pacijenata sa hipodoncijom i 20 modela pacijenata bez hipodoncije (kontrolna grupa).

Inkluzioni kriteriji za grupu modela sa hipodoncijom: kongenitalni nedostatak jednog ili više stalnih zuba (osim trećih molara)

Inkluzioni kriteriji za grupu modela bez hipodoncije: kompetna stalna denticija (osim trećih molara)

Digitalni modeli su dobijeni korištenjem intraoralnog skenera, te su analizirani pomoću odgovarajućih softvera. Na svakom modelu vršena su precizna mjerenja meziodistalnih dimenzija stalnih zuba.

Zaključak: Hipodoncija je povezana sa varijacijama meziodistalnih dimenzija zuba, što može imati značajan uticaj na ortodontsku dijagnostiku i planiranje terapije. Digitalni intraoralni skener predstavlja pouzdanu i efikasnu metodu za precizno mjerenje i analizu veličine zuba u kliničkoj praksi.

Ključne riječi: hipodoncija, mezidostalne dimenzije, digitalni modeli, intraoralni skener

FIELD OF DENTISTRY: ORTODONTICS

TOOTH SIZE VARIATIONS IN PATIENTS WITH NON-SYNDROMIC HYPODONTIAAdna Kobašlija Oruč¹, Lejla Musić², Alisa Tiro¹, Vildana Džemidžić¹¹Department of Orthodontics,

Faculty of Dentistry of University of Sarajevo

²Private dental office "MS-Dent" Žepče**ABSTRACT**

Aim: The aim of this study was to evaluate the mesiodistal tooth dimensions on dental models of orthodontic patients with hypodontia and to compare them with models of orthodontic patients without hypodontia using digital models.

Materials and Methods: The study included 40 patient models. The sample was divided into two groups: 20 models of patients with hypodontia and 20 models of patients without hypodontia (control group).

Inclusion criteria for the hypodontia group: congenital absence of one or more permanent teeth (excluding third molars)

Inclusion criteria for the non-hypodontia group: complete permanent dentition (excluding third molars)

Digital models were obtained using an intraoral scanner and analyzed using appropriate software. Precise measurements of the mesiodistal dimensions of permanent teeth were performed on each model.

Conclusion: Hypodontia is associated with variations in mesiodistal tooth dimensions, which may have a significant impact on orthodontic diagnosis and treatment planning. Digital intraoral scanners represent a reliable and efficient method for precise measurement and analysis of tooth size in clinical practice.

Keywords: hypodontia, mesiodistal dimensions, digital models, intraoral scanner

OBLAST STOMATOLOGIJE: ORTODONCIJA

MEZIODENS KAO UZROK POREMEĆAJA NICANJA ZUBA – PRIKAZ SLUČAJA**Nađa Ćuk Čengiđ, Selman A, Hadžiibrahimović D, Džemidžić V, Babačić R**

Katedra za ortodonciju,
 Stomatološki fakultet Univerziteta u Sarajevu
 Klinika za ortodonciju,
 Stomatološki klinički centar Univerziteta u Sarajevu

SAŽETAK

Uvod: Hiperdoncija se definira kao prisutnost zuba koji su dodatni uz normalni zub. Mogu se javiti u mliječnoj i stalnoj denticiji. Prevalenca u mliječnoj denticiji je 0,2-1,9%, dok je u stalnoj denticiji između 0,1-3,8%. Meziodens je najčešći prekobrojni zub, lokaliziran u razini srednje linije u maksili. Može biti retiniran ili niknuti u usnu šupljinu. Česti znakovi u usnoj šupljini su središnja dijestema, otežano nicanje gornjih stalnih sjekutića ili drugi poremećaji erupcije.

Cilj rada je prikazati slučaj desetogodišnjeg pacijenta sa perzistentnim mliječnim centralnim sjekutićima i prisutna dva meziodensa u području središnje linije maksile, koji blokiraju pravilno nicanje stalnih centralnih sjekutića.

Prikaz slučaja: Desetogodišnji dječak se javlja na Kliniku za ortodonciju zbog perzistencije mliječnih centralnih sjekutića. Kliničkim pregledom te analizom OPG snimka se utvrdi da pacijent ima dva meziodensa u području srednje linije maksile, koji blokiraju pravilno nicanje stalnih centralnih sjekutića. Pacijentu su ekstrahirani mliječni centralni sjekutići, a zatim i dva meziodensa.

Zaključak: Prekobrojni zubi, mogu uzrokovati kliničke probleme kao što su izostanak nicanja, odgođeno nicanje, impakciju, ektopičnu erupciju, distopiju ili rotaciju, zbijenost te traumatski zagriz. Pravovremena dijagnostika meziodensa omogućava adekvatno planiranje terapije i sprječava razvoj ortodontskih anomalija. Hirurška ekstrakcija u kombinaciji s ortodontskim tretmanom daje povoljan terapijski ishod.

Ključne riječi: hiperdoncija, meziodens, prekobrojni zubi, ortodoncija, ekstrakcija

FIELD OF DENTISTRY: ORTODONTICS

MESIODENS AS A CAUSE OF TOOTH ERUPTION DISTURBANCE – CASE REPORT**Nađa Ćuk Čengiđ, Selman A, Hadžiibrahimović D, Džemidžić V, Babačić R**

Department for ortodontics,
 Faculty of Dentistry of University of Sarajevo
 Clinic for Ortodontics,
 Dental Clinica Center of University of Sarajevo

ABSTRACT

Introduction: Hyperdontia is defined as the presence of teeth that are additional to a normal tooth. They can occur in deciduous and permanent dentition. The prevalence in the milk dentition is 0.2-1.9%, while in the permanent dentition it is between 0.1-3.8%.

The mesiodens is the most common supernumerary tooth, localized at the level of the midline in the maxilla. Common signs in the oral cavity are central diastema, difficult eruption of upper permanent incisors or other eruption disorders.

The aim is to present the case of a ten-year-old patient with persistent deciduous central incisors and the presence of two mesiodens in the area of the maxillary midline, which block the proper eruption of the permanent central incisors.

Case study: 10-year-old boy presents to the Orthodontics Clinic due to persistent deciduous central incisors. Clinical examination and analysis of the OPG scan revealed that the patient has two mesiodens in the area of the midline of the maxilla, which block the proper eruption of the permanent central incisors. The patient's deciduous central incisors were extracted, followed by two mesiodens

Conclusion: Supernumerary teeth can cause clinical problems such as absent eruption, delayed eruption, impaction, ectopic eruption, and sct. Timely diagnosis of mesiodens enables adequate therapy planning and prevents the development of orthodontic anomalies. Surgical extraction in combination with orthodontic treatment gives a favorable therapeutic outcome.

Keywords: hyperdontia, mesiodens, supernumerary teeth, orthodontics, extraction

OBLAST STOMATOLOGIJE: ORTODONCIJA

CBCT ANALIZA TEŽINE IMPAKCIJE OČNJAKA KOD ORTODONTSKIH PACIJENATA**Tamara Topalović Starović¹, Maida Mehadžić², Lejla Redžepagić-Vražalica³, Faruk Ljaljević⁴, Azra Jelešković³**¹Privatna stomatološka ordinacija²Dom zdravlja Bihać³Katedra za ortodonciju, Stomatološki fakultet Univerziteta u Sarajevu⁴Klinika za oralnu hirurgiju, Stomatološki klinički centar Univerziteta u Sarajevu**SAŽETAK**

Uvod: Impakcija maksilarnih očnjaka predstavlja značajan dijagnostički i terapijski izazov u ortodontskoj praksi, s potencijalnim posljedicama na funkciju, estetiku i stabilnost okluzije. Savremena trodimenzionalna dijagnostika omogućava detaljnu analizu položaja zuba i objektivizaciju težine impakcije.

Materijal i metode: Retrospektivnom studijom obuhvaćeno je 30 CBCT snimaka ortodontskih pacijenata sa impaktiranim maksilarnim očnjacima. Analiziran je prostorni položaj očnjaka u sagitalnoj, vertikalnoj i transverzalnoj ravni. Težina impakcije kvantifikovana je primjenom KPG indeksa. Statistička obrada podataka uključivaće deskriptivnu statistiku i testove normalnosti distribucije.

Rezultati: Rezultati istraživanja biće prezentirani nakon završetka statističke analize i interpretacije podataka.

Zaključak: CBCT predstavlja zlatni standard u procjeni impaktiranih očnjaka, omogućavajući preciznu trodimenzionalnu evaluaciju njihove pozicije. Primjena KPG indeksa doprinosi standardizaciji procjene težine impakcije i omogućava prediktivniji i individualiziran terapijski pristup u ortodontsko-hirurškom liječenju.

Ključne riječi: impakcija očnjaka, CBCT, KPG indeks, ortodoncija, trodimenzionalna analiza

FIELD OF DENTISTRY: ORTODONTICS

CBCT ANALYSIS OF THE SEVERITY OF IMPACTED CANINES IN ORTHODONTIC PATIENTS**Tamara Topalović Starović¹, Maida Mehadžić², Lejla Redžepagić-Vražalica³, Faruk Ljaljević⁴, Azra Jelešković³**¹Private Dental Practice²Health Care Center Bihać³Department of Orthodontics, Faculty of Dentistry of University of Sarajevo⁴Clinic of Oral Surgery, Dental Clinical Center of University of Sarajevo**ABSTRACT**

Introduction: Impacted maxillary canines represent a significant diagnostic and therapeutic challenge in orthodontic practice, potentially affecting function, aesthetics, and occlusal stability. Contemporary three-dimensional imaging enables precise spatial analysis and objective assessment of impaction severity.

Materials and Methods: This retrospective study included 30 CBCT scans of orthodontic patients with impacted maxillary canines. The spatial position of canines was analyzed in sagittal, vertical, and transverse planes. Impaction severity was quantified using the KPG index. Statistical analysis will include descriptive statistics and normality tests.

Results: The results will be presented upon completion of statistical analysis and data interpretation.

Conclusion: CBCT is considered the gold standard in the assessment of impacted canines, providing accurate three-dimensional evaluation. The application of the KPG index contributes to the standardization of impaction severity assessment and supports a more predictive and individualized orthodontic-surgical treatment approach.

Keywords: impacted canine, CBCT, KPG index, orthodontics, three-dimensional analysis

OBLAST STOMATOLOGIJE: PARODONTOLOGIJA

BIOPOTENCIJAL PLJUVAČNOG 8-HIDROKSIDEOKSIGUANOZINA U REFLEKSIJI KLINIČKOG STATUSA I AKTIVNOSTI OBOLJENJA KOD OBOLJELIH OD HRONIČNOG GINGIVITISA**Mirjana Gojkov-Vukelić¹, Sanja Hadžić¹, EnePašić¹, Merima Orlić Balavac², Sanela Arslanagić³, Aida Hafizović³**¹Katedra za oralnu medicinu i parodontologiju, Stomatološki fakultet, Univerzitet u Sarajevu²Katedra za kvantitativnu ekonomiju, Ekonomski fakultet, Univerzitet u Sarajevu³Klinika za oralnu medicinu i parodontologiju, Stomatološki klinički centar, Univerzitet u Sarajevu**SAŽETAK****Uvod:** Vrijednost pljuvačnog biomarkera 8-hidroksideoksiguanozina korištena je u procjeni oksidativnog oštećenja DNK molekule kod oboljelih od hroničnih parodontalnih oboljenja. Hronični gingivitis karakteriše reverzibilno oštećenje isključivo tkiva gingive.**Metode:** 70 odraslih zdravih pacijenata sa najmanje 20 zuba u denticiji, oba spola, nepušača podijeljeno je u dvije grupe od po 35. Prva: pacijenti sa dubinom sondiranja do 2 mm bez inflamatorne aliteracije parodontalnih tkiva. Druga: pacijenti sa dubinom sondiranja do 3 mm i pratećim kliničkim znacima gingivitisa. Provedena je klinička evaluacija parodontalnog statusa mjerenjem dubine sondiranja i indeksa krvarenja papile te je skupljen uzorak nestimulirane pljuvačke centrifugiran na 3000 obrtaja 10 minuta neposredno nakon skupljanja a potom u manjim alikvotama pohranjen na -20°C te -80°C do provođenja imunokompetitivne ELISA analize; reakcija vezanja antigen-antitijelo mjerena spektrofotometrijski na 450nm+/-2 nm.**Rezultati:** Statistički značajno višu prosječnu vrijednost mjerenog 8-hidroksideoksiguanozina u grupi oboljelih od hroničnog gingivitisa linearno i respektivno prati viša vrijednost kliničkog parametra dubina sondiranja. Korelacija između indeksa krvarenja papile kao mjere aktivnosti oboljenja zajedno sa dubinom sondiranja od 3 mm i mjerenog 8-hidroksideoksiguanozina pokazuje statističku signifikantnost u grupi oboljelih od hroničnog gingivitisa.**Zaključak:** Prosječna vrijednost pljuvačnog 8-hidroksideoksiguanozina kod oboljelih od hroničnog gingivitisa reflektuje klinički status opisan dubinom sondiranja u odnosu na zdrave ispitanike dok njena statistički značajna korelacija sa indeksom krvarenja papile u grupi oboljelih od hroničnog gingivitisa pokazuje biopotencijal pljuvačnog 8-hidroksideoksiguanozina za kliničko praćenje aktivnosti oboljenja odnosno njegove potencijalne progresije.

Svakako su potrebna detaljnija istraživanja unutar brojčano bogatijih grupa.

Ključne riječi: pljuvačni 8-hidroksideoksiguanozin, hronični gingivitis, klinički status, aktivnost oboljenja

FIELD OF DENTISTRY: PERIODONTOLOGY

BIOPOTENTIAL OF SALIVARY 8-HYDROXYDEOXYGUANOSINE LEVELS IN MIRRORING CLINICAL STATUS AND DISEASE ACTIVITY WITHIN DISEASED OF CHRONIC GINGIVITIS**Mirjana Gojkov-Vukelić¹, Sanja Hadžić¹, EnePašić¹, Merima Orlić Balavac², Sanela Arslanagić³, Aida Hafizović³**¹ Department for Oral medicine and Periodontology, Faculty of Dental medicine, University of Sarajevo² Department of Quantitative Economics, Faculty of Economics and Business, University of Sarajevo³ Clinic of Oral medicine and Periodontology, Dental Clinical Centre, University of Sarajevo**ABSTRACT****Introduction:** Salivary levels of biomarker 8-hydroxydeoxyguanosine have been used to estimate oxidative DNA-damage within chronic periodontal diseases. Chronic gingivitis is determined by reversible gingival tissue lesions exclusively.**Methods:** 70 adult healthy patients of both genders non-smokers divided in two groups of 35 with at least 20 teeth within dentition. First group: probing depth to 2 mm, inflammatory non-altered Perio tissues. Second group: probing depth up to 3 mm with clinical signs of gingivitis. Clinical evaluation to gather periodontal status as well as collecting non-stimulated saliva samples were carried out. Saliva samples were centrifuged for 10 minutes at 3000xg stored at small aliquots first at -20°C following -80°C until competitive immunoenzyme ELISA analysis, bonding measured spectrophotometrically at 450nm+/-2nm.**Results:** Statistically higher average values of measured salivary 8-hydroxydeoxyguanosine were found in group amongst diseased of chronic gingivitis linear and respectively follow measured higher average values of clinical parameter probing depth compared to group of healthy patients. Correlation between papilla bleeding index as measure of disease activity along with 3 mm probing depth and measured salivary 8-hydroxydeoxyguanosine shows statistical significance within the group of chronic gingivitis patients.**Conclusion:** Salivary 8-hydroxydeoxyguanosine levels of chronic gingivitis diseased reflect severity of clinical status described by probing depth while its correlation with papilla bleeding index tends to show its biopotential for clinical monitoring of disease activity or progression. Nevertheless, more detailed research of mentioned correlation amongst chronic gingivitis patients in groups larger in number is needed.**Keywords:** salivary 8-hydroxydeoxyguanosine, chronic gingivitis, disease severity, disease activity

OBLAST STOMATOLOGIJE: PARODONTOLOGIJA

REGENERATIVNA TERAPIJA U PARODONTOLOGIJI: PRIMJENA GBR I GTR U LIJEČENJU UZNAPREDOVALOG PARODONTITISA – PRIKAZ SLUČAJA

Anisa Zoronjić¹, Indira Mujić Jahić¹, Sanja Hadžić¹, Arma Muharemović¹, Mirjana Gojkov Vukelić¹, Iman Prčić²

¹Katedra za oralnu medicinu i parodontologiju,
Stomatološki fakultet Univerziteta u Sarajevu

²Stomatološka ordinacija "Konjhodžić" Sarajevo

SAŽETAK

Uvod: Parodontitis je hronično inflamatorno oboljenje koje dovodi do progresivnog gubitka potpornog aparata zuba i predstavlja jedan od glavnih uzroka gubitka denticije kod odraslih. Regenerativne hirurške tehnike, poput vođene regeneracije tkiva (GTR) i vođene koštane regeneracije (GBR), omogućavaju obnovu izgubljenih parodontalnih struktura i očuvanje prirodnih zuba.

Materijali i metode: Prikazan je slučaj muškog pacijenta DŽ.Š. (1989) sa uznapredovalim parodontitisom i prisutnim intrakoštanim defektima. Nakon inicijalne nehirurške terapije proveden je hirurški tretman otvorenim režnjem, uz primjenu GTR membrana i koštanih graft materijala (GBR). Klinički parametri (dubina sondiranja, klinički nivo pripoja, krvarenje na sondiranje) i radiografski nalazi procijenjeni su prije i nakon terapije.

Rezultati: Postoperativno je zabilježeno smanjenje dubine parodontalnih džepova, dobitak kliničkog pripoja i radiografski znaci koštane regeneracije. Zubi su očuvani uz poboljšanu funkciju i stabilnost parodonta.

Zaključak: Primjena GTR i GBR tehnika predstavlja efikasan pristup u liječenju intrakoštanih defekata kod parodontitisa i omogućava očuvanje kompromitovanih zuba kao biološki prihvatljiviju alternativu ekstrakciji i implantološkoj terapiji.

Ključne riječi: parodontitis, regenerativna terapija, GTR, GBR, intrakoštani defekti

OBLAST STOMATOLOGIJE: PERIODONTOLOGY

REGENERATIVE THERAPY IN PERIODONTOLOGY: APPLICATION OF GBR AND IN THE TREATMENT OF ADVANCED PERIODONTITIS – A CASE REPORT

Anisa Zoronjić¹, Indira Mujić Jahić¹, Sanja Hadžić¹, Arma Muharemović¹, Mirjana Gojkov Vukelić¹, Iman Prčić²

¹Department of oral medicine and periodontology,
Faculty of Dentistry of University of Sarajevo

²Private Dental Practice "Konjhodžić" Sarajevo

ABSTRACT

Introduction: Periodontitis is a chronic inflammatory disease leading to progressive loss of tooth-supporting tissues and remains a major cause of tooth loss in adults. Regenerative surgical approaches, such as guided tissue regeneration (GTR) and guided bone regeneration (GBR), enable reconstruction of lost periodontal structures and preservation of natural teeth.

Materials and Methods: A male patient diagnosed with advanced periodontitis and intra-bony defects was treated. Following initial non-surgical therapy, open flap debridement was performed combined with GTR membranes and bone graft materials (GBR). Clinical parameters (probing depth, clinical attachment level, bleeding on probing) and radiographic findings were evaluated before and after therapy.

Results: Postoperative evaluation demonstrated reduced probing depths, clinical attachment gain, and radiographic signs of bone fill. Teeth were preserved with improved periodontal stability and function.

Conclusion: GTR and GBR techniques represent effective treatment options for intra-bony periodontal defects and support tooth preservation as a biologically sound alternative to extraction and implant placement.

Keywords: periodontitis, regenerative therapy, GTR, GBR, intra-bony defects

OBLAST STOMATOLOGIJE: PARODONTOLOGIJA

VOĐENA KOŠTANA I TKIVNA REGENERACIJA U TERAPIJI GENERALIZIRANOG PARODONTITISA STADIJA III, RAZREDA B

Sanja Hadžić¹, Arma Muharemović¹, Mia Hodžić²,
Indira Mujić Jahić¹, Anisa Zoronjić¹

¹Katedra za Oralnu medicinu i parodontologiju,
Stomatološki fakultet Univerziteta u Sarajevu

²Klinika za Oralnu medicinu i parodontologiju,
Stomatološki klinički centar Univerziteta u Sarajevu

SAŽETAK

Uvod: Vođena koštana i tkivna regeneracija predstavlja jednu od najvažnijih regenerativnih metoda u liječenju uznapredovalih parodontalnih lezija, jer omogućava stvaranje uslova za obnovu alveolarne kosti i parodontalnog pripoja. Cilj savremene parodontološke terapije nije samo zaustavljanje inflamatornog procesa, već i regeneracija izgubljenih tkiva. Ovaj rad ima za cilj prikazati značaj i mogućnosti primjene vođene koštane i tkivne regeneracije u terapiji generaliziranog parodontitisa stadija III, razreda B.

Materijali i metode: Prikazan je slučaj pacijenta sa dijagnozom generaliziranog parodontitisa stadij III, razred B. Sproveden je kompletan anamnestičko dijagnostički postupak, nehirurška i hirurška terapija. Primijenjen je minimalno invazivni hirurški pristup (MIST) i tokom zahvata korišten je enamelni matriksni derivat (Emdogain) u kombinaciji s koštanim nadomjestkom životinjskog (goveđeg) porijekla, uz primjenu perikardijalne membrane kao barijere u cilju vođene koštane i tkivne regeneracije.

Rezultati: Na osnovu kliničkih parametara i radiografskog nalaza tri mjeseca nakon zahvata zabilježeno je poboljšanje parodontalnog statusa, što ukazuje na uspješno provedenu regenerativnu terapiju.

Zaključak: Dobijeni rezultati potvrđuju da minimalno invazivni hirurški pristup u kombinaciji s regenerativnim materijalima predstavlja efikasnu terapijsku opciju u liječenju uznapredovalog parodontitisa uz potrebu za daljim praćenjem i održavanjem postignutih rezultata.

Ključne riječi: parodontitis, GTR, GBR, MIST.

OBLAST STOMATOLOGIJE: PERIODONTOLOGY

GUIDED BONE AND TISSUE REGENERATION IN THE TREATMENT OF GENERALIZED STAGE III, GRADE B PERIODONTITIS

Sanja Hadžić¹, Arma Muharemović¹, Mia Hodžić², Indira Mujić Jahić¹, Anisa Zoronjić¹

¹Department of Oral Medicine and Periodontology,
Faculty of Dentistry of University of Sarajevo

²Clinic of Oral Medicine and Periodontology,
Dental Clinical Center of University of Sarajevo

ABSTRACT

Introduction: Guided bone and tissue regeneration represents one of the most important regenerative methods in the treatment of advanced periodontal lesions. It helps create conditions for the regeneration of alveolar bone and periodontal attachment. The goal of contemporary periodontal therapy is not only to stop the inflammatory process but also to regenerate lost periodontal tissues. The aim of this paper is to present the importance and possibilities of applying guided bone and tissue regeneration in the treatment of generalized stage III, grade B periodontitis.

Materials and methods: A patient with generalized generalized stage III, grade B periodontitis is presented. A complete anamnestic and diagnostic procedure was performed, followed by non-surgical and surgical therapy. A minimally invasive surgical technique (MIST) was applied, and during the procedure an enamel matrix derivative (Emdogain) was used in combination with a xenogeneic (bovine-derived) bone substitute, along with a pericardial membrane applied as a barrier for guided bone and tissue regeneration.

Results: Based on clinical parameters and radiographic findings three months after the procedure, an improvement in periodontal status was observed, indicating that the applied regenerative therapy was successful.

Conclusion: A minimally invasive surgical approach combined with regenerative materials represents an effective therapeutic option in the treatment of advanced periodontitis, with the need for further follow-up and maintenance of the achieved results.

Keywords: periodontitis, GTR, GBR, MIST

FIELD OF DENTISTRY: PREVENTIVNA STOMATOLOGIJA

OBRADA PODATAKA PREGLEDANE DJECE STAROSTI OD 7 GODINA U ŠKOLI U ZANZIBARU

Edisa Šiljak-Rašidović

Javna ustanova Dom zdravlja Kantona Sarajevo

SAŽETAK

Uvod: Prilikom odmora na Zanzibaru, Tanzanija, na jednom od fakultativnih izleta posjetili smo osnovnu školu u Nungwi. Tom prilikom sam izvršila stomatološki pregled jednog razreda od 70 učenika (36 djevojčica i 34 dječaka). Za djecu uzrasta od 7 godina nije pronađen dostupan izvor koji pokazuje KEP/kep index kao zasebnu dobnu kategoriju. Najbliži dostupni podaci odnose se na grupu djece od 3 do 10 godina kod koje je 2023. godine zabilježena prevalenca karijesa od 48,59%.

Materijali i metode: Pri pregledu su korišteni maska, rukavice, špatule, prirodni izvor svjetlosti i papirni obrasci za prikupljanje podataka. Cilj je prikazati ukupan broj zdravih, karioznih, ekstahiranih i plombiranih stalnih i mliječnih zuba, prisutnost ortodontskih anomalija, gingivitisa, preventivnih mjera zalijeivanja fisura i kvalitet oralne higijene, te zastupljenost kod dječaka i djevojčica.

Rezultati: 70 pregledanih nema ispuna na mliječnim i stalnim zubima, iako je karijes prisutan... Sva djeca imaju dentoalveolarne anomalije, 39 djece ima gingivitis (17 dječaka i 22 djevojčica), 36 ima lošu oralnu higijenu (15 dječaka i 21 djevojčica) i nema preventivnih mjera zalijeivanja fisura.

Zaključak: Karijes u ranom dječijem uzrastu je značajan javno-zdravstveni problem zbog deficita stomatologa, edukacije roditelja i djece, lošeg socio-ekonomskog statusa. Potrebno je sprovoditi kontinuiranu edukaciju, preventivne preglede i programe za unaprijeđenje oralnog zdravlja.

Ključne riječi: Zanzibar, škola, djeca, pregled, rezultati

FIELD OF DENTISTRY: PREVENTIVE DENTISTRY

DATA ANALYSIS OF EXAMINED 7-YEAR-OLD CHILDREN IN A PRIMARY SCHOOL IN ZANZIBAR

Edisa Šiljak-Rašidović

Public Institution Health Care Center of Sarajevo Canton

ABSTRACT

Introduction: During a vacation in Zanzibar, Tanzania, as part of an optional excursion, we visited a primary school in Nungwi. On that occasion, I conducted a dental examination of one class consisting of 70 pupils (36 girls and 34 boys). For children aged 7, no available data source was found presenting the DMFT/dmft index (Decayed, Missing, Filled Teeth index) as a separate age category. The closest available data refer to a group of children aged 3 to 10 years, in which a caries prevalence of 48.59% was recorded in 2023.

Materials and Methods: The examination was performed using a mask, gloves, wooden spatulas, natural light, and paper-based data collection forms. The aim was to present the total number of healthy, decayed, extracted, and filled permanent and primary teeth, the presence of orthodontic anomalies, gingivitis, preventive measures such as fissure sealants, and the level of oral hygiene, as well as their distribution between boys and girls.

Results: Among the 70 examined children, no fillings were observed on either primary or permanent teeth, despite the presence of dental caries. All children presented with dentoalveolar anomalies. Gingivitis was identified in 39 children (17 boys and 22 girls), while 36 children exhibited poor oral hygiene (15 boys and 21 girls). No preventive fissure sealing measures were recorded.

Conclusion: Early childhood caries represents a significant public health issue due to the shortage of dental professionals, insufficient education of parents and children, and poor socio-economic conditions. Continuous education, regular preventive examinations, and the implementation of oral health promotion programs are necessary.

Keywords: Zanzibar, school, children, examination, results

FIELD OF DENTISTRY: PREVENTIVNA STOMATOLOGIJA

DIGITALNA ZDRAVSTVENA PISMENOST KOD DOKTORA STOMATOLOGIJEŠeila Cilović-Lagarija¹, Elvedina Prlja², Aleksandra Rađenović³, Haris Omić⁴, Kerim Ćosić⁵, Aldijana Đelilović-Proha²¹Zavod za javno zdravstvo Federacije Bosne i Hercegovine²Dom zdravlja Kantona Sarajevo³Privatna stomatološka ordinacija Rađenović⁴Privatna stomatološka ordinacija dr. Ljevo⁵Privatna stomatološka ordinacija dr. Ćosić**SAŽETAK**

Uvod: Digitalna zdravstvena pismenost je ključna kompetencija doktora stomatologije koja omogućava efikasno pretraživanje, procjenu i primjenu online zdravstvenih informacija, značajnih za donošenje kliničkih odluka, profesionalni razvoj i edukaciju pacijenata.

Materijali i metode: Provedeno je presječno online istraživanje u Federaciji Bosne i Hercegovine (maj–jun 2025.) na 124 doktora stomatologije. Podaci su prikupljeni online, a digitalna zdravstvena pismenost procijenjena validiranim instrumentom eHealth Literacy Scale (eHEALS). Prikupljeni su i sociodemografski podaci, a analiza provedena deskriptivnim metodama.

Rezultati: Većinu ispitanika činile su žene (78,2%), dok je muškaraca bilo 21,8%. Najzastupljeniji su bili doktori bez specijalizacije (55,6%), zatim doktori na specijalizaciji (23,4%) i specijalisti (21,0%). Visok nivo sposobnosti pronalaženja zdravstvenih informacija imalo je 86,3% ispitanika, procjene informacija 85,5%, a razlikovanja kvaliteta informacija 89,5%. Niže samopouzdanje u primjeni informacija za vlastito zdravlje iskazalo je 33,9%, dok je 66,1% imalo visoko samopouzdanje.

Zaključak: Doktori stomatologije pokazuju visok nivo vještina pronalaženja i procjene informacija, uz nešto niže samopouzdanje u njihovoj primjeni, što ukazuje na potrebu za dodatnom edukacijom u skladu s EU direktivama.

Ključne riječi: digitalna zdravstvena pismenost, eHEALS, doktori stomatologije, digitalne kompetencije

FIELD OF DENTISTRY: PREVENTIVE DENTISTRY

DIGITAL HEALTH LITERACY AMONG DENTISTSŠeila Cilović-Lagarija¹, Elvedina Prlja², Aleksandra Rađenović³, Haris Omić⁴, Kerim Ćosić⁵, Aldijana Đelilović-Proha²¹Institute of Public Health of the Federation of Bosnia and Herzegovina²Primary Health Care Center of Canton Sarajevo³Private Dental Practice Rađenović⁴Private Dental Practice Dr. Ljevo⁵Private Dental Practice Dr. Ćosić**ABSTRACT**

Introduction: Digital health literacy is a key competency for dentists, enabling efficient searching, evaluation, and application of health information available online. This is essential for clinical decision-making, professional development, and patient education.

Materials and Methods: A cross-sectional online survey was conducted in the Federation of Bosnia and Herzegovina (May–June 2025) among 124 dentists. Data were collected online, and digital health literacy was assessed using the validated eHealth Literacy Scale (eHEALS).

Sociodemographic data were also collected, and analysis was performed using descriptive methods.

Results: The sample comprised 78.2% (97) female and 21.8% male participants. The largest proportion consisted of dentists without specialization 55.6%, followed by specialists 21.0% and dentists in specialization training program 23.4%. A high level of ability to find health information online was observed in 86.3% (107) of participants. A total of 85.5% reported being able to evaluate health information, while 89.5% reported being able to distinguish between high- and low-quality health information. A lower level of confidence was observed in 33.9% of participants when using information for personal health decisions, while 66.1% reported high confidence.

Conclusion: The results indicate a high level of skills in finding and evaluating health information among dentists, with somewhat lower confidence in applying information to their own health. This highlights the need for additional training to ensure safe and critical use of digital information in line with EU guidelines.

Keywords: digital health literacy, eHEALS, dentists, digital competencies

FIELD OF DENTISTRY: PREVENTIVNA STOMATOLOGIJA

ANALIZA STRUKTURE KEP INDEKSA GENERACIJE Z KOD 200 MLADIH ODRASLIH

Samra Alić Fejzić¹, Nina Marković¹, Irmira Tahmišćija²,
Aida Džanković², Samra Korać²

¹Katedra za preventivnu stomatologiju i pedodontiju,
Stomatološki fakultet Univerziteta u Sarajevu

²Katedra za dentalnu patologiju s endodontijom,
Stomatološki fakultet Univerziteta u Sarajevu

SAŽETAK

Cilj istraživanja bio je klinička procjena intenziteta karijesa i analiza strukture KEP indeksa kod populacije mladih odraslih Bosne i Hercegovine.

Materijal i metode: Studija je obuhvatila 200 ispitanika (n=200) oba pola, prosječne starosti 25 godina. Kliničkim pregledom utvrđene su komponente KEP indeksa: broj karijesnih (K), ekstrahovanih (E) i plombiranih (P) zuba. Kao karijes zabilježena je samo kavitacija na zubu, ne i bijela mrlja. U kalkulaciju KEP indeksa nisu uvršteni zubi koji su izvađeni zbog nekog drugog razloga osim karijesa. Podaci su obrađeni deskriptivnom statistikom.

Rezultati: Prosječna vrijednost KEP indeksa u ispitivanom uzorku iznosila je 10,48. Analiza strukture indeksa pokazala je dominaciju plombiranih zuba (P=1671; 79,7%), dok je broj ekstrahiranih zuba iznosio 328 (15,7%), a karijesnih 97 (4,6%). Čak 54,5% ispitanika imalo je najmanje jedan ekstrahiran zub, najčešće premolar i prvi molar, dok je samo 2% ispitanika (n=4) imalo KEP indeks 0.

Zaključak: Činjenice da više od polovine ispitanika ima barem jedan izvađen zub i da samo 2% ispitanika ima KEP = 0 u dobi od 25 godina, ukazuju na neadekvatnu primarnu prevenciju u ranijem životnom dobu. Ekstrakcije su i dalje česta metoda rješavanja dentalnih problema, umjesto endodontskog liječenja. Visok intenzitet karijesa (KEP = 10,48) skoro je duplo veći od poželjnog prosjeka Svjetske zdravstvene organizacije (SZO). Dominantna komponenta P (79,7%), ukazuje na dobru kurativnu stomatološku zaštitu i sugerije dobru dostupnost stomatološke službe. Dobiveni rezultati jasno signaliziraju neophodnost prelaska sa kurativnog na intenzivni preventivni model oralne zdravstvene zaštite.

Ključne riječi: KEP indeks, mladi odrasli, oralno zdravlje, prevencija karijesa, ekstrakcija

FIELD OF DENTISTRY: PREVENTIVE DENTISTRY

STRUCTURAL ANALYSIS OF THE DMFT INDEX IN GENERATION Z AMONG 200 YOUNG ADULTS

Samra Alić Fejzić¹, Nina Marković¹, Irmira Tahmišćija²,
Aida Džanković², Samra Korać²

¹Department of Preventive Dentistry and Pedodontics,
Faculty of Dentistry of University of Sarajevo

²Department of Dental Pathology with Endodontics,
Faculty of Dentistry of University of Sarajevo

ABSTRACT

The aim of this study was to perform a clinical assessment of caries intensity and to analyze the structure of the DMFT index in a population of young adults in Bosnia and Herzegovina.

Materials and Methods: The study included 200 subjects (n = 200) of both sexes, with a mean age of 25 years. During the clinical examination, the components of the DMFT index were recorded: the number of decayed (D), missing (M), and filled (F) teeth. Only cavitated lesions were recorded as caries; white spot lesions were not included. Teeth extracted for reasons other than caries were excluded from the DMFT calculation. Data were processed using descriptive statistical analysis.

Results: The mean DMFT value in the studied sample was 10.48. Analysis of the index structure showed a predominance of filled teeth (F = 1671; 79.7%), while the number of missing teeth was 328 (15.7%) and decayed teeth 97 (4.6%). As many as 54.5% of participants had at least one extracted tooth, most commonly premolars and first molars, while only 2% of participants (n = 4) had a DMFT index of 0.

Conclusion: Tooth extraction remains a common method for treating dental problems instead of endodontic therapy. The high caries intensity (DMFT = 10.48) is almost twice the desirable average proposed by the World Health Organization (WHO). The dominant F component (79.7%) indicates good curative dental care and suggests good accessibility to dental services. The obtained results clearly signal the necessity of shifting from a curative to an intensive preventive model of oral health care.

Keywords: DMFT index, young adults, oral health, caries prevention, tooth extraction

FIELD OF DENTISTRY: RESTAURATIVNA I ADHEZIVNA STOMATOLOGIJA

PRIMJENA VJEŠTAČKE INTELIGENCIJE U EVALUACIJI KOMPOZITNIH RESTAURACIJA: OD DIJAGNOSTIKE DO PREDIKCIJE USPJEŠNOSTI

Belma Muhamedagić

Fakultet za nauku i tehnologiju Sarajevo

SAŽETAK

Uvod: Kompozitne restauracije predstavljaju standard u restaurativnoj stomatologiji. Vještačka inteligencija (AI) se sve više koristi za analizu kliničkih podataka i unapređenje procjene restauracija. Cilj ovog rada je prikazati mogućnosti vještačke inteligencije u evaluaciji kompozitnih restauracija, uključujući dijagnostičke i prediktivne aspekte.

Materijali i metode: U radu je izvršena analiza novije naučne literature pretražene putem baza podataka, kao što su *PubMed*, *Google Scholar*, o primjeni vještačke inteligencije u procjeni kompozitnih restauracija. U obzir su uzete studije koje koriste različite algoritme mašinskog učenja, uključujući neuronske mreže, za evaluaciju estetskih i mehaničkih svojstava, kao i procjeni kliničkih ishoda restauracija.

Rezultati: Rezultati ukazuju na značajan potencijal sistema vještačke inteligencije u preciznoj procjeni različitih karakteristika kompozitnih restauracija, uključujući određivanje boje zuba, procjenu mehaničkih svojstava, detekciju mikropropuštanja i predviđanja dugovječnosti restauracija. Najveća tačnost zabilježena je kod modela za predikciju abrazivnog trošenja i čvrstoće materijala. Međutim, većina studija bazira se na ograničenim uzorcima i laboratorijskim uslovima.

Zaključak: Primjena vještačke inteligencije predstavlja značajan napredak u evaluaciji kompozitnih restauracija, omogućavajući precizniju dijagnostiku i predviđenje kliničke uspješnosti. Za njenu širu primjenu u svakodnevnoj stomatološkoj praksi neophodna su dodatna istraživanja, posebno ona koja uključuju veće i raznovrsnije uzorke, kao i potvrdu rezultata u realnim kliničkim uslovima.

Ključne riječi: Vještačka inteligencija, kompozitne restauracije, restaurativna stomatologija, evaluacija, predikcija

FIELD OF DENTISTRY: RESTORATIVE AND ADHESIVE DENTISTRY

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE EVALUATION OF COMPOSITE RESTORATIONS: FROM DIAGNOSIS TO PREDICTION OF CLINICAL SUCCESS

Belma Muhamedagić

Sarajevo School of Science and Technology

ABSTRACT

Introduction: Composite restorations represent the standard in restorative dentistry. Artificial intelligence (AI) is increasingly used to analyse clinical data and improve the assessment of restorations. The aim of this paper is to present the potential of artificial intelligence in the evaluation of composite restoration, including diagnostic and predictive aspects.

Materials and Methods: This paper includes an analysis of recent scientific literature retrieved from databases such as *PubMed* and *Google Scholar* regarding the application of artificial intelligence in the assessment of composite restorations. Studies using different machine learning algorithms, including neural networks, were considered for evaluating aesthetic and mechanical properties, as well as clinical outcomes of restorations.

Results: The results indicate significant potential of artificial intelligence systems in the precise assessment of different characteristics of composite restorations, including tooth colour determination, evaluation of mechanical properties, detection of microleakage, and prediction of restoration longevity. The highest accuracy was observed in model predicting abrasive wear and material strength. However, most studies are based on limited sample size and laboratory conditions.

Conclusion: The application of artificial intelligence represents a significant advancement in the evaluation of composite restorations, enabling more precise diagnosis and prediction of clinical success. However, for broader implementation in everyday dental practice, further research is necessary, particularly studies involving larger and more diverse samples, as well as validation in real clinical settings.

Keywords: artificial intelligence, composite restoration, restorative dentistry, evaluation, prediction

INSTRUCTIONS FOR THE AUTHORS

made in accordance with the recommendations of the International Committee of Medical Journal based on "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" (<http://www.icmje.org/>).

Submissions of manuscripts are made through the submission form available at web page of the Journal (www.stomatoloskivjesnik.ba) or by sending the email to Editorial office at radovi@stomatoloski.vjesnik.ba

E-mail must be composed of:

A) Covering letter, in which authors explain the importance of their study (Explanation why we should publish your manuscript ie. what is new and what is important about your manuscript, etc).

B) Title of the manuscript

C) Authors' names and email addresses (mark corresponding author with *)

D) Abstract

E) Attached file of the Copyright assignment form and

F) Manuscript.

Authors should NOT in addition post a hard copy of the manuscript and submission letter, unless they are supplying artwork, letters or files that cannot be submitted electronically, or have been instructed to do so by the editorial office.

Please read Instructions carefully to improve yours paper's chances for acceptance for publishing.

Thank you for your interest in submitting an article to Stomatološki vjesnik.

Type of papers suitable for publishing in Stomatološki vjesnik (Journal in following text):

Original Articles, Case Reports, Letters to the Editors, Current Perspectives, Editorials, and Fast-Track

Articles are suitable for publishing in Stomatološki vjesnik. Papers must be fully written in English with at least title, abstract and key words bilingual in Bosnian/Croatian/Serbian language (B/C/S) and English language.

Editorial process:

All submitted manuscripts are initially evaluated by at least two scientific and academic members of editorial board. An initial decision is usually reached within 3–7 days.

Submitted manuscripts may be rejected without detailed comments after initial review by editorial board if the manuscripts are considered inappropriate or of insufficient scientific priority for publication in Stomatološki vjesnik.

If sent for review, each manuscript is reviewed by scientists in the relevant field. Decisions on reviewed

manuscripts are usually reached within one month. When submission of a revised manuscript is invited following review, the revision must be received in short time of the decision date.

Criteria for acceptance:

Submitted manuscripts may be rejected without detailed comments after initial review by editorial board if the manuscripts are considered inappropriate or of insufficient scientific priority for publication in the Journal. All other manuscripts undergo a complete review by reviewers or other selected experts. Criteria for acceptance include originality, validity of data, clarity of writing, strength of the conclusions, and potential importance of the work to the field of dentistry and similar bio-medical sciences. Submitted manuscripts will not be reviewed if they do not meet the Instructions for authors, which are based on "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" (<http://www.icmje.org/>).

Authorship:

All authors have to sign the copyright assignment form. We ask all authors to confirm that: they have met the criteria for authorship as established by the International Committee of Medical Journal Editors; they believe that the paper represents honest work, and are able to verify the validity of the results reported.

Redundant or duplicate publication:

We ask the authors to confirm in the copyright assignment form that the paper has not been published in its current form or a substantially similar form (in print or electronically, including on a web site), that it has not been accepted for publication elsewhere, and that it is not under consideration by another publication. The International Committee of Medical Journal Editors has provided details of what is and what is not duplicate or redundant publication (<http://www.icmje.org>). In the submission letter to the editors, authors are asked to draw attention to any published work that concerns the same patients or subjects as the present paper.

Author Contributions:

Authors are required to include a statement to verify the contributions of each co-author in the copyright assignment form (available at www.stomatoloskivjesnik.ba).

Patient consent forms:

The protection of a patient's right to privacy is essential. The authors may be asked by the editorial board to send copy of patient consent forms on which patients or other subjects of the experiments clearly grant permission for the publication of photographs or other material that might identify them. If the consent form for the research did not specifically include this, authors should obtain it or remove the identifying material.

Ethics committee approval:

The authors must state clearly in the submission letter and in the Methods section that the conducted studies on human participants are with the approval of an appropriate named ethics committee. Please

also look at the latest version of the Declaration of Helsinki (<http://www.wma.net/e/policy/b3.htm>). Similarly, the authors must confirm that experiments involving animals adhered to ethical standards and must state the care of animal and licensing guidelines under which the study was performed. The editorial board may ask author(s) for copy of ethical committee approval.

Declaration of Interest:

We ask the authors to state all potential financial support received for the work. This applies to all papers including editorials and letters to the editor (see below). If you are sure that there is no conflict of interest, please state that.

Copyright:

Copyright assignment form contains authors' statement that all the copyrights are transferred to the publisher if and when the manuscript is accepted for publishing.

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution and for all other derivative works, including compilations and translations. If excerpts from other copyrighted works are included, the author(s) must obtain written permission from the publisher and credit the source(s) in the article.

Formatting requirements:

Manuscript should be written in Times New Roman 12, Normal, double spacing.

Include the following sections, each starting on a separate page: Title Page, Abstract and Keywords, Text, Acknowledgements, Declaration of interest, References, Individual tables and figures with captions.

Margins should be not less than 3 cm. Pages should be numbered consecutively, beginning with the Title Page, and the page number should be placed in the bottom right hand corner of each page.

Abbreviations should be defined on their first appearance in the text; those not accepted by inter-

national bodies should be avoided. Use only standard abbreviations. Avoid abbreviations in the title and abstract. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

The Title Page should carry the full title of the paper and a short title to be used as a 'running head' (and which should be so identified). The first name, middle initial and last name of each author should appear marked with superscript numbers or/and symbols corresponding to their affiliation or/and note. Affiliations of the authors should be written below authors name list. Full name, address, phone and fax number and e-mail of the author responsible for correspondence should appear on the Title Page. Please include the word count of the abstract and word count of text on the title page.

The second page should carry a structured **abstract** of no more than 250 words. The abstract should state the Objective(s) of the study or investigation, basic Methods (selection of study subjects or laboratory animals; observational and analytical methods), main Results (giving specific data and their statistical significance, if possible), and the principal Conclusions. It should emphasize new and important aspects of the study or observations.

The abstract should be followed by a list of 3–10 **keywords** or short phrases which will assist the cross-indexing of the article and which may be published. When possible, the terms used should be from the Medical Subject Headings list of the National Library of Medicine (<http://www.nlm.nih.gov/mesh/meshhome.html>).

Body of the manuscript text of an experimental or observational nature may be divided into sections headed Introduction, Materials and Methods (including ethical and statistical information), Results, Discussion and Conclusion, although reviews may require a different format.

Original Articles: original experimental and clinical studies should not exceed 4400 words (up to 15 pages) including tables and references.

With Case Reports: presentation of a clinical case which may suggest novel working hypotheses, with a

short discussion on the pertinent literature. The text should not exceed 2400 words (up to 8 pages).

Letters to the Editors should not exceed 500 words, should not be signed by more than three authors and should not have more than 5 references. Preferably, letters should be in reference to a Journal article published within the last 3 months or to novel hypotheses so as to stimulate comments on issues of common interest. Authors of the letters accepted for publication will receive the galley proofs. The Editors will generally solicit replies. The Editors reserve the right to modify the text.

Current Perspectives: invited articles by recognized authorities, to include position papers, reviews, and special topics of general interest. Independent submission will also be considered.

Editorials: invited articles or brief editorial comments that represent opinions of recognized leaders in biomedical research.

Fast-Track Articles: short articles on laboratory or clinical findings, representing important new insights or major advances, produced with established methods or new applications of an established or new method. The text should not exceed 2400 words.

Acknowledgements: One or more statements should specify (a) contributions that need acknowledging but do not justify authorship, such as general support by a department chairman; (b) acknowledgements of technical help; (c) acknowledgements of financial and material support, specifying the nature of the support. Persons who have contributed intellectually to the paper but whose contributions do not justify authorship may be named and their function or contribution described – for example, 'scientific adviser', 'critical review of study proposal', 'data collection', 'participation in clinical trial'. Such persons must have given their permission to be named. Authors are responsible for obtaining written permission from persons acknowledged by name because readers may infer their endorsement of the data and conclusions.

Declaration of Interest

A statement must be provided listing all financial support received for the work and, for all authors, any

financial involvement (including employment, fees, share ownership) or affiliation with any organization whose financial interests may be affected by material in the manuscript, or which might potentially bias it. This applies to all papers including editorials and letters to the editor. If you are sure that there is no conflict of interest, please state this.

References

References should be numbered consecutively in the order in which they first appear in the text. They should be assigned Arabic numerals, which should be given in brackets, e.g. [17]. References should include the names of all authors when six or fewer; when seven or more, list only the first six names and add et al. References should also include full title and source information (Vancouver style).

Journal names should be abbreviated as in MEDLINE (<http://www.medscape.com/Home/Search/IndexMedicus/IndexMedicus.html>).

Examples of citation:

Standard journal article:

Tashiro H, Shimokawa H, Sadamatu K, Yamamoto K. Prognostic significance of plasma concentrations of transforming growth factor- β . *Coron Artery Dis* 2002; 13(3):139-143.

More than six authors:

Yetkin E, Senen K, Ileri M, Atak R, Tandogan I, Yetkin Ö, et al. Comparison of low-dose dobutamine stress echocardiography and echocardiography during glucose-insulin-potassium infusion for detection of myocardial viability after anterior myocardial infarction. *Coron Artery Dis* 2002; 13(3):145-149.

Books:

Heger JW, Niemann JT, Criley JM. *Cardiology*, 5th ed. Philadelphia: Lippincott, Williams & Wilkins; 2003.

Chapter in a book:

Braunwald E, Perloff JK. Physical examination of the heart and circulation. In: Braunwald E, Zipes DP, Libby P (eds). *Heart disease; a textbook of*

cardiovascular medicine, 6th edn. Philadelphia: WB Saunders; 2001, pp. 45-81.

Personal communications and unpublished work should not feature in the reference list but should appear in parentheses in the text. Unpublished work accepted for publication but not yet released should be included in the reference list with the words 'in press' in parentheses beside the name of the journal concerned. References must be verified by the author(s) against the original documents.

Tables

- Provide each table on a separate page of the manuscript after the references.
- Each table should be typed on a separate sheet in double spacing.
- Number the table according to their sequence in the text. The text should include references to all tables. Each table should be assigned an Arabic numeral, e.g. (Table 3).
- Include a brief and self-explanatory title with explanations essential to the understanding of the table at the bottom of the table.
- Identify statistical measures of variations, such as standard deviation and standard error of the mean or other where appropriate.

Figures

- Provide each figure on a separate page of the manuscript after the references. Number the figures according to their sequence in the text. The text should include references to all figures.
- Graphs and figures should be in black/white or greyscale format. Colour illustrations are acceptable but not guaranteed. Minimal quality 300dpi, figures should be filed in suitable format (*.JPG, *.PNG, *.TIFF)
- If figures are not original provide source and permission.
- All figures should be 100% of a suitable final size and have the printing resolution of 300dpi and be cropped to include the figure only (no blank space).

Units of measurement

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples. All hematologic and clinical chemistry measurements should be reported in the metric system in terms of the International System of Units (SI).

Post acceptance

All correspondence concerning the copy, editing and production of accepted manuscripts should be addressed to Stomatološki vjesnik.

Charges

Authors will not be charged fees in a first year of publishing Stomatološki vjesnik. Optional charges for colour reproduction of figures may apply. Authors will be informed about this when the proof is supplied to them. The charges must be completed before the article is released.

