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CONCORDANCE BETWEEN TWO VARIOUS ANTEROPOSTERIOR CEPHALOMETRIC MEASUREMENTS

Melina Latić-Dautović[*1], Alisa Tiro[2], Vildana Džemidžić[2], Lejla Redžepagić-Vražalica[2], Enita Nakaš[2]

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ABSTRACT

Cephalometric analysis is important as diagnostic tool in orthodontic treatment planning. On the basis of these analyses we can determine dental and skeletal relationship for the patient. For this purpose numerous parameters have been proposed, such as ANB angle, Wits appraisal.

The aim of this study was to determine the degree of concordance of assessment sagittal skeletal relationship, based on ANB angle and Wits appraisal.

Material and Methods: The study was conducted on 425 lateral cephalometric radiographs of patients from the archives of the Department of Orthodontics of the Faculty of Dentistry in Sarajevo.

Results: Of the total of 425 respondents 142 had I class according to the ANB angle and 71 to Wits appraisal; 146 had class II according to ANB angle and 168 to Wits appraisal. Of the total of 425 respondents 137 had class III according to ANB angle and 186 to Wits appraisal.

Conclusion: These parameters, ANB angle and Wits appraisal should not be used alone, but only the combination of these two parameters will provide more reliable assessment of sagittal skeletal relationships.

Key words: Cephalometrics, Orthodontics, Wits appraisal, Stainer.

Introduction

Cephalometric analysis is important as diagnostic tool in orthodontic treatment planning. Based on these analyses we can determine dental and skeletal relationship for the patient.

Cephalograms can be used to assess dentofacial proportions and to clarify the anatomical basis of malocclusion. [1]

Objectives of cephalometric analysis are to assess relationship of functional components of the face (skull and base of the skull, skeletal maxilla, skeletal mandible, maxillary dentition and alveolar process and mandibular dentition and alveolar process) in all reference planes.

Stainer analysis is one of the most commonly used cephalometric analysis. The base line is the nasion-sella. The analysis can be divided into skeletal and dentoalveolar segment. [2]

SNA angle determines the anteroposterior position of the point A to the cranial base and the location of the upper jaw to cranial base. [3]

SNB angle determines the anteroposterior position of the mandible the point B to the cranial base.

ANB determines skeletal sagittal relationship between the upper and lower jaw.

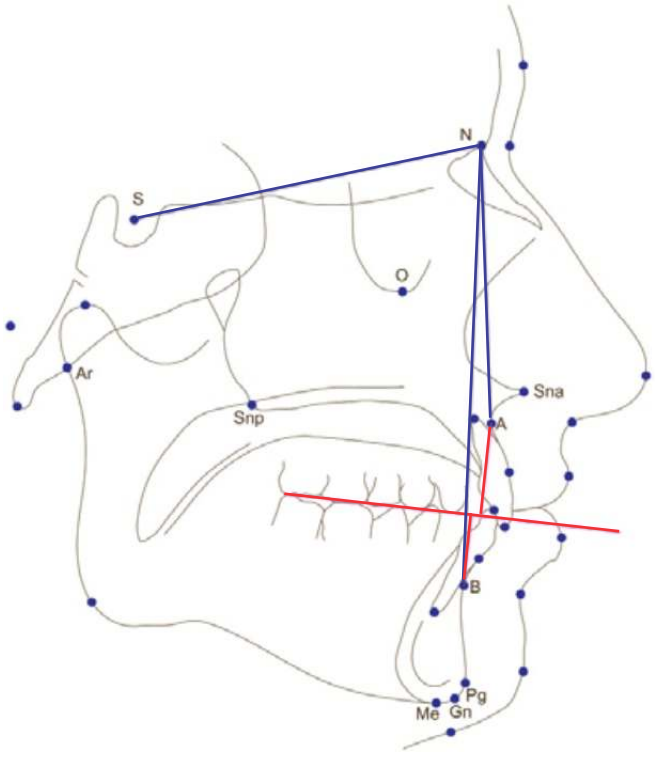

Figure 1.
Drawing of analysis Steiner (blue line) and Wits (red line) 8

A. Jacobson in 1975 and 1976 proposed a new diagnostic procedure called "Wits Appraisal" (Wits assessment). [4, 5] Wits appraisal is a linear assessment of the sagittal relationship, constructed by dropping perpendiculars from point A and point B on occlusal plane, and the distance between the resulting points representing Wits appraisal.

The aim of the research was to determine the degree of concordance of estimated skeletal relationship based on ANB angle and Wits appraisal.

Material and Methods

The sample consisted of 425 lateral cephalometric radiographs of patients from the archives of the Department of Orthodontics of the Faculty of Dentistry with clinics in Sarajevo who have previously signed a consent for using their images for research purposes.

Recordings are made in standardized terms of camera KODAK 8000C Digital Panoramic and Cephalometric System.

For this study we used lateral cephalogram of healthy children and technically good quality.

We excluded subjects with systemic diseases, physical and mental retardation, developmental abnormalities of the teeth and also lateral cephalogram that did not meet the technical quality.

For analysis and drawing we used Corel DRAW X6 as follow:

Stainer analysis:

The point S is position in the center of the bone crypt sella turcica.

Then we marked point at the intersection of N nazofrontal and internasally suture in mediosagital level.

We marked the point A in mediosagital level at the point where the lower edge of spine nazalis anterior passes into the front wall of the maxillary alveolar process.

Then we marked point B being located in the deepest part of the alveolar process of the lower jaw between points of infradental and pogonion in mediosagital level.

ANB is calculated as the difference between angle SNA and SNB angle.

Based on the obtained values of ANB angle respondents were divided into three categories:

1) subjects in class I skeletal (2°- 4°)
2) subjects in class II skeletal (> 4°)
3) subjects in class III skeletal (< 2°)

Wits appraisal

We marked the point A in mediosagital level at the point where the lower edge of spina nazalis anterior passes into the front wall of the maxillary alveolar process.

The, we the marked point B is located in the deepest part of the alveolar process of the lower jaw between points of infradental and pogonion in mediosagitalnoj level.

We draw the occlusal plane of contact between the most distal teeth to half switching incisors. Then, we draw a line from point A to occlusal plane to be per-pendicular to the occlusal plane. We draw a line from point B to the occlusal plane to be perpendicular to the occlusal plane.

We measured the distance between the projection of point A on the occlusal plane (AO) and projections of point B on the occlusal plane (BO).

Based on the obtained values of the distance AO-BO, the patients were classified into three categories:

1st participants in the class I skeletal (-1mm male, 0 mm female)

2nd respondents in class II skeletal (> -1mm male, > 0 mm female)

3rd respondents in class III skeletal (< -1mm male, < 0 mm female)

Results

Class	Frequency	Percent (%)
I	142	33,4
II	146	34,4
III	137	32,2
Total	425	100,0

Table 1. The proportions of subjects to different classes based on ANB angle

Of the total of 425 respondents 142 had I class according to the ANB angle, 146 had class II according to ANB angle and 137 had class III according to ANB angle.

Class	Frequency	Percent (%)
I	71	16,7
II	168	39,5
III	186	43,8
Total	425	100,0

Table 2. The proportions of subjects to different classes based on WITS appraisal

Of the total of 425 respondents 71 had I class according to Wits appraisal, 168 had class II according to Wits appraisal and 186 had class III according to Wits appraisal.

	ANB I	ANB II	ANB III	TOTAL	(%)
WITS I	58	11	2	71	81,69
WITS II	47	115	6	168	68,45
WITS III	37	20	128	186	69,35
TOTAL	142	146	137	425	
(%)	40,85	78,77	94,16		

Table 3. Concordance of estimated skeletal relationship based on ANB angle and Wits appraisal

Of the 71 respondents who had I class according to Wits appraisal 58 of them had I class according to the ANB angle, that is 81, 69%.

Of the 168 respondents who had II class according to Wits appraisal 115 of them had II class according to the ANB angle that is 68, 45%.

Of the 186 respondents who had III class according to Wits appraisal 129 of them had III class according to the ANB angle that is 69, 35%.

Discussion

Determination of intermaxillary relations plays an important role, not only because of participation in the diagnosis, but also to determine the goal of the

treatment, especially in terms of achieving such values of ANB angle, which would be acceptable both in terms of the stability of the results of treatment, and the aspect of facial esthetics of the case. [6,7]

ANB determines skeletal sagittal relationship between the upper and lower jaw. This angle is referred to as positive when the point A is in front of the NB line. Amounts to 0 when the lines NA and NB match, the angle is negative when the point A is behind NB lines. The distal skeletal jaw relationship indicates the class II and class III, mesial. The average value of the angle of the Steiner analysis is 2 ° (± 2 °). [3]

One of the shortcomings of this analysis is that if nasion point is misinterpreted all other parameters are not liable. In other to overcome this, it was found that perhaps ANB should not be interpreted directly, but this angle should be considered as depending on the position of nasion, the length of the front part of the skull base, the size of the SNA angle from the vertical position of nasion to points A and B, and the face rotation type. [3]

Due to the limitations of ANB angle in assessment of sagittal intermaxillary relationship, A. Jacobson (1975) proposed a new diagnostic procedure called "Wits Appraisal" (Wits assessment). [4, 5] Wits appraisal provides reliable indication of anteroposterior skeletal disharmony of the jaws. Measurements based on cranial base do not necessarily provide a reliable expression of the anteroposterior jaw relationships in dentofacial complex. [9]

Therefore, the aim of this research was to determine the degree of concordance of estimated skeletal relationship based on ANB angle and Wits appraisal. The results showed that there is different concordance among three skeletal class, estimated with ANB angle and Wits appraisal (**Table 3**.). Similar studies conducted by Wellens H. (2009.) and Shrikant S. (2011.), where they found a different association between mentioned parameters for assessment of sagital skeletal relationship. [10, 11] Assessment of the sagital skeletal relationship based on these two parameters do not match in all cases raising the question which of these two parameters is correct?

Even though these parameters have been in used as cephalometric parameters, they have their own drawbacks, and orthodontist should be cautions when applying these parameters.

Conclusion

Therefore we can conclude that ANB angle and Wits appraisal should not be used alone, but only the combination of these two parameters will provide more reliable assessment of sagital skeletal relationships.

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CORROSION OF ORTHODONTIC BIOMATERIALS - EFFECT OF pH, FLUORIDE AND ACID CONCENTRATION FROM REMINERALIZATION AGENTS ON ELASTIC PROPERTIES OF ORTHODONTIC NICKEL-TITANIUM ARCH WIRES

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ABSTRACT

Aim: To explore the effect of enamel remineralization agents with various concentration of fluorides on the corrosion of orthodontic nickel-titanium arch wires (NiTi).

Materials and methods: Three types of NiTi with dimension of 0.508×0.508 mm were tested: uncoated (NiTi), rhodium-coated (RhNiTi) and with nitrified surface (NNiTi). Ten samples from each type of wire were immersed for 1 hour at 37° into fluoride agents - Mirafluor-k-gel, Elmex, MI Paste Plus and distilled deionized water with no fluorides (dH2O). Acidity in tested solutions and hydrofluoric acid concentrations was assessed. Three-point bend test was used to assess flexibility and resilience in load and unload.

Results: Exposure of NNiTi to fluorides and dH2O induces significant decrease of flexibility in load in comparison to as-received condition ($p<0.001$), but not in unload. Resilience decreases in MiPaste and Mirafluor in load ($p=0.004$), but not in unload. In RhNiTi MiPaste, Mirafluor and dH2O increase flexibility in load in comparison to as-received condition ($p=0.006$), and Mirafluor and dH2O in unload ($p=0.001$). Flexibility of NNiTi does not change due to exposure to fluorides nor dH2O. No correlation between elastic properties and pH or hydrofluoric acid was present. Weak positive linear correlation between fluoride concentration and flexibility and resilience was found only in uncoated NiTi in load ($r=0.341$ and 0.312; $p\leq0.05$).

Conclusion: Commercial fluoride agents with various fluoride concentration do not significantly decrease unloading elastic properties of orthodontic arch wires therefore they will not affect tooth movement, regardless of wire's surface coating. Predictive value of pH, fluoride and hydrofluoric acid concentration is poor.

Key words: corrosion, nickel-titanium alloy, orthodontic wires.

Introduction

Oral cavity is a dynamic environment where electrochemical processes, including electro corrosion, take place. Saliva is an electrolyte, and the dental metal biomaterials are electrodes where ion exchange is performed [1]. Electro corrosion processes in mouth are influenced by physiology and biochemistry of saliva, food, bacterial fermentation products and oral hygiene products.

Electrochemical corrosion in the oral cavity includes oxidation processes of metal, release of electrons and reduction of hydrogen or oxygen by the gain of electrons. Secondary reactions may result in poorly adhering corrosive products propagating further corrosion, or poorly soluble chemical compounds slowing down further corrosion. In dentistry, biomaterials containing titanium (Ti) and nickel (Ni) for prosthetic and implant prosthetic restorations, endodontic instruments and orthodontic wires and springs are often used. In alloys used for elastic orthodontic wires and endodontic instruments, Ni and Ti are represented in roughly equal proportions. Under the influence of corrosion processes nickel ions (Ni^{2+}) are released easier and in greater amount than titanium ions (Ti^{4+}) [2]. The protective passive film on the surface of the material consists mainly of TiO_2 with a small amount of NiO, thus creating a chemical and physical barrier for external influences [3].

There are several forms of corrosion that can occur in dental and orthodontic alloys: general, pitting, pointed or needlelike and galvanic corrosion [4]. General corrosion is the most common type affecting all metals, and it occurs throughout the metal surface. Pitting corrosion penetrates deep into the metal, it is extremely destructive, and only one pit can lead to material fracture. Metals Fe, Ni, Al, Mg, Cu, Zn and their alloys are subject to that type of corrosion. Although materials with high corrosion resistance are used in orthodontics, they can be subject to intense corrosion, usually as localized corrosion damage, under certain environmental conditions. As earlier researches have shown, pitting corrosion on the NiTi surface is mostly manifested in the weak spots of the surface [5, 6].

Low pH values, found in dental plaque, and fluoride ions released from antiseptics or enamel remineralization agents may propagate corrosion [7-9]. Fluorides in acidified solution induce the formation of a hydrofluoric acid which interacts with titanium oxides on the surface of NiTi alloy creating Ti-F complexes and titanium oxyfluoride, thereby reducing the protective titanium oxide layer [10]. Corrosion could be manifested in changes of the elastic properties of NiTi alloys.

The aim of this study was to explore the effect of fluoride agents with various concentration of fluorides on the corrosion of orthodontic NiTi wires with various coatings in terms of changes of elastic properties. It was hypothesized that corrosion is seen as deterioration of flexibility and resilience, more in unloading than loading. Elasticity will probably be more influenced by hydrofluoric acid concentration than pH or fluoride concentration in enamel remineralization agents. Coating of the arch wire will probably influence corrosion with nitrification improving resistance while rhodium coating causing susceptibility to corrosion.

Materials and methods

Three types of nickel-titanium orthodontic arc wires (Ni=50.4%; Ti=49.6%) with dimension of 0.508×0.508 mm were tested: uncoated (NiTi), rhodium-coated (RhNiTi) and with nitrified surface (NNiTi) (Bioforce Sentalloy, Dentsply GAC Int, Bohemia, USA).

Experimental solutions included Mirafluor-k-gel (Hager&Werken, Duisburg, Germany) – 6150 ppm of fluorides (NaF), Elmex (Gaba, Loerrach, Germany) – 12500 ppm of fluorides (NaF and amine fluoride), MI Paste Plus (GC, Tokyo, Japan) – 900 ppm of fluorides (NaF) with casein phosphopeptide-amorphous calcium phosphate, and distilled deionized water with no fluorides (dH_2O). Measurement of pH in tested solutions was conducted at temperature 37°C by using pH-meter MP 220 (Mettler Toledo Int., Greifensee, Switzerland). For the calculation of hydrofluoric acid (HF) concentrations in solutions the following formula was used: $[HF]=[F^-]/10^{pH-pKa}$, where $[F^-]$ is the fluoride concentration and pKa is the constant of dissociation of hydrofluoric acid 3.17 [11].

Ten samples (25 mm long) were taken from each type of wire and immersed for 1 hour at 37° in order to simulate total exposure to fluoride agents in

duration of 5 min per week during 12 week period. After that they were rinsed with dH_2O.

For testing the elastic properties three-point bend test on a universal machine (Instron 1125/5500, Instron, Norwood, USA) were done. The supporting span of Texture Analyzer TA.HD.plus (Stable Micro Systems, Godalming, UK) was set to 12 mm and loaded with a low force (5 kg, factory calibrated). During the measurement, the temperature in the thermal chamber was set at 37° C. Each sample was deflected to 3.1 mm and then unloaded to 0 mm at a crosshead speed of 0.0167 mm/s. Force (N) and deflection (mm) were recorded every 5 ms for each sample in both loading and unloading, using Texture Exponent software (Stable Micro System, Godalming, UK). Force-deflection curves were generated. From data on elastic modulus (E) and yield strength (YS) in load and unload springback ratio as a measure of flexibility (YS/E) and modulus of resilience as a measure of resilience (YS2/2E) were calculated. Decrease of both values indicated a deterioration of elastic properties. As-received was used as an absolute control, while exposed to dH_2O as a negative control.

Differences in elastic properties between exposed and unexposed arch wires was tested by using analysis of variance (ANOVA) with Student-Newman-Keuls post hoc. Pearson correlation was used to explore relationship between elastic properties and concentration of fluorides, hydrofluoric acid and pH of solution. Commercial software IBM SPSS 22 (IBM Corp, Armonk, USA) was used.

Results

Data on concentration of pH, fluorides and hydrofluoric acid is presented in **Table 1**.

Media	pH	F (ppm)	HF (ppm)
MI Paste Plus	6.6	900	0.33
Mirafluor	5.1	6150	72.26
Elmex	5.5	12500	58.47
dH_2O	6.1	0	0.00

Table 1.
Data on concentration of pH, fluorides and hydrofluoric acid

Wire	Variable		pH	F	HF
NiTi	springback ratio load	r	-0.178	0.342*	0.198
		p	0.271	0.031	0.222
	springback ratio unload	r	-0.067	0.266	0.047
		p	0.682	0.097	0.773
	modulus resilience load	r	-0.125	0.312*	0.102
		p	0.444	0.050	0.533
	modulus resilience unload	r	-0.055	0.286	0.023
		p	0.737	0.073	0.889
RhNiTi	springback ratio load	r	-0.020	-0.152	-0.005
		p	0.900	0.350	0.974
	springback ratio unload	r	-0.007	-0.216	-0.114
		p	0.963	0.180	0.483
	modulus resilience load	r	-0.171	-0.031	0.081
		p	0.290	0.847	0.619
	modulus resilience unload	r	-0.074	-0.171	-0.074
		p	0.651	0.291	0.652
NNiTi	springback ratio load	r	-0.021	0.161	0.017
		p	0.897	0.322	0.918
	springback ratio unload	r	-0.063	0.278	0.072
		p	0.698	0.083	0.658
	modulus resilience load	r	-0.029	0.273	0.022
		p	0.860	0.089	0.893
	modulus resilience unload	r	-0.046	0.297	0.060
		p	0.776	0.063	0.715

Table 2. Pearson correlations between elastic properties, pH and concentration of fluorides and hydrofluoric acid

Exposure of uncoated NiTi to fluorides and dH_2O induces significant decrease of flexibility in load in comparison to as-received condition ($p<0.001$), but not in unload (**Figure 1**). Resilience decreases in MiPaste and Mirafluor in load ($p=0.004$), but not in unload. MiPaste and Mirafluor have decreased flexibility and resilience in unload in comparison to Elmex ($p \leqslant 0.012$), but not to unexposed wire nor dH_2O.

In rhodium coated NiTi MiPaste, Mirafluor and dH_2O increase flexibility in load in comparison to as-received condition ($p=0.006$), and Mirafluor and dH2O in unload ($p=0.001$). Resilience increases only dH_2O in unload ($p=0.008$), but not in load.

Flexibility of nitrified NiTi does not change due to exposure to fluorides nor dH2O. Elmex induced higher resilience than Mirafluor and MiPaste in load ($p=0.015$), and Mirafluor in unload ($p=0.022$). Resilience does not change in comparison to unexposed wires.

When analyzing only arch wires exposed to fluoride agents and dH_2O no correlation between elastic properties and pH or hydrofluoric acid was

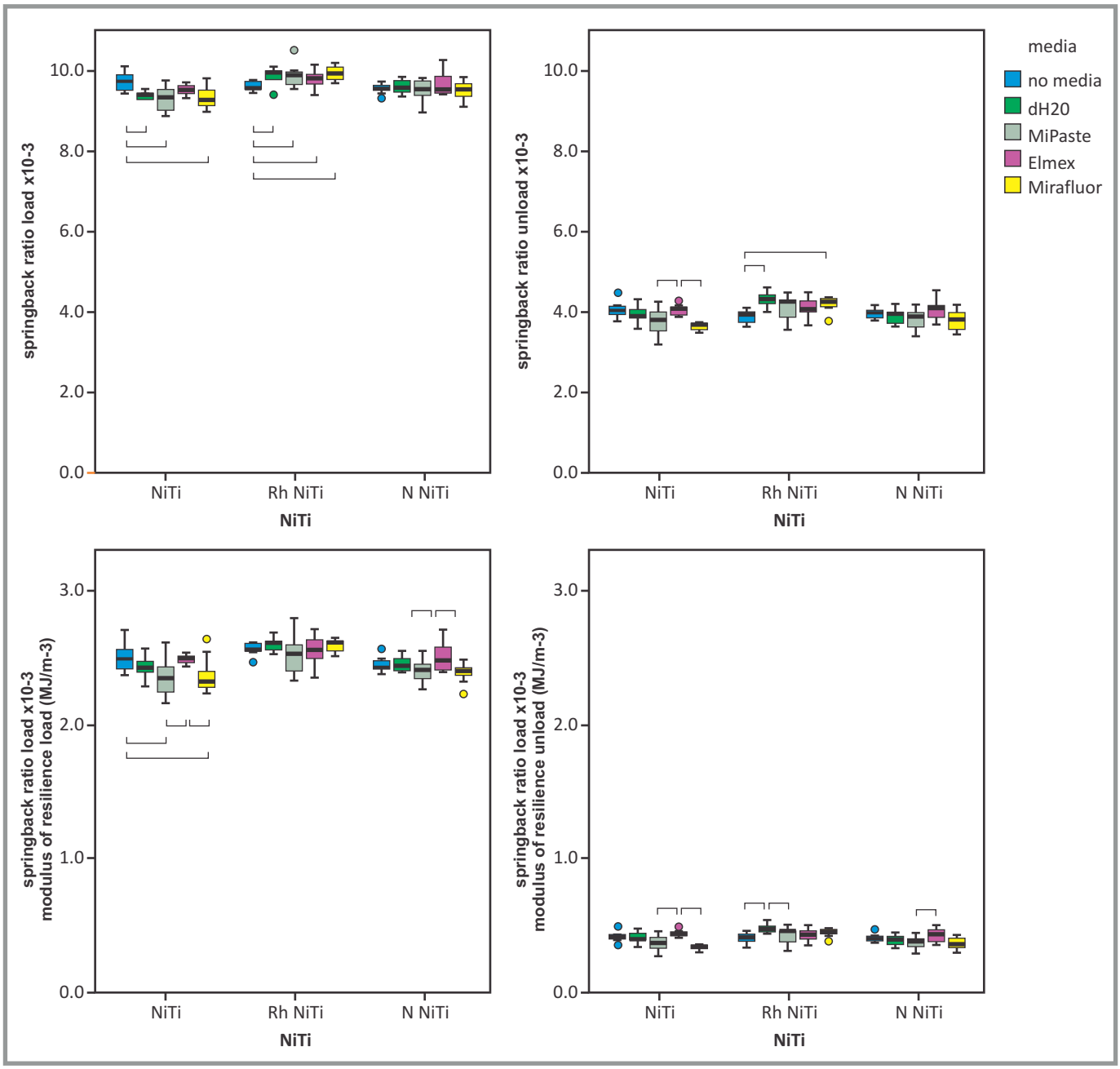

Figure 1. Influence of fluorides on elastic properties of NiTi archwires

present (**Table 2**). Correlation with concentration of fluorides was not present in NNiTi nor RhNiTi. A weak positive linear correlation between fluoride concentration and flexibility and resilience was found only in uncoated NiTi in load (r=0.341 and 0.312; p<0.05).

Discussion

Present study demonstrates that enamel remineralization agents induce corrosion of orthodontic biomaterials to some extent. It is seen in changes in elastic properties of some orthodontic NiTi arch wires.

It was hypothesized that corrosion would be seen as deterioration of flexibility and resilience of NiTi arch wires, more in unloading than loading. However that was not the case. In fact, in uncoated NiTi alloy agents with lower fluoride content (MiPaste and Mirafluor), decrease of elastic properties occurs only in loading but not in unloading phase. And unloading phase is the one used to move teeth during

orthodontic treatment. So it will not affect orthodontic biomechanics, duration of treatment nor provoke high forces and damage of periodontal ligament, cementum or alveolar bone. Opposite is reported previously, but it depends on the type of NiTi arch wire [12,13].

Our hypothesis that coating of the arch wire will probably influence corrosion with nitrification improving resistance while rhodium coating causing susceptibility to corrosion was only partially confirmed. So, fluorides have the lowest influence on NNiTi, lower than uncoated alloy. Agents with higher fluoride content even have tendency to improve elasticity of RhNiTi arch wires.

To reduce corrosion and improve esthetics, the surface of biomaterials is coated with various coatings. Nitrification is one of the most important methods of thermochemical treatment of the surface. It is based on nitrogen implantation on the surface layer forming a TiN coating increases the hardness and resistance to both wear and corrosion [14].

Research indicates that nitrification of surface slows down corrosion of NiTi alloys in saliva or makes the alloy more resistant to general corrosion, but does not make it more resistant to localized corrosion [15, 16]. Rhodium coating increases the tendency towards general and localized corrosion [15]. By applying a thin layer of rhodium on wire better esthetics is achieved, but obviously not higher corrosion resistance. The cause of increased corrosion is the occurrence of galvanic couple between noble coating and non-noble NiTi base due to coating breakdown, whereby the coating becomes a cathode and the base alloy anode. The corrosion process is carried out locally, in areas where the coating is porous [17]. However, the coating does not behave equally in all environmental conditions, it modifies the influence of oral agents on NiTi alloy [18]. It was found that commercially available coatings are not homogeneous, therefore do not bring a significant improvement of corrosion properties compared to uncoated wires [19].

It was expected that elasticity will be more influenced by hydrofluoric acid concentration than pH or fluoride concentration in enamel remineralization agents. However, predictive value of pH, fluoride and hydrofluoric acid concentration is poor, particularly with unloading elastic properties regardless of the wire's surface coating. In fact, no correlation between elastic properties and pH or hydrofluoric acid concentration was detected. Fluorides weakly correlated only in loading and only in uncoated NiTi. Still, our previous research demonstrates that concentration of hydrofluoric acid from enamel remineralization agents predict release of nickel and titanium ions from NiTi alloys more than pH or concentration of fluorides solely [11].

Corrosion of orthodontic biomaterials has numerous implications, beside their impact on working properties of arch wires which can directly alter orthodontic biomechanics. Continuous release of low doses of nickel ions from orthodontic appliances can initiate gingival hyperplasia by increasing proliferation of epithelial cells [20]. It can also induce IV hypersensitivity reactions, i.e. cell-mediated delayed hypersensitivity [21]. The prevalence of nickel allergy is the most common metal allergy affecting up to 30% of the population, being three times more common in women [22]. Oral clinical signs and symptoms of nickel allergy may include burning mouth sensation, gingival hyperplasia, lichenoid reaction, labial desquamation, angular chelitis, erythema multiforme, periodontitis, stomatitis with mild to severe erythema, papular perioral rash, loss of taste or metal taste, tenderness, ulceration on the tongue, and less often edema of the lips [23]. It was found that the most important risk factors for nickel allergy is number of piercings and time exposed to the jewelry. Orthodontic treatment before wearing earrings reduces the risk for nickel allergy [24].

Adhesive consistency of prophylactic agents allows a prolonged contact with teeth as well as orthodontic appliances, which can cause changes in working properties and corrosion resistance of appliances. Present study demonstrated that commercially available caries preventive agents affect the change in working performance of nickel-titanium wires to a lower extent, depending on the composition of their surface. Generally, they do not reduce the elasticity of the wire during unloading, which is the working phase in which the teeth are moved. Therefore, it is unlikely that it will disrupt the course and duration of orthodontic treatment. The problem of surface corrosion induced by fluorides and low pH appears not to be clinically significant, as long as no more than a 1500 ppm fluoride concentration agents are used [25]. Clinically, the use of fluoride varnishes at specific, caries-risk sites may

provide protection while minimizing the potential risk of adverse effects [26].

Conclusion

Commercial fluoride agents with various fluoride concentration do not significantly decrease elastic properties of orthodontic arch wires in unloading that moves teeth, regardless of wire's surface coating.

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Declaration of interest

No conflict of interest.

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MODIFICATIONS OF THE CONVENTIONAL METHOD FOR THE DETECTION OF MUTANS STREPTOCOCCUS

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ABSTRACT

Objectives: Modifications of the conventional method of Dentocult Strip Mutans (DSM) for determining the mutans streptococcus (MS) level from saliva in the method of determining MS from the dental biofilm and testing the correlation level between these two methods. Testing the ability of postponed cultivation of MS colonies of dental biofilm with the use of saliva in the case of transport medium and evaluation of its efficiency in comparison to the conventional DSM method.

Methods: In order to make study of DSM method modification as a module for detection and enumeration of MS, we used the target sample of 100 children aging from 13 to 18 years. According to the manner of MS cultivation, three groups have been created: a modified method of immediate cultivation, a modified method of postponed cultivation and the control group – standard method (salivary MS determined by standardized method using a commercial DSM test).

Results: Three methods for detection of MS (the standard method, the method of modified immediate cultivation and modified method of postponed cultivation), do not provide significantly different results (the Friedman test 3.06, $p>0.05$). On the basis of existence of high significance ($p<0.001$) and correlation coefficient larger than 0.6 in all three tested groups of couples, the existence of high connection between aforementioned methods can be determined.

Conclusions: A modified method of immediate and postponed cultivation for detection and enumeration of MS do not completely provide the same results as the conventional DSM method. However, the compatibility level in measuring the MS levels using these three methods is sufficiently high in order to enable the use of modified methods in cases when it is not possible to apply the DSM test in the standard manner.

Key words: mutans streptococcus detection, chair side method modifications.

Introduction

Mutans streptococci (cariogenic species *S. mutans* and *S. Sobrinus),* are associated with early demineralization, that is, with initial phases of cavity occurrence [1]. They have a high cariogenic potential due to the following characteristics: acidogenity, acidurity, the ability to create extracellular and intracellular polysaccharides, the ability of sugar transport and the ability of adhesion to dental area [2].

The infection with mutans streptococci (MS) has global distribution – they are present from 33-75% of preschool children, 80-90% of adolescents and they can be found at almost all adults [3]. A quick and reliable procedure for identification of Mutans streptococci is important for epidemiological research, as well as for daily use in the clinical practice [4]. It is significantly important to determine the level of Mutans streptococci in case of small children, since studies have shown that most children that have been colonized with Mutans streptococci in their early years will develop carious lesions in the future [5] and that it can be used as an indicator for carious lesions on milk teeth [6,7,8,9].

Laboratory microbiological methods with the use of selective backgrounds have been used for detection and enumeration of MS, but they are expensive, impractical and time-consuming. At the end of the eighties, commercial tests started to be used for detection and enumeration of MS whereby the detection process of carious microorganisms was simplified and can be performed in conditions of dental offices [10].

Dentocult-SM® Strip Mutans (*Orion Diagnostica, Espoo, Finland*) is the ''chair side'' test measuring the MS level in stimulated saliva, based on research that indicated that the quantity of MS in the saliva is reflecting the number of dental areas that have been colonized with the same microorganism [11]. Numerous studies confirmed that Dentocult Strip Mutans (DSM) method of determining MS from the saliva is efficient in comparison to conventional laboratory methods of determining the MS level [10, 12, 13, 14].

The survival period of mutans streptococcus from the saliva is a couple of days, whereas the majority of these microorganisms, if found in external conditions without a transport medium or culture for cultivation, at a room temperature, dies within the first seven hours [15]. During in vitro conditions, it is confirmed that dental bacteria can grow in the saliva to a certain degree [16] or at the agar made of saliva [17], whereby the growth of MS in the saliva is directly connected to glucose concentration in the saliva, serving as a primary source of energy for the cell growth [18, 19].

Regardless to advantages of commercial tests for MS detection and enumeration, it is not used in dental offices as a standard.

Study goals were to test the successfulness of modification of a conventional DSM method for determining the MS level from the saliva in the method of determining MS from the dental biofilm and to test the ability of postponed cultivation of MS colonies from the dental biofilm, with the use of saliva as a transport medium.

Material and methods

The sample included 100 children from 13-18 years of age, regular patients of the Clinic for preventive and child dentistry at the Faculty of Dentistry in Sarajevo, whose parents provided a written consent for participation in the study.

Patients who used antibiotics within 14 days from the sampling moment, as well as patients who used antibacterial mouthwash within 12 hours from the moment of taking sample did not participate in this study.

The sampling of stimulated saliva for the standard DSM method, served as a control group, was performed according to manufacturer's instruction. Immediately after, sampling for determination of MS from biofilm was performed by using a sterile cotton swab, moistened with physiological liquid, through occlusal and vestibular surface of all teeth. Afterwards, the strip with biofilm sample was placed 10 times with rotating moves through a DSM strip with culture that was cultivated immediately (immediate cultivation, modified method).

The same strip used for taking samples for immediate cultivation was used in the same manner for sampling biofilm from teeth and the strip was placed in a sterile tube where a 2 ml of stimulated saliva, taken when sampling for a standard DSM method, was

added. Such sample was stored for 48 hours at a temperature of 20 degrees Celsius, and afterwards, it was cultivated to a standard DSM strip with culture, in the manner as performed during the immediate cultivation procedure. Thereby, the sample for a modified method of postponed cultivation was provided.

Results for all groups were presented in the same manner, where the number of adhered colonies of MS was compared with the manufacturer's chart. The score 0 presents very low MS values, score 1 presents low MS values, score 2 presents high values and score 3 presents very high MS values.

Data were processed with the following statistic tests and methods: a descriptive statistics (distribution of frequencies, medium values, and contingency tables), correlation, and the Friedman test. A statistic program SPSS 15.0 (SPSS, Inc, Chicago, Il) and MedCalc® Statistical Software, version 9 were used for statistical data processing.

Results

The total of 100 participants were examined and two participants did not meet the inclusion criteria. Out of total 98 participants of both genders, MS cultivation using a modified method of immediate cultivation (n=97) was not successful for one examinee, and a modified method of postponed cultivation (n=95) was not successful for three examinees. The standard method was successful for all 98 examinees (n=98). For all three methods, the median is 2 (high MS values). For the standard method and postponed cultivation method, mod is 2 (high MS values), whereas for the immediate cultivation method, mod is 1 (low MS values).

The comparison of these 3 methods for Streptococcus mutans detection was performed by using the Friedman test, which showed that three methods for Streptococcus mutans detection do not provide significantly different results (p>0.05).

The correlation test between these three methods indicated that there is high correlation between the standard method and the immediate cultivation (Spearman's correlation coefficient 0.69, p<0,001), there is high correlation between the standard method and postponed cultivation (Spearman's correlation coefficient 0.61, p<0,001) and there is a high correlation between the immediate and postponed cultivation (Spearman's correlation coefficient 0.65, p<0,001),

(Table 1.)

Both methods (a standard and modified method of immediate cultivation) showed the same level of MS in 58.54% cases. A higher match between these methods is present when detecting high and very high MS values (18.6% identical measurements in case of high and 16.5% in case of very high MS values).

(Table 2.)

Both methods showed the same level of Streptococcus mutans in 59.9% cases. A higher match between these methods is present when detecting high and very high MS values (36.8% identical measurements in case of high and 60% in case of very high MS values), in relation to measurement of low

		Immediate Cultivation				Total
		0	1	2	3	
Standard Method	0	13 (**13.41%**)	9 (**9.3%**)	0 (0%)	0 (0%)	22 (22.7%)
	1	4 (4.1%)	10 (**10.3%**)	5 (5.2%)	5 (5.2%)	24 (24.7%)
	2	4 (4.1%)	8 (**8.2%**)	18 (**18.6%**)	5 (5.2%)	35 (31.6%)
	3	0 (0%)	0 (**0%**)	0 (0%)	16 (**16.5%**)	16 (16.5%)
Total		21 (21.6%)	27 (**27.8%**)	23 (23.7%)	26 (26.8%)	97 (100.0%)

Table 1. Contingency table for the standard method and immediate cultivation

		Postponded Cultivation				Total
		0	1	2	3	
Standard Method	0	14 (**14.7%**)	2 (2.1%)	6 (6.3%)	0 (0%)	22 (23.2%)
	1	3 (3.2%)	8 (**8.4%**)	10 (10.5%)	3 (3.2%)	24 (25.3%)
	2	4 (4.2%)	2 (2.1%)	25 (**26.3%**)	3 (3.2%)	34 (35.8%)
	3	0 (0%)	0 (0%)	5 (5.3%)	10 (**10.5%**)	15 (15.8%)
Total		21 (22.1%)	12 (12.6%)	46 (48.4%)	16 (16.8%)	95 (100.0%)

Table 2. Contingency table for the standard method and postponed cultivation

		Postponded Cultivation				Total
		0	1	2	3	
Immediate Cultivation	0	12 (**12.6%**)	1 (1.1%)	8 (8.4%)	0 (0%)	21 (22.1%)
	1	7 (7.4%)	8 (**8.4%**)	11 (11.6%)	0 (0%)	26 (27.4%)
	2	2 (2.1%)	2 (2.1%)	17 (**17.9%**)	2 (2.1%)	23 (24.2%)
	3	0 (0%)	1 (1.1%)	10 (10.5%)	14 (**14.7%**)	25 (26.3%)
Total		21 (22.1%)	12 (12.6%)	46 (48.4%)	16 (16.8%)	95 (100.0%)

Table 3. Contingency table for immediate and postponed cultivation

and very low values (23.1% identical measurements).

(Table 3.)

Both methods showed the same level of MS in 53.6% cases. A higher match between these methods is present when detecting high and very high MS values (32.6% identical measurements in case of high and 53.6% in case of very high MS values), in relation to measurement of low and very low values (21% identical measurements).

Discussion

The need for detecting and enumerating MS with patients, and especially children is unquestionable. Since the efficiency of the DSM test for determining the level of salivary MS was proved through a series of studies [10, 13, 14, 20], this method was taken as a reference in our research and two modified manners of detecting MS were confirmed with this method. In daily work with the patients, in cases of higher need for a timely detection of these cariogenic microorganisms – with small children, taking of saliva samples in order to detect MS is severely difficult and in many cases, impossible. Working with children demands the use of quick, simple and efficient methods and thus, this was the guiding idea behind this study – to modify or simplify the taking of biological sample for the existing method in order to obtain reliable results. Therefore, instead of taking MS sample from the saliva, MS sample was taken from biofilm – a modified method of immediate cultivation. The second part in modification of the standard method refers to storing of a biological material (dental biofilm) for 48 hours from cultivation for a

commercial test. Thereby, the possibility for a dentist to take the biofilm sample from the patient would be provided and cultivation could be performed 48 hours after the following sampling.

Results of this study show encouraging results. The Friedman test for comparison of more than two depending samples, using the method of a mutual rank, indicated that three methods (the standard method and modified methods of immediate and postponed cultivation) for MS detection do not provide significantly different results.

Contingency tables analyzing different methods for MS detection indicate the number of cases where we obtain the same results using different manners of MS detection. In general, a greater number of matching measurements are present when detecting high values of MS, being significant for a practical work within dental offices.

In our study, the control group (determination through Dentocult SM test) included detection of MS from the saliva. However, for a modified method of immediate cultivation, dental biofilm from occlusal and vestibular/oral teeth surfaces was used as a biological sample. We did not determine the existence of significant differences in the number of MS determined by three different manners, regardless of the used biological sample (stimulated saliva or dental biofilm). This is in accordance with study of Dasanyake and authors [21] who compared the MS level from unstimulated saliva and plaque, from stimulated saliva and plaque, and from stimulated and unstimulated saliva, where the plaque was taken from approximal tooth surfaces. Results indicated that there were no significant differences in detection of MS between stimulated saliva and plaque, where the peculiarity of the plaque method is somewhat higher than in the saliva samples. The same authors gave recommendations that sampling from the plaque or biofilm ("the swab technique" with a sterile stick in the manner as performed in our study), is performed in cases when trying to perform a qualitative estimate of MS, and in cases of quantitative analyses from the saliva [21]. Motisuki and authors compared the MS level from plaque collected from all present teeth surfaces with MS from the saliva and found no differences in the MS level, which is also in accordance with results of our study [22]. On the grounds of the aforementioned, it can be concluded that a modified method of immediate cultivation can be used in situation when we are unable to apply the standard method for determining the MS level (in case of uncooperative children or patients with decreased salivation). In most cases, this method will provide the same results as the standard method, especially in the case of detecting high or very high MS values.

One of the first studies indicated a relatively short survival time of MS outside dental cavity was the research done by Körler and Bratthall, proving that the survival time of MS from the saliva is only a few days [15]. Most of these microorganisms, if located in external environment without a transport medium, that is, culture for cultivation, at a room temperature, die within the first seven hours. However, certain bacteria can survive and create colonies 18 hours after spending in external conditions but in a far lower number than the bacteria growing on an agar plate [15]. The study of Gomez and Bratthall aimed at determining the survival period following the 48-hour incubation for already created colonies on a test strip with a selective culture (a commercial test Dentocult Strip Mutans) if colonies are kept under different conditions (temperature, different transport medium and etc.). The study showed that colonies of MS can survive the longest if kept frozen in glycerol and they can survive up to one year [4]. This study indicates that if they are dried on air and kept at a room temperature, colonies of MS can survive for a couple of weeks. Longer survival of their colonies in relation to bacteria from the saliva is explained by creation of polysaccharide capsule around colonies from the media enriched with sucrose. During in vitro conditions, it was confirmed that dental bacteria in a particular degree can grow in the saliva or at agar made of saliva but this growth is limited with particular essential nutrients [16, 17].

De Jong and authors in their studies indicated that the growth of mutans streptococcus and actinomyces viscosusa in the saliva is directly related to glucose concentration in the saliva, serving as a primary source of energy for the cell growth [18, 19].

Since MS without a transport medium or culture for cultivation, under conditions of external environment, can survive for a very short period, the use of saliva as a transport medium for postponed MS cultivation was considered. Results of our study showed that the method of postponed cultivation is also providing credible results in relation to the standard

method. However, the percentage of high values of MS is higher than in the case of a standard method.

This research cannot give contribution to explanation of the bacteria survival mechanisms within the saliva as the medium and it cannot provide a credible protocol for storing biological sample that will be cultivated later on. However, study results indicate that if there is a need for transporting a biological sample from the sampling location to the cultivation location, the method of postponed cultivation can be used instead of the standard method.

Conclusion

A modified method of immediate and postponed cultivation for the detection and enumeration of mutans streptococcus do not completely provide the same results as a conventional Dentocult Strip Mutans method. However, the correlation level in measurements of MS levels using these three methods was sufficiently high in order to enable the use of modified methods, in cases when it is not possible to apply the Dentocult Strip Mutans test in standard manner.

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ORAL HEALTH AND ITS IMPACT ON THE QUALITY OF LIFE IN ADULT POPULATION IN THE SARAJEVO CANTON

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ABSTRACT

The aim of the study was to determine the extent of consequences of teeth extraction on quality of life of the adult population in the Sarajevo Canton, measured through self-assessment of dysfunctionality, inconvenience and inability to perform chewing and speech function.

Methods: The sample consisted of 300 patients over 18 years of age who attended the community dental service. The OHIP-20 questionnaire was used as an instrument of research, the purpose of which was to indicate how the respondents experienced the problem of tooth loss. Results relating to the age and number of the extracted teeth are of high concern because they show that the majority of respondents who had extracted teeth were younger and middle-aged respondents. Cross-analysis between the age of the patient and the number of extracted teeth shows that the highest percentage of teeth extracted in both male and female populations refers to the age group of 18-34 and 35-54 with 1 to 16 extracted teeth. The results do not show a statistically significant difference in the number of the extracted teeth neither in relation to the sex nor the age group (Chi-square test = 159.447 df = 12, $p > 0.05$).

Conclusion: The results of this study have shown that self-assessment of dysfunctionality, discomfort and inability to perform chewing and speech function as a result of tooth extraction have no impact on the quality of life of the adult population in the Sarajevo Canton.

Key words: Oral health-related quality of life, OHIP-20.

Introduction

Improvement of oral health, and thus, improvement of the quality of life, is the main goal of modern dental care. Oral health is considered to be an important part of the patient's general health. In 1946, the World Health Organization (WHO) defined health as a state of complete physical, mental and social well-being, and not just as the absence of disease and impotence [1].

The psychological and social impact of illness on the quality of everyday life is evident. Any illness, which can affect activities of daily life, can have an adverse effect on the general quality of life. Therefore, it can be said that the term oral health in relation to the quality of life was the result of many observations and studies of the effects of mouth and tooth diseases on different aspects of life [2].

Although the impact of general and systemic diseases on the quality of life has been explored for a long time, the modern concept of quality of life as a result of oral health (OHRQoL) has only developed in the last few decades. The term "oral health-related quality of life - OHRQoL" has no strict definition. However, there is a general consensus that this is a multidimensional concept that reflects, among other things, the sense of a person's comfort during eating, sleeping and social interaction; their self-esteem and satisfaction with oral health.

Starting from the point of view that disease and health are independent, the question of the relationship between health and quality of life arises. The quality of life related to oral health ("OHRQoL") should be defined as a personal assessment of the impact of the following factors on a patient's well-being:

a. functional factors (chewing, swallowing, speech),

b. psychological factors (personal appearance and self-esteem),

c. social factors (social interaction, communication, socializing), and

d. factors related to the experience of pain and discomfort (acute and chronic) [3].

The Oral health impact profile (OHIP) is one of the most popular questionnaires developed on the basis of OHRQoL model. In addition to using OHRQoL measures to evaluate the results of treatment, it is important to determine the extent to which tooth loss actually affects the quality of life in the first place. This data enables the development of clinical decision-making in public health and the provision of appropriate oral health care.

The Oral Health Impact Profile (OHIP), as an empirically developed questionnaire, has been verified and tested by extensive research in a large number of countries around the world. It is applied when it is necessary to quantitatively assess the effect of the condition of the oral cavity on the quality of life. It is a reliable and important instrument for the detailed measurement of the social impact of dental problems and has a potential benefit both in research and decision-making for a particular therapy [4].

The OHIP questionnaire was developed in a similar way as some other general health assessment questionnaires, such as the questionnaire by Gilson and collaborators from 1975, or the questionnaire by Hunt and collaborators from 1986 [5].

The original OHIP questionnaire consists of 49 questions, divided into seven constituent domains: function limitation, mental pain, psychophysical instability, psychic instability, psychological instability, social instability and handicap. Answers to the questions are given in the form of a Likert scale with a maximum of 4 points (never = 0, almost never = 1, sometimes = 2, quite often = 3, very often = 4). The points of all 49 questions are summarized, so the total OHIP is equal to the sum of the points / answers to each question. The total OHIP 49 and the sum of domains indicate the effect of the condition of the oral cavity on the quality of life. The greater the sum, the lower the quality of life. Gary D. Slade and A. John Spencer present, for the first time, this questionnaire with the abbreviated OHIP in their article which was published in 1994, and later, with translating it into different languages, this original version was abbreviated, for example, OHIP-E49 [5, 6, 7, 8]. In order to avoid shortcomings, as a result of the modification of the original OHIP-49 questionnaire, an OHIP-20 questionnaire was created.

The aim of the study was to determine the extent of consequences of teeth extraction on quality of life of the adult population in the Sarajevo Canton, measured through self-assessment of dysfunctionality,

inconvenience and inability to perform chewing and speech function.

Material and Methods

The participants in this study were 300 patients over 18 years of age who attended the community dental service "Omer Maslić".

The oral status of all the respondents was established by a clinical examination. The DMFT status was established for each respondent according to the instructions of WHO [9, 10]. Dental status was examined with a dental probe and a dental mirror from right to left in the upper jaw, then from left to right in the lower jaw, from one adjacent tooth to another. It was considered that a tooth was present if there was at least one surface of that tooth visible. The status of dental caries was recorded in dental records specially created for this study following the WHO criteria.

To assess the impact of oral health on the quality of life, each patient filled the OHIP questionnaire consisting of 20 questions individually.

The questions are conceptualized in groups:

3 for functional constraints,

4 for psychic pain,

2 for psychophysical instability,

4 for psychic instability,

2 for psychological instability,

3 for social instability and

2 for disposition.

These questions were ranked in the Likert scales, where each respondent was offered 5 different answers: never, almost never, sometimes, quite often and very often. These responses indicate how the respondents experienced a problem in the range of responses from 1-5, where 1 indicates patient's dissatisfaction and higher values were for more satisfied patients. In some cultural environments, the Likert scale is reversed, i.e., a smaller number indicates more satisfied patients and vice versa [3].

The influence of tooth loss on the quality of life of the respondents was evaluated by the self-assessment of dysfunctionality, unpleasantness or incompetence, which the respondents identified as the result of extraction.

Statistical methods which were used in this study were: descriptive statistics- used to calculate frequencies, percentage, and standard deviation, Chi-square test - used to tested differences between the answers to the questions in OHIP-20 and ANOVA test was used to test the differences between two categories of participants.

Results

The study is a prospective epidemiological study involving 300 patients older than 18 years who attended the community dental service "Omer Maslić" in the period from December 2012 to April 2013 and who have already undergone the extraction of one or more permanent teeth.

The sample in this study consisted of 300 respondents, including 119 men and 181 women.

By examining the influence of socioeconomic status on the number of extracted teeth of the respondents, this study showed that the highest number of respondents are employed, 136 of them (45.3%), 97 (32.3%) are unemployed, 57 (19%) are retirees. The fact that the majority of respondents in this study are employed means that they are socially integrated and in contact with others and their environment. The relationship between the socioeconomic status and the number of the extracted teeth in the study was statistically significant (the Chi-square test is 90,900, df = 16, p <0,05), since, out of 300 respondents, 163 of them are in the group with 1 to 8 missing teeth, of which 85 are employed, 65 are unemployed and 6 are retired, 58 respondents are in the group with 9 to 16 missing teeth, of which 32 are employed, 14 are unemployed and 11 are retirees, and as many as 43 interviewed respondents are in the group with 24 or more missing teeth, of which 11 are employed, 7 are unemployed and 24 are retired (**Table 1.**).

Cross-analysis between the age of patients and the number of the extracted teeth, as shown by sex (**Table 2.**), shows that the highest number of extracted teeth in both male and female populations refers to the age groups of 18-34 and 35-54 with up to 16 extracted teeth.

In the group with 1-8 extracted teeth, 39 (13%) male and 62 (20, 66%) female respondents were

Current employment	Number of extracted teeth											
	1-8 extracted teeth		9-16 extracted teeth		17-20 extracted teeth		21-24 extracted teeth		25 and more extracted teeth		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Full time	85	28,33	32	10,66	6	2,00	2	0,66	11	3,66	**136**	**45,33**
At home	5	1,66	1	0,33	0	0,00	0	0,00	1	0,33	**7**	**2,33**
Unemployed	65	21,66	14	4,66	6	2,00	5	1,66	7	2,33	**97**	**32,33**
Retired	6	2,00	11	3,66	11	3,66	5	1,66	24	8,00	**57**	**19,00**
I do not want to give an answer	2	0,66	0	0,00	0	0,00	1	0,33	0	0.00	**3**	**1,00**
Total	**163**	**54,31**	**58**	**19,31**	**23**	**7,66**	**13**	**4,31**	**43**	**14,32**	**300**	**100,00**

Table 1. Influence of socioeconomic status on the number of extracted teeth

Sex	Age	Number of extracted teeth											
		1-8 extracted teeth		9-16 extracted teeth		17-20 extracted teeth		21-24 extracted teeth		25 and more extracted teeth		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	18-34 years old	39	13,00	2	0,66	0	0,00	0	0,00	0	0,00	**41**	**13,66**
	35-54 years old	21	7,00	12	4.00	4	1,33	4	1,33	1	0,33	**42**	**14,00**
	55-64 years old	2	0,66	7	2,33	2	0,66	2	0,66	5	1,66	**18**	**6,00**
	65+ years old	2	0,66	4	1,33	4	1,33	1	0,33	7	2,33	**18**	**6,00**
	Total	**25**	**8,33**	**25**	**8,33**	**10**	**3,33**	**7**	**2,33**	**13**	**4,33**	**119**	**39,66**
Female	18-34 years old	62	20,66	6	2,00	2	0,66	1	0,33	0	0,00	**71**	**23,66**
	35-54 years old	34	11,33	19	6,33	5	1,66	2	0,66	7	2,33	**67**	**22,33**
	55-64 years old	2	0,66	5	1,66	4	1,33	0	0,00	13	4,33	**24**	**8,00**
	65+ years old	1	0,33	3	1,00	2	0,66	3	1,00	10	3,33	**19**	**6,33**
	Total	**33**	**11,00**	**33**	**11,00**	**13**	**4,33**	**6**	**2,00**	**30**	**10,00**	**181**	**60,33**

Table 2. The number of extracted teeth in relation to age and sex of the participants

aged 18-34, and 21 (7%) male and 34 (11, 33%) female were 35-54 years of age. There was no statistically significant difference in the number of extracted teeth neither in relation to the sex nor age group (Chi-square test is 159,447 df = 12, p >0,05). These findings are contrary to the findings of the several other studies including the survey of the reasons for dental extraction in adult population in Greece [6,7,11]. The author Chrysanthakopoulos N. A., wanted to estimate the reasons for tooth extraction in adult population in Greece and its correlations with several aspects such as gender, age and type of the teeth extracted, and he found that the differences among the mean numbers of teeth extracted per patient by age groups and by sex were statistically significant in a manner that older

Age	Have you ever been worried about dental problems?												Total	
	Constantly		Most of the time		Sometimes		Periodically		Rarely		Never			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
18-34 years old	23	7,66	14	4,66	40	13,33	10	3,33	13	4,33	12	4,00	**112**	**37,33**
35-54 years old	12	4,00	23	7,66	26	8,66	6	2,00	18	5.96	24	8,00	**109**	**36,33**
55-64 years old	3	1,00	10	3,33	10	3,33	3	1,00	4	1,32	12	4,00	**42**	**14,00**
65+ years old	1	0,33	9	3,00	5	1,66	2	0,66	5	2,00	14	4.66	**37**	**12,33**
Total	**39**	**13,00**	**56**	**18,66**	**81**	**27,00**	**21**	**7,00**	**41**	**13,66**	**62**	**20,66**	**300**	**100,00**

Table 3. Concern about the impact of oral health problems by age

Number of extracted teeth by groups		Constantly	Most of the time	Sometimes	Periodically	Rarely	Never	Total
1-8 extracted teeth	No.	22	23	55	13	20	30	163
	% number of extracted teeth	13,5%	14,1%	33,7%	8,0%	12,3%	18,4%	100,0%
	% Have you been worried about your dental problems?	56,4%	41,1%	67,9%	61,9%	48,8%	48,4%	54,3%
9-16 extracted teeth	No.	12	13	12	3	7	11	58
	% number of extracted teeth	20,7%	22,4%	20,7%	5,2%	12,1%	19,0%	100,0%
	% Have you been worried about your dental problems?	30,8%	23,2%	14,8%	14,3%	17,1%	17,7%	19,3%
17-20 extracted teeth	No.	0	5	5	0	6	7	23
	% number of extracted teeth	0,0%	21,7%	21,7%	0,0%	26,1%	30,4%	100,0%
	% Have you been worried about your dental problems?	0,0%	8,9%	6,2%	0,0%	14,6%	11,3%	7,7%
21-24 extracted teeth	No.	2	5	2	2	0	2	13
	% number of extracted teeth	15,4%	38,5%	15,4%	15,4%	0,0%	15,4%	100,0%
	% Have you been worried about your dental problems?	5,1%	8,9%	2,5%	9,5%	0,0%	3,2%	4,3%
25+ extracted teeth	No.	3	10	7	3	8	12	43
	% number of extracted teeth	7,0%	23,3%	16,3%	7,0%	18,6%	27,9%	100,0%
	% Have you been worried about your dental problems?	7,7%	17,9%	8,6%	14,3%	19,5%	19,4%	14,3%
Total	No.	39	56	81	21	41	62	300
	% number of extracted teeth	13,0%	18,7%	27,0%	7,0%	13,7%	20,7%	100,0%

Table 4. Concern about the impact of the number of extracted teeth on oral health problems

patients lost more teeth than the younger ones and males participants showed higher percentage of extracted teeth than females [11].

The analysis of the results obtained on the basis of the responses provided by the respondents by completing the OHIP-20 questionnaire shows that the age of patients (**Table 3.**) with a certain number of extracted teeth significantly influences the perception of the quality of life of these respondents (Chi-square test=34.198, df = 15, p < 0,05.). The greatest dissatisfaction was present in the younger population of the respondents aging 18-34, than in the group of 35-54 years.

Although the result from **Table 4**. is not statistically significant (Chi-square test= 30,519, df = 20, p >0,05), the analysis of data from the table shows that 56.4% of respondents in the group with 1-8 extracted teeth were constantly concerned about dental problems, and in the group with 9-16 extracted teeth 30.8% respondents emphasize their concern. These percentages indicate that a greater number of the extracted teeth mean the greater concern about dental problems of the subjects in this study, suggesting that the lack of teeth does affect the quality of life, although not statistically significant.

Discussion

Having in mind that Bosnia and Herzegovina still does not have a developed methodology for determining the degree of poverty and monitoring its reduction, socioeconomic status of the participants was evaluated by the fact whether they employed or not. The highest number of respondents in this study are employed full time, 136 (45.3%) of them, 97 (32.3%) are unemployed, and 57 of them (19%) are retirees. The fact that the majority of respondents in this study are employed means that respondents are socially integrated and in contact with others and their environment. The relationship between the socioeconomic status and the number of the extracted teeth in the study was statistically significant (the Chi-square test is 90,900, df = 16, p <0, 05), in an unexpected way. Out of the 300 respondents, the greatest number of the extracted teeth was found in a group of full time employed participants (85 or 28,33% have one to eight extracted teeth, 32 or 10,66 % of them have 9-16 extracted teeth and 11 or 3,66, participants in this group have 24 and more extracted teeth). In the same time, results showed that unemployed participants have better oral health with 2,33 % of them who have 24 and more extracted teeth, 4,66% of them with 9-16 extracted teeth and 21,66 % of them with 1-8 extracted teeth.

Although the number of extracted teeth can serve as an indicator of socioeconomic development and levels of oral hygiene in a country [12], a fact that fully employed participants in this study have a worse oral health indicates the lack of preventive measures and oral health promoting activities in dentistry in Bosnia and Herzegovina. The presented results showed a statistically significant link between the socioeconomic status and the number of extracted teeth which has been proven on the basis of the clinical examination of the dental status of the respondents and the answers given in the OHIP-20 questionnaire.

One of the important indicators of dental status is the number of remaining teeth. Researches by Anneloes, Finbarr, Witter, Bronkhorst and Creugers showed that the presence of at least 20 teeth is necessary for the preservation of the minimum necessary functions of the dental system. The results of their researches suggest that the number of occlusal pairs is an important indicator of OHRQoL, and the frequency of adverse effects on oral health significantly increases when the number of existing teeth drops below 20 [13]. Guided by this fact, the study "Impact of oral health and number of extracted teeth on the quality of life in adult population" has also investigated the influence of the number of extracted teeth on the quality of life of the respondents. The results of the study show that the majority of respondents, 113 of them, had never experienced any difficulties while chewing food. Nevertheless, more than half of respondents, 58.1% of them in the group with 1-8 extracted teeth, said that they sometimes had problems with chewing. In the group with 9 to 16 extracted teeth, as many as 50% of them had constant chewing problems. In the group with 24 or more extracted teeth, 40.0% of them had problems most of the time, and 33.3% constantly. Although the results of the Chi-square test do not show statistical significance (the value of the Chi-

square test = 35,196; df = 20; p>0,05), depicted values indicate that extracted teeth, in any case, influenced the chewing function and consequently the quality of life of the respondents. These findings are confirmed in the study by Pallegedara C. and Ekanayake L. [14] who, investigating the impact of tooth loss on the quality of life associated with the oral health of the elderly population of Sri Lanka, found that both groups (both respondents who do not have any teeth and respondents who have their natural teeth) indicated "discomfort during eating" as the subject of the most frequently reported oral health impact on the quality of life.

In the description of two studies in three cross-examinations in the United Kingdom, Australia and Finland, a subjective and objective view of the quality of life after the extraction of teeth was compared with respondents who have 25-32 remaining teeth, respondents who have 21-23 teeth, respondents with 17-20 teeth, 9-16 teeth and respondents with 1 to 8 remaining teeth. The results of these studies have shown that the presence of a smaller number of remaining teeth has a greater impact on OHRQoL, with a marked deterioration when the number of remaining teeth is below 17. Most studies show a statistically significant correlation between the number of remaining teeth and unfavorable OHRQoL results [13], being opposite to the results of the analysis of the OHIP questionnaire in the study "Impact of oral health and number of extracted teeth on the quality of life in adult population in the Sarajevo Canton", where answers do not indicate statistically significant concern about tooth loss, nor do the respondents of this study consider that teeth loss overly affects the quality of their life in its entirety.

Conclusion

The results of this study have shown that the self-assessment of dysfunctionality, discomfort and inability to perform chewing and speech function as a result of tooth extraction have no impact on the quality of life of the adult population in the Sarajevo Canton. This results showed that the adult population in the Sarajevo Canton still didn't accept the fact that oral health is inseparable part of general health and that it affects people in both positive and negative ways and thus both enhances and reduces life quality.

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TOOTH WHITENING IN CHILDREN AND ADOLESCENTS: POSSIBILITIES AND DILEMMAS

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ABSTRACT

Smiling is one of the most important communication skills. White, healthy teeth represent one of the synonyms for good health and youth. Nowadays, tooth whitening is one of the most frequently performed dental procedures in adults, and the most requested aesthetic procedure in adolescents. The colour of the teeth is determined by the combination of their intrinsic colour and the presence of external pigments at the surface of the teeth. Change in tooth colour can result from extrinsic stains, endogenous factors affecting teeth during their formation, trauma or endodontic complications, as a result of oral diseases or conditions involving the exposure of the inner layers of the tooth tissue, etc. Today, various hydrogen or carbamide peroxide- based products are available for professional and at-home teeth whitening. Before starting tooth whitening, a detailed dental examination and analysis of aesthetic needs of the patient has to be performed. During the whitening procedure, professional monitoring is needed in order to achieve desired aesthetic effect, and to minimize the possibility of adverse events occurrence. This paper presents an overview of modern whitening techniques for vital and non-vital teeth, and specificities, possible risks and limitations of their use in children and adolescents.

Keywords: aesthetics, vital tooth whitening, non-vital tooth whitening, children, adolescents

Introduction

Smiling is one of the most important communication skills. It has been shown that the appearance of teeth adds to the beauty of smile more than their position in the dental arch [1]. Today, with the constant promotion of a healthy life style, white, healthy teeth represent one of the synonyms for good health and youth. Tooth whitening is an aesthetic procedure that has passed the great path from avant-garde to everyday dental procedure in the past thirty years. Nowadays, this is one of the most frequently performed dental procedures in adults, and the most required aesthetic procedure in adolescents.

The color of the teeth is determined by the combination of their intrinsic color and the presence of external pigments that can adsorb on the surface of the teeth [2]. Natural color differs not only between the tooth groups, but also between different parts of one tooth due to diverse thickness, translucency and optical characteristics of the enamel and dentine. The inner tooth color is largely influenced by the absorption of light and the reflection of light by enamel and dentin, while dentin plays a crucial role in determining the overall color of the teeth. The outer color is related to the adsorption of the pigments onto the surface of the enamel [3].

Extrinsic causes of tooth discoloration include pigment containing foods and liquids, poor oral hygiene (dental plaque), chromogenic bacteria, as well as tobacco use during adolescence. The exact mechanism of tooth discoloration has not yet been fully understood, but chromogens are considered to react with dental pellicle proteins [4]. As to the factors involved in tooth formation, over 100 possible causes of structural developmental defects which can lead to tooth color alteration have been identified. Endogenous factors include: chronic diseases, infections and drugs intake during pregnancy, metabolic disorders (alkaptonuria, congenital erythropoietic porphyria, congenital hyperbilirubinemia), hematopoietic disorders (Erythroblastosis featalis, Icterus gravis neonatorum, sickle cell anemia and Thalassaemia), iatrogenic factors (fluorosis, tetracycline antibiotics), hereditary factors (Amelogenesis imperfecta, Dentinogenesis imperfecta) and idiopathic developmental disorders of teeth (environmental change, nutritive disorders, infections in early childhood...) that might lead to the molar-incizor-hypomineralization [4, 5].

However, the most significant etiological factor of tooth discolorations in children is dental trauma. Dental injuries can affect the tooth either as a direct complication of the injury itself or as indirect damage to the permanent successor after the trauma to primary tooth. Internal discolorations in traumatized teeth can be caused by pulpal bleeding after the injury, trauma induced pulp necrosis (tissue degradation products), excessive formation of irregular dentin, or root resorption. In addition, inadequate endodontic treatment, i.e. pulpal tissue remnants or residue of root canal sealer in the cavity, as well as some dental materials (amalgam) can cause internal tooth discoloration [6].

Certain oral diseases and conditions can also result in tooth discoloration, so the stains can be a consequence of the exposure of the inner tooth tissue layers due to enamel erosion or change of the color can occur due to the presence of large caries lesions [4].

Whitening of non-vital teeth has been performed since the middle of 19th century [6], and whitening of vital teeth, so called "night guard vital bleaching", was firstly described in 1989 [7]. Few years late, the first protocol for tooth whitening in younger patients was published [8].

All the contemporary tooth whitening devices are hydrogen peroxide- or carbamide peroxide based. Hydrogen peroxide is a strong oxidizing agent which accomplishes its effect by releasing highly reactive free radicals [9]. The peroxide diffuses into the tooth and reduces or breaks the double bonds of the pigment molecules, which in this way either decompose into smaller molecules whose dimensions permit diffusion from the teeth or modifies them to absorb less light and, therefore, become brighter [4]. Carbamide peroxide is easily decomposed into the urea and hydrogen peroxide, which continues its action according to the mechanism described above. The urea should further be decomposed into carbon dioxide and ammonia raising the local pH to facilitate further bleaching [4]. Ten percent of carbamide peroxide responds approximately to 3% hydrogen peroxide.

Decision-making on tooth whitening in children

Before deciding on tooth whitening, a thorough interview with the patient, as well as a detailed and accurate dental examination has to be performed. In that way, the correct diagnosis of the cause of discoloration can be made, and the treatment is going to be as effective as possible and with long lasting effects. Attention should be paid to allergy to plastics or peroxide, pregnancy/breastfeeding, the history of hyposalivation associated diseases, as well as to long-term use of medications that may reduce the salivary flow (possible side effects of over 400 drugs [10]), medications with high cariogenic potential (with added flavored sweetening syrups) or those that may lead to tooth discoloration (tetracycline antibiotics, fluoride). Dietary considerations should include the frequency and amount of pigment containing foods and liquids, as well as substances that can harm enamel surface (fermentable carbohydrates and acidic foods).

The dental history should include onset and progression of the discoloration and its previous treatment. Dental examination should primarily identify the cause and location of the discoloration, and then the presence of white spots, caries lesions, developmental anomalies, tooth infractions and fractures, erosion, dentine hypersensitivity, bruxism, as well as the presence of restorations in the aesthetic zone that require or may require replacement after tooth whitening. All these observations should be precisely noted. Also, inflammation and defects of oral soft tissues, the presence and type of orthodontic (fixed/mobile) or prosthetic appliances (partial dentures, crowns, and adhesive bridge) should be recorded. Oral hygiene techniques and products and use of fluoride should be broadly discussed with patient. If necessary, patient should be taught and motivated to maintain good and effective oral hygiene.

Contraindications that should be considered before the dental whitening procedure include: unrealistic expectations from the patient, incompliant patient (unwilling to perform night guard treatment at home), untreated caries, multiple white spot caries lesions, dental erosion, bruxism, tooth sensitivity, large composite restorations in the aesthetic smile zone, or periapical lesions, pulp chamber/root canal obliteration or root resorption confirmed by X-ray radiograph.

Before and after the whitening procedure is completed, it is advised to take a frontal view photos of natural smile, with retracted cheeks, upper and lower teeth in *tête-à-tête* contact, and with a shade tab. Upper and lower teeth visibility of smile should be analyzed as well [11].

If there is a need, two weeks before starting the procedure, thorough prophylactic removal of all soft deposits, calculus and stains from the tooth should be performed, in order to reverse existing inflammation of the gingiva.

Vital tooth whitening

For the vital tooth whitening in childhood, the most commonly used technique is the overnight at-home whitening treatment including custom-made whitening trays usually made of ethylene-vinyl acetate copolymer. The whitening gel is placed into the tray and seated over the teeth. This procedure is performed at home, but is monitored by a dentist.

The exposure time to the whitening agent depends on the type and the concentration of bleaching compound. It is recommended that the 10% carbamide peroxide is used 8-10 hours per day, 4-6 hours is recommended for 15% carbamide peroxide, 2-4 hours for 20% carbamide peroxide, and only 30 minutes for 35% carbamide peroxide. However, using 10% carbamide peroxide whitening technique in children and adolescents is considered the gold standard.

Over-the counter bleaching products

Numerous whitening systems, including tooth-pastes, mouth rinses, gels, chewing gums, dental strips, etc. can be found on the market today. Their main advantages are affordability, low cost and convenience of use.

Whitening toothpastes contain substances with abrasive (silicates, perlite, $CaCO_3$, $CaHPO_4 \times 2\ H_2O$, $Ca_2O_7P_2$, Na_2CO_3), optical (blue covarine) or chemical effect (H_2O_2, CaO_2, Na-citrate, $Na_2H_2P_2O_7$, $Na_5P_3O_{10}$,

$NaPO_3$) that are able to remove extrinsic stains from tooth surface or prevent their occurrence [12]. Although good results have been achieved in *in vitro* studies [12], only a few clinical studies have been published so far [13-15]. Despite the short observation periods (only several weeks), these studies are showing a positive effect of the whitening toothpastes, but neither the longevity of the tooth whitening effect, nor the extent to which the participants in these studies perceived a color change, are reported.

Tooth whitening strips comprise flexible polyethylene base coated with hydrogen peroxide gel at various concentrations (5.3%, 6.5%, and 14%). The strips are applied to the teeth once or twice daily, depending on the manufacturer's instructions. Donly et al. [16] compared the efficacy and safety outcomes of hydrogen peroxide whitening strips and carbamide peroxide in a custom tray. Fifty-eight 12-17 years old subjects were treated using one of these techniques over a 14-day period. Changes in color and lightness of frontal teeth, measured by digital image analysis, did not differ significantly between the groups. Likewise, no differences in the frequency and intensity of adverse effects during the treatment were observed.

It is, however, advisable that a (young) patient consult the dentist even before treatment of over-the counter whitening products (excluding toothpastes) as those products may be a significant source of concern in terms of safety and efficacy because of their potential for long-term overuse and abuse by uninformed patients.

Side effects of tooth whitening products

Acute cytotoxic effect appears at doses over 5 g/kg/day for a product containing 10% carbamide peroxide [17]. Based on the observations of systemic effects in animal models, Dahl and Becher [18] concluded that the maximal daily exposure should be up to 10 mg of carbamide peroxide in a 70-kg human. Taking into account that one syringe of whitening gel contains 1.5 grams of carbamide peroxide, patients should be warned of the risk of side effects in case of overfilling the trays, or of repeated daily application of the whitening agent.

Local side effects comprise: increased enamel surface roughness and lowered micro hardness, increased risk of enamel demineralization, degradation of existing restorations and/or unacceptable changes in their color, gingival irritation and tooth sensitivity. Of course, the intensity of unwanted side effects depends on whitening technique and the product concentration [17].

Zanter et al. [19] evaluated effect of different at-home whitening products on enamel surface microhardness and showed a significant influence of whitening paints, gels and stripes. Still, a significant recovery (enamel micro hardness increase reaching the baseline values) has been observed after the 6-week storage in artificial saliva.

Scanning electron microscope images of an enamel surface revealed no morphological alterations after whitening procedure with 10% carbamide peroxide gel [19], as well as when agents at higher concentrations (35% hydrogen peroxide) were used [20]. On the other hand, an energy dispersive spectroscopy study [21] reported a significant reduction in enamel calcium levels following treatment with various concentrations of carbamide peroxide, suggesting enamel demineralization after the whitening procedure.

Data on changes of enamel surface roughness after tooth whitening are somewhat conflicting. Some authors report only slight increase in enamel roughness after 10% and 15% carbamide peroxide application [22], as well as after the use of high-concentration agents (35% urea peroxide, 38% hydrogen peroxide) [23]. To the contrary, Hosoya et al. [24] found a significant increase in enamel roughness after the use of 35% hydrogen peroxide, and subsequent increased adhesion of *Streptococcus mutans* to the toot surface.

Whether tooth whitening can increase the caries risk, due to possible enamel demineralization and physical properties alterations, has not been sufficiently investigated. However, it is now widely known that progression of demineralization can be controlled by the use of remineralization agents after the tooth whitening procedure, especially calcium phosphate- based products (casein phosphopeptide-amorphous calcium phosphate (Recaldent), hydroxyapatite, calcium sodium phosphosilicate (NovaMin)) [25-27].

One of the major problems connected with tooth whitening is tooth sensitivity which occurs in 11 to 93% of patients. This phenomenon is explained by passage of the hydrogen peroxide through the enamel and dentine into the pulp resulting in slight pulpal inflammation. This inflammation leads to triggering of pulpal sensory nerves in response to stimuli (cold) [4]. Pulpal inflammation is transient and no harmful damage of the pulp tissue have been confirmed histologically [28, 29]. Some authors suggest that use of a desensitizing agent (3% potassium nitrate and 0.11% by weight fluoride ion) for 30 minutes prior to whitening may reduce teeth sensitivity [30].

Professional vital tooth whitening

Professional tooth whitening is accomplished using high concentrations (30-40%) of hydrogen peroxide with or without further activation by a LED light or laser. The advantages of this procedure are: professional control, proper isolation and soft-tissue protection and full patient compliance. In addition, the desired results are achieved faster compared to at-home whitening techniques [31]. However, studies show more pronounced enamel surface roughness, reduced enamel micro hardness, and greater demineralization after the professional tooth whitening [27, 32-36]. Likewise, higher concentrations of the whitening product create higher tooth sensitivity [6, 37]. Bearing the above in mind, professional teeth whitening is not recommended in pediatric dentistry [38].

Clinical recommendations for vital teeth bleaching in children and adolescents

Having in mind limited patient cooperation and safety concerns, whitening of primary teeth is not recommended. Due to significant color variations between primary and permanent teeth, whitening in mixed dentition is not recommended. At-home use carbamide peroxide represents an ideal combination of safety, comfort for the patient and efficiency for whitening of permanent teeth in children and adolescents. Parental supervisory is recommended, especially in younger patients [31, 38].

Whitening of non-vital tooth

As previously mentioned, tooth discoloration due to trauma and/or inadequate endodontic treatment is commonly seen problem in pediatric dental practice. Considering the frequency of traumatic dental injuries in childhood that often lead to an aesthetic issue demanding an improvement, whitening of the non-vital teeth is more frequent and more justified in the child and adolescent period. For this technique, 35% hydrogen peroxide, 35% carbamide peroxide, or sodium perborate are placed into the cavity of the stained tooth.

Before the treatment, periapical radiographs should be made to evaluate the quality of the root canal filling. The access cavity is then made, taking care that all the remnants of the filling material, root canal sealer and necrotic pulpal tissue are removed [6]. The root filling should be removed 2 mm below the cement-enamel junction and sealed with glass-ionomer cement [39]. This protective barrier should prevent leakage of the whitening agent into the cervical and apical region as well as bacterial penetration that could lead to late complications of endodontic treatment. It also prevents leakage of the pigment from the root canal sealer.

The cavity should be then cleaned with sodium hypochlorite [40]. Some authors also recommend cavity conditioning with 37% orthophosphoric acid aiming at the smear layer removal from the cavity and increased penetration of the whitening agent into the dental tubules and consequent higher bleaching effect [6]. However, this effect has not been proved [41], and there is a concern that smear layer removal may increase the penetration of the whitening agent to the periodontium thus promoting the risk of the cervical root resorption [42].

The whitening agent is placed directly into the cavity which is then sealed with temporary filling. Camps et al. [43] analyzed the diffusion of hydrogen peroxide through human dentin in order to determine its optimal renewal time (after the active substance loses its effect). The results showed that the whitening agent should be renewed every 18 hours in mature teeth and every 33 hours in young teeth until achieving the desired aesthetic result. In practice, this renewal should be done every day in adults and every other day in young patients.

It has been shown that 35% carbamide peroxide and 35% hydrogen peroxide are equally effective and more efficient compared to sodium perborate for non-vital tooth whitening [44]. Few clinical trials evaluating the effectiveness of non-vital tooth whitening are available in the literature, and authors of the present paper are aware of only one that included children and adolescents. Abbott and Heah [45] evaluated 203 patients with a total of 255 non-vital teeth required aesthetical improvement. Of these, 3% were patients younger than 10 years, 53% were 11–20-year olds. In 87% of the treated teeth good aesthetical result was achieved, and acceptable effect was reported in remaining 13%. Retreatment was needed in 4% of bleached teeth.

One of the main concerns regarding the intracoronal bleaching is a risk of external cervical root resorption. Diffusion of hydrogen ions from the intracoronal bleaching agents through the dentinal tubules into the periodontium may provide an acidic environment that is optimal for osteoclastic activity [46]. Higher incidences of root resorption were observed when hydrogen peroxide was mixed with sodium perborate [40] or sodium perborate was heated [47]. It has also been shown that 35% carbamide peroxide causes significantly lower diffusion of hydrogen peroxide compared to 35% hydrogen peroxide and sodium perborate [46]. Therefore, carbamide peroxide is recommended for intracoronal bleaching of non-vital teeth in children [31, 38].

The influence of whitening agents on dental restorative materials

Another clinical concern is the influence of whitening agents on dental restorative materials. Studies *in vitro* revealed that 10% carbamide peroxide induced the release of mercury and silver from dental amalgam fillings [48], but *in vivo* the presence of dental biofilm reduces the release of metals [49]. Tuker and Biskin [50] reported significant increase of surface roughness, wash-off of the material, and serious cracks at the surface of glass-ionomer materials after exposition to carbamide peroxide-based bleaching agents, while surface of composite materials was less affected [50-52]. On the other hand, Cehreli et al. [53] reported decreased surface hardness of glass-ionomer materials and increased surface hardness of resin-based materials after exposure to whitening agents. Anyhow, regardless the effect, contemporary literature suggest polishing of the restorations after bleaching [54].

Weaker adhesion of composite materials to enamel [55-61] and dentine [61-64] immediately after the whitening procedure has been explained by morphological alterations of dental hard tissues and residual oxygen which may inhibit polymerisation of the composite resins. Setting of the glass-ionomer cements may also be inhibited by oxygen remnants [65]. It is therefore advisable to postpone placement of definitive restoration for one, ideally to 3 weeks [54].

Conclusion

Contemporary dentistry supports tooth whitening in children and adolescents. Carbamide peroxide- based products are recommended for both vital and non-vital teeth. Due to the danger of inappropriate use or abuse of whitening products, dentist's consultation and monitoring of the whitening process is advocated. It is also important to educate and motivate patient on good oral health in order to achieve long lasting whitening effects.

Declaration of interest

The authors declare that they have no competing interests.

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USE OF THE Er:YAG LASER IN MINIMALLY INVASIVE SOFT TISSUE SURGERY

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ABSTRACT

The unique characteristics of lasers are making this treatment modality minimally invasive technology that offers great advantages when compared to available conventional techniques. Among different laser systems, pulsed-wave solid-state Er:YAG laser was proven to be safe and effective for both, hard and soft tissues procedures, due to its specific wavelength which is superficially absorbed by water. Therefore, Er:YAG laser can be successfully used for incisional and excisional biopsies, frenectomies, ablation of lesions, gingivectomies, gingivoplasties, soft tissue tuberosity reductions, operculum removal and crown lengthening procedures.

Key words: Er:YAG laser, soft tissues surgery, laser therapy

Introduction

The unique characteristics of lasers are making this treatment modality minimally invasive technology that offers great advantages when compared to available conventional techniques [1, 2]. The major advantageous properties of lasers are efficient ablation of the biological tissues, together with hemostasis, analgesia, reduction of inflammation and the lower probability of scars [2]. In addition, laser treatment has a potential to reduce patients' mental stress and anxiety caused by visit to the dentist, usually connected with a conventionally used drill and burs. At present, many laser systems are used for the dental procedures. Among different laser systems, pulsed-wave solid-state Er:YAG laser has proven to be safe and effective for both, hard and soft tissues procedures, due to its specific wavelength (2940 nm) which is superficially absorbed by water [1-3]. Er:YAG laser is having strong water absorption, therefore, the width of the thermal affection and damage of the tissue is minimal (only 5 μm deep) [3]. The hemostatic effect is weaker, than for other lasers, but the healing of the laser wound is relatively fast and comparable to that of a scalpel wound [4].

Er:YAG laser is successfully used in the soft tissue management for the incisional and excisional biopsies, frenectomies, precise ablation of lesions, gingivectomies, gingivoplasties, soft tissue tuberosity reductions, operculum removal (pericoronitis) and crown lengthening procedures [1-3]. Advances in laser technology have provided delivery systems for site-specific delivery of laser energy with short interaction items on tissue to be ablated. The advantages of Er:YAG include a relatively bloodless surgical and post-surgical field, minimal swelling and scarring, vaporization and cutting, in most of the cases without suturing, reduction in surgical time, and, in a majority of cases, no intraoperative or postoperative adverse effects. In addition, recently it has been mentioned that beneficial effects of Er:YAG laser can be partly explained by the effects of photobiomodulation effects of Er.YAG laser [5, 6]. Photobiomodulation is defined as a certain amount of energy that simultaneously penetrates or scatters into the surrounding or underlying tissues during high-level Er.YAG laser irradiation, [5]. That phenomenon is also known as laser therapy/low-level laser irradiation, and it causes efficient activation of biological response, which in turn helps the promotion of wound healing/regeneration.

Frenectomy

The position and extension of frenulum influence both periodontal health and the alignment of the permanent dentition. Irregular frenal attachment (too coronal) can cause diastema between the maxillary and mandibular incisors. Abnormality in lingual frenulum can cause ankyloglossia which can lead to difficulties in eating (especially breastfeeding), swallowing, speaking and maintaining oral hygiene. When frenulum is extremely extended through the papilla on to the palate, some interproximal bone should be removed also. In that cases, when osseous surgery is required, the Er:YAG laser is treatment of choice. Laser frenectomy has numerous benefits for the patients and dentists, but the main advantage is that Er:YAG laser frenectomy (energy of 60 mJ, pulse of 10 Hz and without water spray) is one session surgery, with no need for the suturing of the surgical wound.

Gingival overgrowth removal/Gingivectomy

Gingivectomy is surgical procedure where soft tissue is totally or partially removed in order to eliminate suprabony periodontal pockets and/or to lengthen the height or width of the tooth. Gingivectomy/gingivoplasty are frequently used in order to achieve aesthetic in asymmetrical and unaesthetic gums. Er:YAG laser gingival re-contouring and/or reshaping is safe, easy and predictable, by using various fine contact tips.

Gingival overgrowth (enlargement, hyperplasia) is benign painless condition, characterized by massive enlargement of the interdental papillae, which can be accompanied by swelling of the gingival margin and partial cover of the occlusal surface of teeth, causing aesthetic and functional limitations [7]. It can be caused by various factors, such as inflammatory changes, poor oral hygiene, mouth breathing, vitamin C deficiency, heredity, malignan-

cies, hormonal alterations (seen in puberty and pregnancy) and the adverse effects associated with the systemic administration of certain drugs (anticonvulsants, immune-suppressants and various calcium channel blockers) [7]. Er:YAG laser is not the laser of choice in the gingival overgrowth treatment because of its weak hemostatic effects when compared to other available lasers, that may result in a bloody surgical field.

In removable prosthodontics, Er:YAG laser can be successfully used in the contouring of the denture base, namely removing of chronically inflamed hyperplastic gingiva on the ridge, vestibuloplasty and soft tissue tuberosity reductions. Further, since Er:YAG laser is capable to ablate both, hard and soft tissues, it can be used for torus reduction (osseus tissues re-contouring).

Also, Er:YAG laser should be used in cases of operculum removal/pericoronitis.

Crown lengthening

Er:YAG laser can be applied in crown lengthening procedures, since it is very safe and the wound healing is fast and favorable, owing the minimal thermal alteration of the treated surface [1-3]. Some authors recognized Er;YAG photobiomodulation as a reason of improved wound healing after such surgical procedures.

Regarding crown lengthening, special attention should be given to understand the relationship between the final positioning of the restoration margin and the biologic width of the periodontium (violation of biological width will lead to restoration failure). With the use of Er:YAG laser, the depth and amount of soft tissue ablation is more precisely and delicately controlled than with mechanical instruments. The clinicians should be aware that Er:YAG laser can ablate enamel tissue, too. Therefore, when using Er:YAG laser, the clinicians must direct laser beam away from the tooth structure.

Gingival discoloration removal

Although clinically gingival discoloration (such as melanin hyperpigmentation and/or metal tattoo) is not a medical problem or a disease, the demand for cosmetic corrections is on the increase, mainly by fair-skinned people and when discolorations are located on the anterior labial gingiva [8]. This problem is aggravated in patients with a "gummy smile" or excessive gingival display while smiling [8]. For gingival discoloration removal, many authors recognize laser as a treatment of choice, since it has been demonstrated effective and safe therapy approach with uneventful healing, minimum postoperative pain and no re-pigmentation. Even though, melanin depigmentation can be safely and effectively accomplished by CO_2, diode and Nd:YAG lasers, Er:YAG laser is considered laser of choice in areas of thin gingiva, where above mentioned lasers can have a risk of producing gingival ulceration and recession, as a result of their relatively strong thermal and/or deeply penetrating effects [8]. Especially, combination of the Er:YAG laser with a surgical microscope makes the procedure more precise (complete elimination of remaining pigmented areas, as well as careful irradiation of the delicate area of the gingival margin and papilla).

Incisional and excisional biopsy

The Er:YAG laser can be used for the biopsy of e.g. fibromas, epulis fissuratum, lichen planus, squamous papilloma, pyogenic granuloma, focal melanosis, non-healing traumatic ulceration, hemangioma and lymphangioma [9]. When using Er:YAG laser, the clinicians should be aware of laser tissue penetration irregularity due to anesthesia application (anesthesia should be given 1 cm away from the tissue to be removed). Also, it is imperative to plan wide borders that incorporate the entire lesion, as well as some normal tissue surrounding the lesion, but not to be thermally damaged/destructed by Er;YAG laser in order to be properly histo-pathologically evaluated.

Adjunctive laser soft tissue surgery in implantology

Er:YAG laser can be successfully used in implant dentistry in a variety of ways, such as diseased granulation tissue removal and wound disinfection after tooth extraction without thermal side effect, implant placement preparation, uncovering surgery

procedures in second stage surgery (removing soft tissues covering the integrated implant) and therapy of peri-implantitis. Since Er;YAG laser are reflected from metal surfaces, they interact only minimally with the implant. The Er;YAG laser can be safely used for removal and re-contouring of the bone tissue in order to prepare edentulous sites for implant placement. Furthermore, Er:YAG laser (100 mJ, 10 Hz) can decontaminate implant surfaces (bactericidal effect) and provide an environment favorable to osseous integration [1]. Osseous integration can be partly achieved by Er:YAG laser photobiomodulation (1.5-3 J/cm^2) by enhancing the local microcirculation and cells proliferation and differentiation (fibroblasts, osteoblasts, osteocytes).

Regardless very wide and successful use of Er:YAG laser in soft tissue surgery, the accent should be given in development of standardized protocols for each and every application. So far, there are many clinical studies with usage of unique laser irradiation parameters (energy, frequency, time/distance of irradiation…). In order to clearly state the benefits of Er:YAG in minimally invasive soft tissue surgery, the further studies are, however necessary. Further studies should clarify "golden standard" Er:YAG laser parameters for each and every soft tissue procedure to be used.

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TITLE: **ENDODONTIC PROPEDEUTICS**

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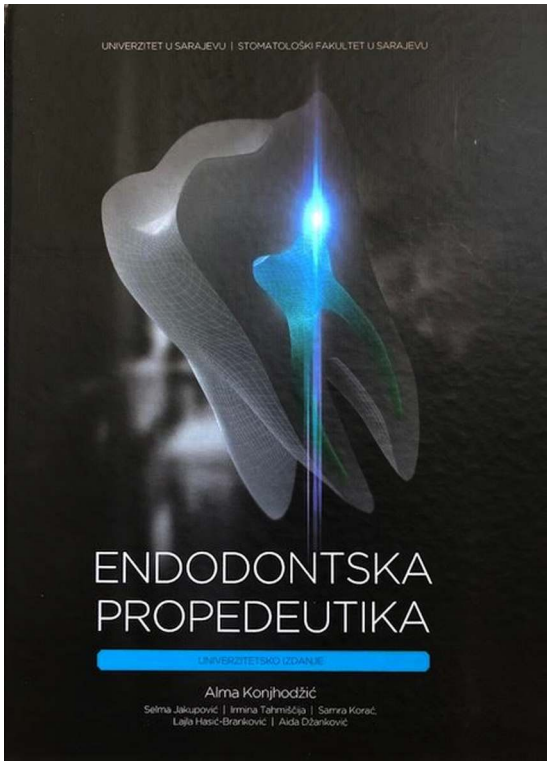

Propedeutics is a collection of knowledge that introduces students to clinical medicine, or dentistry. Endodontic propedeutic is an excellent university textbook with aim to repeat the knowledge that reader has adopted on various dental subjects from dental morphology, dental physiology, dental materials, restorative dentistry, etc. It is the entrance to clinical endodontics, which is the synthesis of contemporary scientific facts combined with clinical and educational experience of the authors.

The book is divided into twelve systematically organized chapters. These chapters are:

1. Pulp-dentine complex
2. Basics of canal morphology in permanent teeth
3. Clinical diagnosis and therapeutic guidelines in endodontics
4. Diagnostics in endodontics
5. Endodontic instruments
6. Achieving and maintaining a dry working field
7. Trepanation and access cavities
8. Odontometrics-establishing working length
9. Techniques of mechanical processing (instrumentation) of root canals
10. Root canal irrigation
11. Intracanal medication
12. Obturation of root canala

The emphasized key facts, logically structured text, understandable terminology and detailed schemes and photographs make this book a comprehensive resource to both undergraduate and postgraduate students as well as dental practitioners seeking for continuing education. This book is a valuable source on introduction to endodontics. It is current and valuable for both classrooms and reference use. Overall, it provides readers an insight to endodontics as one of the most demanding disciplines in clinical dentistry.

5th CONGRESS OF DENTISTS OF BOSNIA AND HERZEGOVINA WITH INTERNATIONAL PARTICIPATION

TESLIĆ, BOSNIA AND HERZEGOVINA, 2018

ORAL PRESENTATIONS

PSYCHOSOCIAL ASPECT OF DENTOFACIAL AESTHETICS IN CHILDREN

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Introduction: Study was conducted between the students of different ages with the purpose to determine whether children notice the way their teeth influence their physical appearance, and if that appearance influences their social relations. As well, the study wanted to determine whether parents notice the appearance of their children's teeth, whether is it important to them, and whether they are aware of the fact that it can be the cause of bullying that may happen to their children.

Materials and methods: Two groups participated to the study - children and their parents. There were 50 children - 25 ten year olds and 25 fourteen year olds, 32 girls and 18 boys. The questionnaire consisted of 6 questions for children and 4 questions for their parents.

Results: Students do notice the appearance of their teeth, and 40% of them consider that everything except „perfect" teeth is „ugly". Regardless of such noticing, they consider that it's not acceptable to say anything about someone's teeth, or to bully a child because of that.

Conclusion: Beautiful teeth, pleasant look of the jaws and a beautiful smile are one of the three most important physical characteristics, said the majority of the children.

CHILDREN WITH CONGENITAL HEART DEFECTS IN DENTAL PRACTICE

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Introduction: Congenital heart defects represent a problem in the structure of the heart being present at birth. They arise as a result of disorders during the embryonic tissue development out of which the heart develops. The prevalence ranges from 0.8 to over 1%, and the etiological factors are diverse.

Objective: To point out the importance of prevention of oral diseases in children with congenital heart anomalies, as well as the importance of antibiotic prophylaxis in the dental therapy.

Material and Methods: The presentation will show the cases of children with cardiac anomalies.

The conclusion will be derived from the comparative analysis of domestic and international literature.

PREVENTIVE CLOSURE OF FISSURES / FISSURE FISSION / FIRST PERMANENT MOLARS

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Introduction: Preventive closure of fissures / fissures fission/ first permanent molars is a specific clinical procedure for the application of appropriate materials in order to protect the wells and fissures of occlusal surfaces of the tooth from the influence of the cariogenic factors of the oral environment. It is one of the most effective methods in caries prevention.

Objective: To show the number of children who went through the Clinic of Pediatric Dentistry of the Health Center "Izudin Mulabećirović-Izo" Tešanj in the period January 2017 to January 2018 with the aim of preventing the caries by the method of fissure fission. Another objective is also to compare this number to the total number of children who went through the aforementioned Clinic.

Materials and methods: For this analysis, dental cardboard of children who went through the Clinic of Pediatric Dentistry Health Center "Izudin Mulabećirović-Izo" Tešanj were taken with exact indicators for the same.

Results: The results show that the average number of fissure fission was one tooth daily. Considering the number of working days in 2017, this is not a bad indicator since the parent's awareness of this type of intervention is very low.

Conclusion: Despite the high quality of work, the impression is that there is lot of space for the improvements.

CARIES PREVALENCE ON THE FIRST PERMANENT MOLARS

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Introduction /Aim: Caries is a multifactorial disease, prevalence and frequency of caries on the first permanent molars is largely affected by bad eating habits and inadequate oral hygiene. Since the habits produced in milk dentition are transferred to permanent dentition, the first permanent molar has fissures in which food is easily retained making this tooth mostly exposed to the emergences of caries. The aim of this study was to determine the prevalence of caries of the first permanent molar.

Material and Method: The prevalence study covered 100 school children (aged 12-15 years) who were patients at the Dental Clinic of Children and Preventive Dentistry at the Faculty of Medicine in Foča during the summer semester of the school year 2016/17. The health status of the first permanent molar was examined by means of a dental probe and mirror followed by the analysis of caries indices. Data analysis was done using SPSS version 20.

Results: In the examined group of children (KIO) is 99%, (KIZ) is 78.5%, while the average (KIP) was 3.15. In the structure of KEP, 74.3% of the first permanent molars are with caries (K), 10.5% were extracted (E) and 15.2% with teeth filling (P). Analysis found that the healthiest are molars (46) participating with 20%, while caries was mostly diagnosed on the molars (16) with 60%.

Conclusion: The health condition of the first permanent molars is unsatisfactory. Children and parents need to be educated on the importance of keeping the first permanent molars healthy and of their importance in the orofacial region.

REASONS FOR PRIMARY TEETH EXTRACTION

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Purpose/Aim: Primary teeth are important for mastication, phonetics, proper growth and development of the orofacial complex. The aim of this paper was to determine the reason for the extraction of the primary dentition teeth.

Material and Method: The study was cross sectional. The patients were identified by analyzing dental records of the children aged 5 to 15 years (178 boys and 153 girls), who were patients at the Faculty of Medicine in Foča from 2016 to 2018. 1016 extracted primary teeth were analyzed from 331 patients who had at least one primary tooth extracted. We entered data according to the type of extracted teeth, the reason for its extraction and the age of the child during the period of tooth loss. Data analysis was done using SPSS version 20.

Results: Primary dentition teeth were extracted due to: caries or its complications (77.65%), physiological resorption 21.45%, orthodontic reasons 0.69% and injuries 0.2%. Because of caries, 91.70% of molars were extracted, while physiological shift extracted 59.21% of incisors and 55.55% of canines. The analysis suggests that 1.8% of children were left without all primary molars until their eighth year. Because of caries, 51.23% of molars were extracted at children aging from 7 to 8 years.

Conclusion: The study pointed out great presence of caries lesions that had to be resolved by teeth extraction. It is necessary to draw attention to the importance of maintaining all teeth healthy.

DENTAL CARIES PREVALENCE IN SCHOOL CHILDREN

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Introduction/Aim: Caries is the most common oral disease of the hard dental tissues. It is a chronic infectious disease that occurs in early childhood. The aim of this

study was to assess the prevalence of caries in permanent teeth in schoolchildren.

Material and Method: The study included 100 school children (aged 12-15years) who were patients at the Dental Clinic of Children and Preventive Dentistry at the Faculty of Medicine in Foča, Bosnia and Herzegovina, during the summer semester of the school year 2016/17. Teeth examination and criteria for diagnosis and coding were estimated on the basis of the World Health Organization criteria (WHO). To estimate dental health DMFT index [number of carious teeth (D), missing (M), and filled teeth (F)] and related indices (Person Caries Index (PCI), Teeth Caries Index (TCI) and (DMFT) structure) were used.

Results: Average value of caries index (DMFT) is 7, 32. Caries is diagnosed at 99% of examined children (PCI). The average value of Teeth Caries Index was (TCI) is 28, 86%. On the average, every child had 5, 29 caries teeth (D), 0, 46 extraction teeth (M) and 1, 55 filled teeth (F).

Conclusion: The present results indicate that the prevalence of caries in children is very high. In order to improve the health and preserve the oral health of children it is necessary to organize and apply preventive-prophylactic measures.

THE FREQUENCY OF VERTICAL IRREGULARITIES IN BITE IN CHILDREN AGED 8-10 YEARS

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Introduction/Aim: Vertical irregularities of the bite include open and deep bite. Open bite is an abnormality in the vertical direction and has no vertical contact between the group of teeth antagonists in the central or habitational occlusion. Contact incisal edges of lower incisors with middle third of the upper incisors is considered to ideal depth of bite. The aim of our study was to register the percentage of children, aging 8-10 years having vertical irregularities in the bite.

Material and Method: The study included 103 children, who were patients at the Dental Clinic at the Faculty of Medicine in Foča, Bosnia and Herzegovina, during the summer semester of the school year 2016/17. The respondents undergone a clinical examination of their teeth, teeth prints in the alginate were made, study models and x-ray were analyzed. Open bite was measured from one to the other incisal edge at their most expressive spot. The deep bite was estimated on the basis of the overlap of the labial surface of the lower incisors with the upper incisors.

Results: The results showed that out of the total number of patients open bite was detected in 14.5%; while 53.7% have some form of deep bite (overlapping 1/3 to 2/3 lower incisors with upper incisors, from 2/3 to complete overlapping and complete overlapping of the lower incisors with the upper incisors).

Conclusion: There is high prevalence of vertical abnormalities of the bite in examined children. It's necessary to apply preventive orthodontics measures.

PERIODONTAL STATUS IN MIDDLE AGED PERSONS

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Purpose: Based on the review of the existing research, the insufficient data have been found on the condition of oral health in adult persons. The following research goals were to determine the socioeconomic status of the population, to evaluate the cpitn index, to examine the relation between socioeconomic status and cpitn index for population.

Methods: The sample included 310 subjects, 64.52% are female and 35.48% are male. Every person was determined as belonging to low, medium and high socioeconomic status. Clinical examination gave data regarding indicators on the condition of dental health. During the research, the relationship between the socioeconomic status and the cpitn index was established.

Results: Bad condition of oral health of the population was established. The periodontal status of the subjects is at a very low level, 38.39% of participant had dental plaques and 34.19% depth pockets 4-5 mm. The condition of periodontium is worse in the subjects belonging to low socioeconomic status. Obtained data were statistically processed and analyzed, and the results were presented in tables and charts.

Conclusion: The condition of oral health of the work-active population is at a very low level. The periodontal

status of the subjects is dissatisfactory. Persons belonging to low socioeconomic status have lower condition of oral health. This research provided valuable data which can serve as the basis for the creation of further prevention programs aimed to the improvement of oral health of the population of Bosnia and Herzegovina.

CLINICAL USE OF AAPDS GUIDELINES FOR THE MANAGEMENT OF TRAUMATIC DENTAL INJURIES: 2. AVULSION OF PERMANENT TEETH

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Introduction: Avulsion of permanent teeth is one of the most severe dental injuries and urgent treatment is decisive factor for long-term prognosis of the replanted tooth. In 2013, the American Academy of Pediatric Dentistry (AAPD), in cooperation with the International Association of Dental Traumatology (IADT), published "Guidelines for the Management of Traumatic Dental Injuries: 2. Avulsion of permanent teeth". The guide is created by experienced researchers, with various specialties based on consensus research, literature, professionals' practice and opinion. At Department of Pediatric and Preventive Dentistry at the Faculty of Dental Medicine in Sarajevo, these guide is used in case of avulsion.

Objectives: The aim of this paper is to demonstrate the successes and failures of the clinical application of the AAPD's Guidelines to Avulsed Teeth.

Conclusion: The AAPD's Guidelines for the treatment of avulsed permanent teeth has been developed by eminent and experienced experts in the field of dental traumatology. The clinical application of this guide in the prevention of permanent teeth loss increases the chances of therapeutic success and can be recommended as a good clinical practice.

DENTURE AND PATIENT – THE OBJECTIVE EVALUATION OF THE QUALITY OF DENTURE, IMPACT (INFLUENCE) ON THE QUALITY OF LIFE

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Introduction: Different questionnaires are used to assess the state of oral health and the perception of individuals regarding the impact of dental problems to the quality of their daily life. One of the most commonly used is OHIP-49 (Oral Health Impact Profile) and its shorter version OHIP-14.

Material and methods: The sample of the study consisted of the patients from all parts of BiH with partial edentulousness, patients with prosthesis. The OHIP-14 questionnaire was used to test the oral health related-quality of life, after mobile and fixed prosthodontic therapy in the Bosnian population.

Results: The results of the research will be presented in the tables and graphs.

Conclusion: OHIP-14, as a shorter version of the questionnaire examining the oral health related-quality of life, has not been used in the Bosnian population for examining the quality of life of prosthetic patients.

FORENSIC CHEILOSCOPY IN THE PROCESS OF INDIVIDUAL IDENTIFICATION

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Introduction: Forensic cheiloscopy is the method used to identify the person, based on characteristics arrangement and shape of lines that appear on the vermillion part of the lips. Lip prints are useful in forensic investigation and individual identification being considered as the important form of evidence. The lip prints are fixed, permanent and enable the establishment of classification.

Materials and Methods: This study was conducted on 40 subjects (20 males and 20 females). Materials: Red colored lipstick, cellophane tape, white paper, magnifying lens. The lip prints were classified using the Tsuchihashi's classification, proposed in 1970.

Results: The results have shown that two identical lip prints do not exist. The most frequent pattern in all participants was pattern Type I, followed by pattern Type

II, Type III, Type I', Type V and Type IV. The most frequent pattern for a woman was Type I, followed by Type I', Type II, Type III, Type V. Type IV was not found. The most frequent pattern for men was Type II, followed by Type I and Type III, Type IV, Type V, Type I'.

Conclusion: The results of the research showed that lip prints are unique. Tsuchihashi's classification is clear, simple to use and understandable for beginners. The records of lip prints is noninvasive process and could help in identification process. Because of this, it would be recommended to introduce new records into standard dental procedures. This way, a database could be created which could be used for identification processes.

AVULSION OF CENTRAL AND LATERAL MAXILLAEY INCISORS– PROPOSAL OF A CASE

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Introduction: Tooth avulsion represents the most complicated form of dentoalveolar trauma requiring serious approach. Although immediate replantation is the best choice for avulsion therapy, we are witnessing the fact that this procedure is rarely implemented caused by loss of time from the moment of trauma to the moment of therapy. In this study a case of an avulsion of two maxillary incisors is described.

Methods: Girl with central and lateral maxillary teeth avulsion came urgently at our Clinic 4 hours after the trauma. Anamnesis discovered that trauma happened at home due to the fall on table as a result of loss of conscience with unknown etiology. The avulsed teeth were in dry environment for 40 minutes whereupon they have been submerge in salted solution. At the Oral Surgery Clinic both avulsed teeth were replanted and splinted with wire composite splint for the period of 4 weeks.

Results: The tenth day after splinting root canal obturation with the Ca (OH)2 paste was done along with and definitive obturation one month later. Meanwhile, the tooth 21 was bleached and filled with composite. The patient underwent regular checkups, where on the last x-ray first signs of replacement resorption were noticed.

Conclusion: One year after replantation, we have successfully achieved aesthetics and function. However, visible replacement resorption will lead to the loss of both teeth. This outcome raise a question how to minimize the length of the extra alveolar period, and how to maintain the PDL cells vitality, which is an imperative for successful replantation.

EVALUATION OF KNOWLEDGE ON DENTOALVEOLAR TRAUMA AMONG STUDENTS AND DENTISTS

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Introduction: Dentoalveolar trauma represents an injury of tooth and the surrounding tissues. Avulsion, the hardest form of this type of trauma, is the complete displacement of a tooth from its socket in alveolar. An avulsed tooth can be replanted. Dentists play the key role in rehabilitation process, therefore their knowledge in treating the condition and their competence to act promptly are exceptionally important for trauma outcome.

Material and methods: In order to check the volume of knowledge on the topic and because of a possible need for subsequent education, references on the topic have been collected, and served as a basis for creating a survey of 23 questions. The survey was carried out among 141 students from the Faculty of Dentistry in Sarajevo (4th and 6th year students), and 18 residents from the Oral Surgery Department. The survey has been carried out online as well, and is undergoing among dentists from all over Bosnia and Herzegovina.

Results: 4th year students got 48% of the answers correct, 6th year students got 47%, while the residents achieved 36%.

Conclusion: The current results have shown a lower level of knowledge related to maintaining dentoalveolar trauma. The treatment outcome and its consequences affect physical growth, development, emotional and psychological state of the patients, especially children who are the most affected category. Therefore, further education of the target groups is needed.

POSTER PRESENTATIONS

REGENERATIVE POTENTIAL OF LEUCOCYTE - AND PLATELET - RICH FIBRIN IN PERIODONTAL THERAPY

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Introduction: Fibrin-rich thrombocytes (PRF) is an autologous blood derivative thrombolytic concentrate with a 3D structure (fibrin net) incorporating platelets, growth factors and cytokines which can be released after a period of time. PRF has favorable biological properties accelerating soft tissue healing and bone healing and has a beneficial effect on hemostasis and tissue regeneration, and as such, has the potential to regenerate periodontal tissue as well. PRF can be enriched with leukocytes (L-PRF) also having a positive influence on regeneration of periodontal tissue.

Materials and Methods: Available literature, which includes studies in which PRF and L-PRF were used during periodontal therapy, published in the last 8 years, has been analyzed. This report will present the most relevant information related to the use of PRF in regenerative periodontal therapy.

Conclusion: Based on collected research results, we can conclude that PRF significantly contributes to the more successful regeneration of all periodontal tissues.

INTERDISCIPLINARY THERAPY APPROACH TO COMBINED PERIO-ENDO LESION IN PATIENTS WITH AGGRESSIVE PARODONTITIS

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Introduction: The pulp and periodoncium are embryonically, anatomically and functionally related. They communicate through dental, lateral and access canals, and apical openings that represent the main communication path.

This paper's aim is to demonstrate a successful treatment of the second upper right premolar tooth with the pulp necrosis, the palatal abscess and deep periodontal pocket.

Materials and methods: A.R. (39) came to the Clinic of Periodontology and Oral Medicine, Faculty of Dental Medicine, University of Sarajevo, due to the swelling on the palate.
By clinical examination of the tooth 25, the depth of the probe was determined palatinally, indicating a real periodontal pocket, moving physiological barriers and a tooth not sensitive to the percussion test. Radiological analysis showed horizontal and vertical resorption of the bone and a distal periapical lesion extending towards the apex. In cooperation with an endodontic specialist, a first-class filling, a negative vitality test, and a root with one canal were determined. The diagnosis of combined perio-endo lesions was established.
The therapeutic approach included endodontic treatment and periodontal therapy. Following the chemical-mechanical treatment of the canal, a calcium hydroxide filling was placed, followed by periodontal therapy. Afterwards, the canal was permanently filled.

Results: Despite the poor prognosis, the periapex healed and the depth of the pocket decreased.

Conclusion: Periodontal and endodontic lesions can be successfully treated if diagnostic and therapeutic protocols are adequately performed. Interdisciplinary collaboration between specialists of periodontology and endodontics is the key step in this therapy.

PERIODONTAL BONE REGENERATION IN A TREATMENT OF AGRESSIVE PARODONTITIS AFTER BONE TISSUE REGENERATION - A CASE REPORT

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Introduction: Aggressive periodontitis (AgP) is dental tissue disease affecting all parts of the periodontium. It belongs to a severe form of periodontitis that begins in

puberty or in adolescence, and rarely occurs in older age. Therapy is a great challenge for periodontologist. It is characterized by the existence of infrabone deep pockets, rapid loss of supporting tooth tissue, and the presence of plaque on the teeth is not proportional to the severity of the clinical picture.

Objective: Show results of surgical treatment with bone regeneration in a patient with aggressive periodontitis.

Materials and Methods: We will present the case of patient with AgP who contacted Department of Oral Medicine and Periodontology. A complete anamnestic-diagnostic procedure, mechanical-medicament therapy was conducted. In the case report, the flap of the region 15-16 was performed using the artificial bone Maxresorb R.

Results: After a month, clinical parameters and control rtg record showed successful bone regeneration of the infrared pocket after using artificial bone.

Conclusion: An early diagnosis and therapeutic protocol involving mechanical-medical and surgical therapy is crucial for the treatment of AgP.

CLINICAL EXPPERIENCE WITH THE TREATMENT OF OROANTRAL COMMUNICATION (ADVANTAGE OF THE MODERN METHOD)

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Introduction: There are numerous surgical methods for treating oroanthral communication. The Wasmund-Rehrman method is widely accepted and relatively simple. It implies two pieces of divergent incision in the vestibulum obtained on the mobility of the cutting and covering the defect. Disadvantage is that there is no bone base, the vestibulum is significantly lowered and edema of the face is formed. The Ashley method is a single palatinal cutting which contains blood vessels allowing good blood circulation covering the defect better and more safely than vestibular cutting. Disadvantage of this cutting is a large and painful defect of the palatinal mucosa that secondary epithelizes and leaves the recesses on the surfaces. The aqueous tissue regeneration technique is relatively simple procedure. Alloderm is human collagen matrix designed to qualitatively suppress autogenous augmentation material.

The purpose of this Study is to determine the consequences of oral communications due to tooth of oroantral treatment extraction.

Methods: The study is an observational study of clinical cases from own casuistry, combined with the meta-analysis and review.

Results: Study showed a statistically significant reduction in postoperative complications in patients with advanced augmentation material.

Conclusion: After surgery treatment on certain number of patients at the Oral Surgical Department Health Center Novi Travnik, we have come to the conclusion that using classic surgical methods complications are quite common and usual in terms of sensitivity of teeth and gingiva reaching 30 % on the operated side, relapse of oroantral communication 20 %, sinus inflammation 16 % and the use of modern technology – non complication.

APPLICATION OF PRF IN ORAL-SURGERY PRACTICE OWN CASUISTRY

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Introduction: Popularization of the PRF use in oral surgery practice has been noticeable in modern dental medicine lately, aiming to better healing of bone and soft tissues after oral surgery treatments. PRF (Platelet rich fibrin) is a relatively new method where protein fibrin is extracted from the patient's blood by centrifugation method, which is rich in platelets and growth factors. PRF is a unique biomaterial, biological auto-transplant widely applied in oral surgery, but also in other branches of dental medicine. Use of PRF in oral surgery procedures contributes to faster healing of tissue, it accelerates processes of vascularization and reparation of tissue, reduces possible postoperative discomfort, such as swelling and pain which can emerge after a surgical procedure.

Aim: Aim is to display the use of PRF in several different cases in oral surgery from own casuistry.

Material and methods: PRF is in use in oral surgery practice on regular basis. We are presenting three cases where PRF was applied, two cases of apicoectomy and one where maxillary sinus was closed by placing PRF in the post-extraction wound.

Result: Through their own experience the authors showed the advantages of working with PRF and its biological attributes, which resulted in a faster postoperative recovery of a patient with minimal postoperative difficulties.

Conclusion: PRF method is safe for a patient and carries no risk. Use of PRF in oral surgery procedures significantly reduces costs and need for expensive biomaterial and it brings desirable results.

MENAGEMENT OF DENTAL PATIENTS WITH SPECIAL HEALTH CARE NEEDS - A CASE REPORT

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Introduction: Dental patients with special health needs are considered as specific problem, in diagnostic as well as in treatment. Those patients may have disabilities that are hereditary or acquired. Nevertheless, all of them have a need to be treated in general anesthesia. Mostly, they are patients with Down sy, epilepsy, cerebral paralysis, various degenerative diseases etc. General approach towards those patients is multidisciplinary including dentist, maxillofacial surgeon, pediatrician, neurologist, cardiologist, ENT and of course, anesthesiologist. In some specific cases, other specialists may be included in the preoperative team, depending on a primary diagnosis.

We will present a case report of a patient B.M., 19 years old with Idiopathic generalized epilepsy and Sy epileptica, treated under general anesthesia at the Department for Maxillofacial Surgery at the University Hospital Foča, because of multiple carious tooth and tooth root bimaxillary.

ODONTOGENIC PHLEGMON OF THE BUCCAL AND INFRAORBITAL REGION – A CASE REPORT

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Introduction: Soft tissue infection of the face, jaws and neck represents a significant medical issue. Often, they develop as a consequence of a secondary bacterial infection of odontogenic origin, rarely as a primary infection. Acute odontogenic infections may occur in two clinical and patho-anatomical forms: abscesses or phlegmona. Phlegmona is a localized area of acute inflammation of the connective soft tissue, without tendencies towards limitation and forming of an abscesses.

In our case report we will present a patient B.N., 39 years old with swelling of the right side of the face and infraorbital region, trismus and raised body temperature being subsequent to a toothache one day before hospitalization at the Department for Maxillofacial Surgery of the University Hospital Foča. After a detailed clinical examination, X-ray diagnostic and blood analysis, surgery was performed with the administration of antibiotics (intravenous and intramuscularly). After this procedures carried out with the respect of the algorithm for treatment of odontogenic phlegmonas, the signs of infection have gone with good local and overall state of the patient.

MENAGEMENT OF ODONTOGENIC INFECTIONS AT THE DEPARTMENT OF MAXILLOFACIAL SURGERY AT THE UNIVERSITY

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Introduction: Infections of the orofacial region are majority odontogenic. A tooth infection can spread to surrounding tissues and distant areas that in some cases needs hospital care.

Material and methods: In the retrospective study, patients were admitted to the UKC RS at the Department of Maxillofacial Surgery from 2012 - 2017 with the diagnosis of dental infection.

Results: Out of 244 identified patients, 141 (58%) were men and 103 (42%) women. The subject tooth was reported in all patients. 23 (10%) patients were treated conservatively and 221 (90%) surgically. Only conservative antibiotic therapy was applied in smaller, limited inflammatory infiltrate with good general condition, the inflammatory changes with signs of regression, and cases of recurrence. Surgical therapy was performed in patients with clear or less pronounced fluctuation, with signs of spreading infection and disturbed general condition. Immediately with surgery started antibiotic therapy. Surgery was performed by extraction in 73 (30%) cases, and when not sufficient the incision was performed in 99 (40%). Only incision, intraoral and/or extra-oral was carried out in 46 (19%) patients. In 3 (1%) cases trepanation of the tooth and evacuation of purulent content was performed through root canal with the use of antibiotics.

Conclusion: Surgery has a central place in the treatment of odontogenic infections. With the measures of central tendency and standard deviation of 1.2%, we established the reliability of surgical therapy in the management of dental infection.

COMPLICATIONS OF ODONTOGENIC INFECTIONS AT UNIVERSITY-CLINICAL CENTAR OF REPUBLIC SRPSKA BANJA LUKA IN FIVE-YEAR PERIOD

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Introduction: The frequency and type of complications of dentogenic infections depend on the number of factors, and the most important are (in)adequate treatment, the stage of infection and the presence of significant comorbidities (diabetes, steroid therapy, organ transplants, malignancy, chemotherapy, chronic renal disease, malnutrition, alcoholism, end-stage AIDS).

Material and methods: The retrospective study analyzed the number and type of complications of dentogenic infections in the period 2012-2017 at the Department of Maxillofacial Surgery, UKC RS Banja Luka. The data were collected from medical documentation.

Results: Out of 224 identified patients, 141 (57.78%) were men and 103 (42.21%) women, the average age 36 (the youngest 2 and the oldest 82 years). The average length of hospitalization was 3.8 days. After treatment (surgery, antibiotic and/or suppressive therapy) in 45 (18,44%) cases it was necessary to consult physicians of other specialty due to other disease in these patients, or due to a weakened immune system. 10 (4.10%) patients had complications during the treatment of dental infections: 3 (1.23%) patients were allergic to the drugs, 2 (0.82 %) patients had the postoperative bleeding, 3 (1.23%) thrombophlebitis, 1 sepsis (0.41%) and 1 (0.41%) had a lethal outcome. The cause of death was not associated to a dental infection, but due to cardiac problems.

Conclusion: Complications could not be avoided. It is important to recognize them immediately and respond promptly in order to minimize them.

IMPLANT-PROSTHETIC POSSIBILITY FOR REHABILITATION OF PARTIALLY EDENTULOUS PATIENTS WITH ASSOCIATED ATRITION OF TEETH – A CASE REPORT

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Introduction: Attrition is the loss of hard tooth tissue caused by tooth to tooth contact during functional or parafunctional jaw movements. The physiological attrition is characterized by an uniform physiological wear of the tooth substance, while the pathological attrition is associated with mineralization disorders and parafunctions.

Materials and methods: A 70-year-old male patient appeared in "Dental Clinic Dr. Davor Planinić" for dental intervention. After anamnesis, clinical examination and x-ray images, attrition of teeth 14, 13, 12, 11, 21, 22, 23 and decreased occlusal vertical dimension were diagnosed. In the lower jaw there was bilaterally shortened dental arch. A CBCT imaging (Cone Beam Computed Tomography) was performed, a 3D implant positioning plan was created (Implant Planer, ZirkonZahn), and a surgical template was made (CAD CAM, ZirkonZahn M5), by means of which two implants on each side were placed in the lower jaw (Implant Direct Legacy 3). Endodontic treatment of teeth 12, 11, 21, 22 was preformed and core build-up was made (FRC, Relyx unicem). After that, teeth 14, 13, 12, 11, 21, 22, 23 were prepared for crowns and definitive prosthetic restoration was performed with seven single crowns in the upper jaw and two tree-unit bridges in lower jaw (Multilayer Zirconium-high Translucent, WhitePeaks). Bite guard was made and night wearing recommended.

Conclusion: A proper approach in treating patients with dental attrition is possible with adequate indications and therapeutic methods, while respecting basic aesthetic, functional and minimal invasive principles of contemporary dentistry.

CENTRIC RELATION: WHEN AND WHY

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Introduction: Since 1930ies there were 26 definitions of centric relation and it was a subject of numerous academic discussions.

Problem analysis: In the central relation, the condylum, disk and masticatory muscles are not exposed to load. Therefore, the central relation is a healthy basis for many restorations. CR can be found regardless of the presence or absence of the tooth. It is used in prosthetic rehabilitation in the absence of a large number of teeth. This paper describes the need to use the central relation which method is most reliable.

Conclusion: The position of the centric relation remains of great importance for prosthetic rehabilitation because it does not differ greatly from the position of maximum

inter-cuspidation and therefore is a therapeutic compromise.

THE DEGREE OF RESIDUAL RIDGE RESORPTION IN COMPLETELY EDENTULOUS PATIENTS

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Introduction: Residual ridge resorption is a continuous and irreversible process being greater during the first few months upon tooth extraction than later. In the first fifteen years, the resorption degree of mandible is moderate in 50 % of patients and severe in 50% respectively. Some authors reported that bone resorption is more expressed in women than in men.

The aim of this study was to examine the degree of residual ridge resorption in completely edentulous patients and the relationship between the degree of residual ridge resorption and gender.

Material and methods: A total of 60 participants, totally edentulous patients, of both sex, aged between 40 and 70, participated in this study. The research was conducted at the Department of Prosthodontics at the Faculty of Dentistry, University of Sarajevo. Ortopantomographic images were made with the same digital ortopantomographic equipment Kodak 8000C Digital Panoramic and Cephalometric System. The measurements were performed by using measuring instrument of the computer program Kodak Dental Imaging Software 6.11.7.0. The degree of residual ridge resorption was determined by the Wical and Swoope method, modified by Ortman.

Results: The mean value of degree of resorption (IC/IM) was 2,124 on the right side, and 2,177 on the left side of mandible. Results chi-square test demonstrated no statistically significant difference for IC/IM between gender groups.

Conclusion: The moderate degree of resorption was the most represented. There is no gender-related differences for resorption degree.

MAGNETOTHERAPY IN DENTISTRY – A CASE REPORT

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Introduction: Increasing awareness of oral hygiene and demanding dentistry work should offer available methods for oral hygiene assistance. Magneto-therapy by pulsating electromagnetic field (PEMP) acts on the regenerative function of the bone system, on faster wound healing and on bone stimulation. The purpose of this report is to determine the clinical improvement of the gingival and mucosa condition of the implant and to improve the periodontal index post magneto-therapy.

Materials and Methods: Examination was performed to determine the condition of the tooth/tissue support around the implant. The approximate plaque index (API), the papilla bleeding index (PBI), the periodontal pocket depth (PD) and the gingival/mucosa retraction were measured by periodontal probe. After removal of dental deposits and instructing for proper maintenance of hygiene, we suggest magneto-therapy by pulsating electromagnetic field during 16 minutes, 3-4 times a week, 1250 μT, 200 Hz(Sanza,Santerra, Piding,Germany). Parameters were measured 30 days after therapy.

Results: Examination found a poor condition of the tooth/mucous support tissue around the implant before therapy. Tooth:API:1;PBI:1;average value PD:3.25mm, gingival retraction-0mm;Implant:API:1;PBI:1; average value of PD:3.5mm; retraction of mucous-0mm.

At the end of magneto-therapy, improvement of gingival/mucous and periodontal indexes were observed. Tooth:API:0;PBI:0;average value PD:2.5mm; retraction-0mm; Implant:API:0;PBI:0;average value PD:2.75mm; retraction-0mm.

Conclusion: We conclude that proper hygiene and supportive magneto-therapy can improve the values of periodontal indexes and clinical findings to determine the improvement of gingival/mucous condition. To obtain more relevant results it is necessary to conduct further research on more subjects.

PROBIOTIC IN DENTISTRY

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Introduction: Probiotics are microorganisms which presence in human body have a positive effect in the sense of keeping good health, as well as, more rapid and successful

healing. Microbiome of the oral cavity is the best place for the usage of probiotic. By this research we wanted to evaluate the influence of the previously applied probiotic upon the clinical parameters of periodontal disease. The product BioGaia - *Lactobacillus reuteri Protectis* was used in the form of lozenge. The patients were instructed to suck one per day. The UZ therapy was not done before using probiotics. Patients didn't have any systemic disease, antibiotic treatment or milk allergy.

Materials and methods: Plaque Index (PI), Gingival Bleeding Index (GBI) and probing pocket depth (PPD) were registered in 113 patients. All patients were using probiotics BioGaia once a day during 30 days. After that the clinical measurements were done again.

Results: From the total number, at 110 patients the signs of inflammation were present (97, 34%). A month after the application of probiotics the significant decrease of inflammatory values were established. PI was reduced from 36,36% to 20,9% .GBI 34,54% to 22,72%.PPD 29,10% to 10%.

Conclusion: The appliance of probiotics has a positive effect upon control of biofilm. Although the further researches are necessary the introduction of probiotic is recommended.

THE MOST COMMON INDICATIONS FOR THE PERMANENT TEETH EXTRACTION IN THE AREA OF BANJA LUKA

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Introduction: Tooth extraction is an oral-surgical procedure where the tooth is removed from the dental alveolus. Although prevention is the basic starting point of modern dentistry, the number of extracted teeth is still very large.

The aim of this study is to identify the main reasons for the extraction of permanent teeth in the area of Banja Luka.

Material and methods: The five-month study was performed by a general dentist. The records about the reason for tooth extraction, type of tooth, oral hygiene, gender, age and personal anamnesis were taken for all the participants.

Results: The study included 300 extracted teeth. The most common reasons for the extraction were avital teeth with no treatment options, more than half of them (55.3%), then periodontal disease (37%), while the rarest cases were for orthodontic reasons (1.6%). Significant correlation between tooth extraction and oral hygiene was confirmed, only 0.6% of extracted teeth had good oral hygiene. Somewhat more cases of extracted teeth were recorded by the male population, (56%). Also, a large number of extracted teeth (54.6%) were recorded for the participants with a positive personal anamnesis.

Conclusion: This study confirmed that organized prevention in dentistry in the Banja Luka area is not at the enviable level. Poor oral hygiene is considered a major direct risk factor for tooth loss.

DIAGNOSTIC PROTOCOL IN DENTO-ALVEOLAR TRAUMATOLOGY

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Introduction: Dento-alveolar trauma is tooth and the surrounding tissues injury caused by external forces. It is one of the most common traumas, especially in children and adolescents age, and can result in fracture, dislocation and tooth decay, soft tissues injury and bone fracture. In addition, brain structures can also be damaged thus emphasizing the urgency of these conditions. Rapid and efficient response increases the chances of a good prognosis and prevents the physical and mental consequences.

The aim of this paper is to form cardboard with systemic questions, in precise order, to reach a proper diagnosis and thus provide adequate therapy.

Methods: Having reviewed recent medical literature, special cardboard was developed for data to be collected in the case of dento-alveolar trauma. The card contains personal data sheets, history, detailed description of the injuries, subjective difficulties, clinical and radiographic data, patient's medical status data, general condition of the dentition and parts for the treatment plan.

Results: The cardboard should be placed in visible place in the clinic making easier for the therapist to pass through the anamnestic protocol, without omitting any of questions crucial for dental trauma for further therapy.
The card can also be used as a written record in court-medical expertise.

Conclusion: The existence of a unique protocols for dento-alveolar trauma is of extraordinary significance because it allows us to give proper medical care to the patient quickly and efficiently and if necessary, refer him for further treatment or examination.

THE USE OF MOUTH-GUARDS AMONG ATHLETES ACTIVE IN MATERIAL ARTS

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Introductions: Dental trauma is the most common injury of the orofacial system that can occur during sports activities. In order to prevent dental trauma, protective mouth-guards have been constructed and their use in the martial arts is compulsory.

Aim: The aim of this paper was to determine the prevalence of mouth-guards use in athletes actively involved in martial arts as well as the experiences and attitudes regarding the use of mouth protectors.

Materials and methods: Data were collected from 30 athletes (19 men, 11 women), aging between 18 and 30 years. Respondents completed an anonymous survey and the data obtained were statistically processed.

Results: Half of the respondents were actively involved in martial art jiu-jitsu (50%), one third of them trained judo, and other respondents were boxers, karate and taekwondo practitioners. Almost one third (26.7%) of respondents performed sports activities professionally, while others were amateurs (73.3%).
All respondents (100%) confirmed that they were informed regarding the properties and benefits of mouth-guards. They learned about mouth-guards through the media (46.7%), while only one respondent received this information from the dentist.
When it comes to the type of appliances, almost all respondents (96%) used universal shields, while only one respondent used an individual shield made by a dentist.

Conclusion: Mouth-guards are very useful appliances in sports-related dentoalveolar injury prevention. Athletes and their trainers should, through educational programs, be more familiar with the protective function of the mouth-guards. Dentists should play more active role in promoting the use of mouth-guards among athletes.

ESTHETIC RECONSTRUCTION OF UPPER LEFT PEG-SHAPED LATERAL INCISOR

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Introduction: Upper lateral incisors are in phylogenetic reduction presenting the evolution process characterized by reduction of number and size of the teeth. This paper will present the example of esthetic reconstruction of tooth crown in patient MM who was diagnosed with hypodoncy of upper right lateral incisor, persistency of deciduous upper right canine and rudimentary form of the upper left lateral incisors (peg shaped incisor), based on clinical and OPG analysis.

Material and Methods: Esthetic planning of smile was made in Digital smile design, followed by wax-up on situation model and manufacture of silicon key that was used for palatal and aproximal surfaces build-up. Esthetic reconstruction of tooth crown was made by layering technique using dentin and enamel colors of nanochibrid composite material.

Results: This way of work achieved preservation of maximally healthy tooth tissue, improvement of function, lower material costs and satisfying esthetic results.

Conclusion: Preoperative designing approaches such as wax-up and silicon index as a restoration guide have been successfully applied in practice for improving the esthetic appearance of the anterior dentition and remodeling of the morphology of tooth crown.

COMPARISON OF EFFICACY OF INTER-DENTAL BRUSHES AND DENTAL FLOSS TOWARDS DECREASING DENTAL PLAQUE

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Introduction: The low level of oral hygiene has for a consequence a large quantity of dental biofilm being accumulated on teeth and other places in the oral cavity. As dental biofilm is the main cause of caries and periodontal diseases, the incidence of caries and periodontal disease formation is bigger when there is irregular oral hygiene. The aim of the research was to prove the efficacy of using toothbrushes, inter-dental brushes as well as dental floss in order to reduce the value of Plaque index (PI) and the Approximal plaque index (API).

Materials and methods: The research was implemented on Faculty of Medicine in Banja Luka, Department of Periodontology and Oral Medicine. 25 healthy persons participated, aging 19-23, over a period of one month, with follow ups on 7, 14 and 21 day.

Results: The decrease of PI was noticed at an average value of 0, 45 to 0, 19, and decrease of API from 95, 12% to

75, and 26% on the left and from 93% to 53% on the right side respectively.

Conclusion: With the use of basic products for maintaining oral hygiene following motivation and persistence, the significant decrease of PI and API was noticed. The greater efficacy of interdental brushes in decreasing the value of API was proven rather than use of the dental floss.

CONCRESCENCE OF PRIMARY MAXILLARY INCISORS – A CASE REPORT

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Introduction: Double teeth formations appear more freequently in the deciduous than in permanent dentition, and are most commonly in the front teeth. The prevalence in primary dentition is 0.5-0.8%. Double formations in the primary dentition are followed by aplasia of the permanent successor in 20 %—75% cases. This group of anomalies include: fusion - synodontnia which represents joining of two or more adjacent dental germs, gemination resulting from incomplete division of teeth, shizodonthia resulting from complete division of dental germ and concrescence which represents anomaly in which two fully formed teeth are joined along the root surfaces by cementum.

The aim: of the study is to describe the rare case of a a concrescence involving supernumerary maxillar lateral incisor, lateral incisor and central incisor in a 4 year old boy.

Clinical case: A 4 year-old boy reported to the dental clinic because of a pain in the upper right incisor region. Clinical examination revealed three cariously destructed teeth crowns on the right side, positioned between central maxillary incisor of the oposite side and a canine on the same side. Furthermore, a fistula on the mucosa of the apical region above the teeth was present. Radiographically, besides extensive radiolucency in the apical region of teeth, fused roots of all of the three destructed teeth were revealed. The extraction was a therapy of choice, due to severely destructed crowns and uncooperative patient.

Conclusion: Since management of double teeth is challenging, early diagnosis and intervention is essential for the timely and succesfull treatment.

DENTAL CROWN FRACTURE WITHOUT OPEN PULP

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Introduction: Fracture of enamel and dentine (uncomplicated crown fracture) is the loss of tooth tissue limited to enamel and dentin, without opening the pulp chamber. These injuries account for 18, 2% - 45.8 % of all tooth fractures. Visual inspection shows loss of enamel and dentine without exposed pulp. Usually, the tooth is not movable, it is not percutaneous sensitive (except if there is no associated periodontal injury), the vitality test is positive. The forecast of these traumas is favorable, pulp necrosis occurs in 1 – 6% cases. The goal of the treatment is to protect the pulp from external factors and to provide normal function and aesthetics. Dental treatment includes the reimbursement of the lost part of the crown of teeth with composite materials.

Aim: To show the treatment of traumatic fracture of the crown of tooth with unfinished growth and root development in seven-year-old boy.

Method and material: According to the dental trauma guide protocol (Dental Trauma Guidelines) the tooth crowns were compensated by the use of composite materials by the method of complete etching. The exposed surface of dentine is covered with a calcium-hydroxide based preparation.

Results: After the completion of the procedure, function and aesthetics were provided, and a small patient returned a smile on the face.

Conclusion: Contemporary composite materials facilitate the treatment of traumatic tooth injuries.

FREQUENCY OF ORTHODONTIC ANOMALIES IN EIGHT-YEAR-OLDS IN THE MUNICIPALITY OF FOČA

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Introduction: Incorrect position of teeth and orthodontic anomalies cause various problems such as disturbed aesthetics, disturbance of oral functions (chewing, swallowing and speech), increased inclinations of trauma, periodontal disease and caries. Orthodontic anomalies can be the cause and disorders of oral function (chewing, swallowing, and speech).

Material and method: The research was conducted in the primary school Sveti Sava in Foča, where a total of 127 children (69 boys and 58 girls) were surveyed aged 8-9 years. With each student for whom there was an informative consent of parents and school directors, a dental examination was performed with a standard dental method, a mirror and a probe using artificial lighting. Children received instructions on proper nutrition, hygiene, tooth protection and elimination of bad habits. Parents were informed by registered orthodontic anomalies through teachers.

Results: Sagital abnormalities of the bite were present in a total of 39 (32%) children, while a total of 44 (36.1%) anomalies related to vertical irregularities of the bite, with 14 (11.5%) respondents having open bite and 30 subjects (24.6%) deep bite $p < 0.05$. Crowded was observed in 52 subjects (42.7%): primary crowded was found in 28.4% of subjects, and secondary crowded at 12.59% $p < 0.05$.

Conclusion: For an eight-year-old, it is necessary to begin with the use of preventive and interceptive measures as soon as possible, in order to preserve the aesthetic and functional characteristics of hard dental tissues.

ORTHODONTIC CARE FOR CHILDREN WITH MENTAL DISABILITIES – CASE REPORT

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Introduction: People with psychophysical development are individuals who have one or more physical, medical, mental or emotional problems. It is estimated that of the total number of children 5-8% are impaired in psychophysical development. According to the types of disorders, there are sensory disorders (vision, hearing), communication (speech, language skills), psychological, physical and combined disorders. Many studies have shown that compared to healthy people with disorders in psychophysical development have significantly less oral hygiene, and numerous other dental problems.

Case Report: Patient D.K, born in 2006 accompanied by one parent, appears at the Clinic of the Faculty of Dentistry in Foča. After taking anamnesis, clinical examination and X-ray examination, a diagnosis of caries of a number of teeth was set. Due to lack of cooperation and refusal of dental treatment in a girl, an intervention was reported in general anesthesia in which teeth extracted 11, 14, 15, 21, 22, 23, 24, 25. A mobile orthodontic device was indicated to the patient. After 8 weeks, teeth prints in the alginate were taken and study models were made. The patient received a mobile orthodontic device that compensates aesthetic and functional characteristics.

Conclusion: For patients with this problem, the team work of a children's dentist and orthodontist is needed in order to make an adequate treatment plan, preserve space for later prosthodontics and provide aesthetic and functional characteristics until the end of growth and development, when adequate prosthetic intervention is possible.

INTERDISCIPLINARY APPROACH TO SOLVING THE PROBLEM OF OLIGODONTIA – A CASE REPORT

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Introduction: Oligodontia is considered as rare condition consisting of the congenital absence of six or more teeth, excluding the third molars. The loss of several permanent teeth causes masticatory impairment with long-term problems, including a negative impact on the remaining teeth. Previous studies have reported a prevalence of around 0.1% to 0.3% considering the worldwide population. The etiology of oligodontia includes several hypotheses such as traumatic injury during tooth development, endocrine disturbances, infections, as well as radiation or chemotherapy during childhood cancer therapy.

Case Report: An eight-year-old boy, accompanied by his parents, appeared at the Faculty of Dental Medicine in Foča. After the anamnesis and clinical examination of the teeth, rtg recordings and analyzes, study models were made, after which the diagnosis of oligodontia was made. From the anamnesis, we learn that the emergence of dairy teeth has gone smoothly and that hypodionation is present in mother. After a week, the boy was made mobile orthodontic appliances that compensate aesthetic and functional characteristics.

Conclusion: The consequences of missing teeth are many and depend on the number and type of missing teeth. The most common disorders of speech and mastication function and aesthetic problems caused by disturbance of growth and development of the orofacial area, which can manifest beyond the mouth. In people with oligodontion an early and accurate diagnosis is needed, and careful plan of the treatment with the vision of the final solution.

REPRESENTATION OF IRREGULARITIES OF NEGATIVE OVERBITE IN 7-15 YEAR OLD CHILDREN PATIENT OF THE PUBLIC INSTITUTION HEALTH CENTRE OF THE SARAJEVO CANTON

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Introduction: The proper relationship of the incisor in the sagittal plane implies that the upper frontal teeth are placed in front of the lower. The normal distance between the vestibular surfaces of the lower and palatal surfaces of the upper incisors is 2-3 mm. Incorrect relationship between the incisors can be observed at the beginning of the eruption. The cause of the negative overbite is the oral inclination (more often in the central) or the palatinal position of the individual teeth (more often in the lateral incisors).

Aim: The aim of the study was to examine the frequency of negative overbite in school children in the Sarajevo Canton.

Material and Method: The study was conducted at Public Institution Health Centre of the Sarajevo Canton, Department of Orthodontics. We examined 188 study models and medical cards, 106 boys and 82 girls, taken from March 2016 to March 2018. The impressions were taken with orthodontic spoon in the alginate, after which they were cast and analyzed.

Results: The results show that 37 children of 188 had a negative overbite, which is 19.7%, 20 girls (10, 6%) and 17 boys (9, 1 %).

Conclusion: The high incidence of negative overbite in children can be prevented by early interceptive measures and corrected by orthodontic therapy. Negative overbite is an orthodontic irregularity that falls under the priorities for early orthodontic treatment.

POSSIBILITY OF RELAPSE CORRECTION AFTER ORTHODNTIC TREATMENT WITH ORTHO-ALIGNERS

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Introduction: Retention is an integral part of orthodontic treatment and represents a period after the removal of fixed orthodontic appliance and stability of the achieved results is maintained by means of fixed or mobile retention devices. Returning of teeth to the original position after treatment is called a relapse and is mostly a consequence of failing to follow the instructions for wearing the retention appliance.

Case Report: Patient S.T. (18) is diagnosed with crowding in the area of the lower incisors that occurred as a relapse after completed orthodontic treatment due to failure to follow the instructions for wearing the retention device. The treatment plan implied the use of ortho-aligners to correct the existing orthodontic irregularity. Computer analysis established that it is necessary to create a set of 6 individual ortho-aligners.

Conclusion: Ortho-aligners represent a fast, efficient and precise method for correcting relapse caused by irregular or incorrect application of retention appliances after completed orthodontic treatment.

MICROSCOPIC AND NANOSCOPIC TECHNIQUES IN ANALYSIS THE SURFACE STRUCTURE AND DAMAGE OF TOOTH ENAMEL

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Introduction: This paper will analyze microscopic and nanoscopic techniques used in testing surface structure and tooth enamel damage with special accent to the Atomic Force Microscopy- AFM.

Material and Methods: Work material included 50 permanent teeth. Teeth were immediately placed into the solution of artificial salvia, in order to preserve physiological enamel mineralization. Afterwards, etching material has been applied and left for 30 seconds. Thereafter, surface to which etching agent was applied, and after thorough dry cutting of tooth enamel was conducted to the following dimensions of 3mm x 2mm x 2mm, followed by polishing of surfaces which are to be scanned. Samples of tooth enamel were fixed to the AFM Microscope JSPM-5200. Image analysis was carried out with use of WinSPM program.

Results: On the basis of the obtained values of roughness parameters for the untreated and etched –treated teeth we came to the conclusion that mean values of roughness

for etched-treated samples are higher than the mean values of roughness parameters for untreated samples ranging from 22,26 % to 39,93%.

Conclusion: Obtained results from the analysis of etched enamel as a preparation for the bonding of brackets show significant structural changes compared to the untreated samples. All the parameters for roughness measuring are significantly higher in acid treated surfaces. AFM images of etched enamel zones show in addition to micro cavities, zones of prism structure damage in a wider range.

INFLUENCE OF NATURAL SWEETENERS IN PROTECTION OF TOOTH ENAMEL

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Introduction: This paper analyzes activity of natural sweeteners (xylitol and stevia) in protection and repair of tooth enamel from the activity of soft drinks. First, we will analyze to what extent the natural sweeteners such as xylitol and stevia may protect and repair enamel surface from damage caused by aggressive soft beverages like Coca Cola, and then compare the results of enamel structure with ultra structure obtained with SEM.

Material and Methods: Work material included 96 human teeth extracted for orthodontic reasons, which were divided into 3 groups. These samples were prepared for the analysis according to standard procedure. After the treatment with appropriate preparation for that type of analysis, samples were prepared for the analysis with Scanning Electron Microscope (SEM).

Results: In stevia samples, analysis of mineralized masses has shown that crystals are smaller and more directed. In deeper parts where there was obviously no stronger corrosive activity of soft beverage basic prism structures are observed. In addition, crystal structures are developed from the spherical globule on the surface. Directivity is found in deeper layers where transfer from amorphous to crystal mass occurs.

Conclusion: Tooth enamel in contact with xylitol in vitro shows less pronounced roughness caused by corrosive activity of soft beverages. Xylitol and stevia show potentials as sweeteners in Cola drinks for prevention of demineralization of enamel and help its repair.

IMPACT OF DIABETES MELITUS ON MORPHOLOGICAL CHANGES IN THE PULP

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Objective: The aim of this study was to determine the morphological changes in the pulp of rat tooth with experimentally induced DM after immunohistochemistry, 14 and 30 days after the exposure of animals to lead.

Material and methods: The study was conducted in rats of Wistar strains divided into three groups (2 experimental and one control). Experimental animals received lead-acetate at a concentration of 1500 ppm via water ad libitum and diabetes mellitus in these animals was induced by Alloxan. Longitudinal sections of the rat dental pulp tissue were analyzed by pathohistological and immunohistochemical analysis.

Results: An analysis of the morphological changes in rat tooth pulp who received lead in water for 14 days with experimentally induced DM indicated morphological changes in pulp in 88% of cases, while groups of rats who received lead in water for 30 days of this change were recorded in only 54.5% of cases. There was no statistically significant difference in the presence of morphological changes in the investigated groups (Hi square = 25.918; p <0.001). The presence of morphological changes in the pulp was not observed in any sample of rat tooth from the control group.

Conclusion: Morphological changes in pulp were most common in the group of rats with experimentally induced DM who took lead for 14 days.

SILICONE KEY METHOD IN THE CASE OF COMPOSIT RESTAURATION OF THE FRACTURED TOOTH

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Material and methods: A 9 years old boy was admitted to the Medical Specialist Centre Dr Radojković accompanied

by his parents who reported an unfortunate event. During a game, boy fell down and hit his head on a side walk. It was a direct hit in his upper jaw which caused a fracture of the upper central left tooth. Based on obtained imprint with alginate mass, a model was made in hardwood plaster. The model depicts a fractured tooth in gypsum on which was shaped, with melted wax, a future restauration of the tooth. Once that the wax was attached, the imprint was made with the silicone mass by placing it on a palatal side of the tooth. Silicone Key serves as a matrix on which is applied.

Conclusion: The production of silicone key allows: more accurate replacement of lost tooth tissue and more precise work in case of modelling layered composite filling.

EVALUATION OF THE SUCCESS OF ENDODONTIC TOOTH TREATMENT IN STUDENTS OF DENTISTRY AT THE UNIVERSITY OF BANJA LUKA

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Introduction: This study evaluated the technical quality of root canal treatment (RCT) and detected iatrogenic errors in undergraduate dental students in Banja Luka.

Material and method: The success of endodontic therapy was evaluated on 34 RTG images. At the Department of endodontics, the one-month practical work of the fifth year medicine students was evaluated. A sample of 34 endodontically treated teeth with diagnosis of pulpitis was selected. We used Step-Back technique and filled with cold lateral condensation of the gutta-percha with AH plus. Parameters that were analyzed included: obturation length, radio-density, broken instruments in channel.

Results: In 19 (57.57%) teeth, RCT was adequate and without procedural errors. However, in 15 (44.11%) teeth, RCT contained procedural errors. The frequency of procedural errors in the entire sample was 44.11% as follows: broken instruments 3.03%, voids in the obturation 18, 18%, under-filling 24, 24%.

The technical quality of RCT performed by undergraduate dental students was classified as adequate in 57, 57% of cases.

Conclusion: Conduct an analysis of students' theoretical knowledge, indicate areas with low percentage of success, and improve student training at preclinical and clinical levels.

RE-TREATMENT OF ENDODONTICALLY TREATED TEETH – ROOT CANAL RE-TREATMENT

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Introduction A re-treatment of the root canal is a clinical procedure in which endodontic treatment is repeated as the previous one has been evaluated as inadequate or unsuccessful.

Case report: NN, a 16-year-old patient, came to the outpatient clinic of the Health Centre "Novo Sarajevo" due to the pain in the area of the lower jaw front teeth. Clinical examination and RTG analysis found the presence of a chronic periapical process as a result of incomplete permanent tooth obturation 31, 32, 41. Such condition represents the absolute indication for the repetition of endodontic treatment. After established diagnosis, the re-treatment of the root canal was initiated:
- the former filling was removed,
- the length of the prepared canals was determined,
- mechanical and medicated treatment was performed, and calcium hydroxide paste was inserted as a temporary filler for a month period.

The absence of subjective symptoms, monitored on a control RTG scan, was a condition for permanent obturation, followed by the conservative care of the tooth crown with the composite material.

Result: The treatment resulted in the clinically positive flow of periapical lesions reparation, disappearance of painful sensations after permanent root canal obturation, all accompanied by comparative analyses of control radiological findings.

Conclusion: Successful endodontic therapy implies proper implementation of each of the endodontic treatment phases. The endodontic therapy plan is based on proper diagnosis, adequate indications and careful selection of the treatment methods.

THE IMPORTANCE OF EARLY DIAGNOSIS OF LARYNGOPHARYNGEAL REFLUX (LPR) IN PREVENTION OF DENTAL DIEASES

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Introduction: LPR is defined as reflux of gastric content into oesophagus, pharynx, larynx and oral cavity. Prevalence of the disease is high and can be the one of

common reason to visit a dentist and family medicl doctor. Reflux of gastric content in oral cavity is one of the most important causes for damaging the enamel. It happens without any symptoms until progressive stage. Enamel begins to dissolve at pH 5,5. Gastric content has very low pH. Acid food and gastric content activate pepsinogen in pepsin causes the progressive erosions of dental enamel and oral tissues. New method of examining pepsin in saliva PEPTEST can conform the presence of pepsin in oral cavity and diagnosis of LPR.

The aim: is to emphasize that the early diagnosis of LPR with non-invasive procedures (PEPTEST) and specific dietary measures have an important role in the prevention of erosions.

Patients and methods: 120 patients (82 female, 38 male, ages 25-50 years) from two institutions ("MedicusA" and Polyclinic Doboj-Jug) had laryngeal symptoms and erosions of dental structures. PEPTEST was performed at 50 patients.

Results: Positive PEPTEST from this group was found at 46 patients (92%). This group was treated with lifestyle modification, the use of alkaline food and water, alginates and high doses of proton pump inhibitors. All patients had an adequate improvement of the condition.

Conclusion: PEPTEST is simple, non-invasive and we can apply it easy in dental practice. With early diagnosis of LPR we can prevent enamel erosions and others structures in oral cavity.

EARLY DENTAL SERVICES AND ORAL-HYGIENE PRACTICE AT INFANCY

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Background: According to American Academy of Pediatric Dentistry: "First dental visit by the first birthday", the best time for the first dental checkup is by the end of the first year. As important as this is, to start early and maintain a good oral-hygiene practice at infancy.

Aim: The aim of this research was to reveal the practice of dental visits and oral-hygiene habits in early children`s age.

Design: A randomized sample of 216 parents of children attending kindergartens in municipality of Banja Luka, completed questionnaires, in order to assess their behavior and knowledge toward children`s utilization of dental services and oral-hygiene practice.

Results: Only 2.31% of examined children visited the dentist by the end of the first year of life and almost 50% of the preschool children have not yet been at the dental checkup. We discovered that 10% children for the first time visited the dentist due to toothache. About 14.29% of questioned parents did not start oral-hygiene practice at their children.

Conclusions: Parent`s behavior and knowledge about early and regular use of dental services and good oral-hygiene at their children is not satisfying. Therefore, further action in oral health education is necessary as soon as possible.

AVERAGE ANNUAL USAGE OF ORAL HYGIENE PRODUCTS IN BOSNIA AND HERZEGOVINA

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Introduction: One of the most important preservation and improvement of oral health measures is oral cavity hygiene, where mechanical plaque control with toothpaste usage is the most effective and widespread administration method. Methods of achieving good oral hygiene practice include tooth brushing at least twice a day with toothpaste and daily usage of dental floss. However, very few people are carrying out adequate and regular oral hygiene to ensure that their oral health is satisfactory. The aim of this study was to determine the average annual usage of oral hygiene products per capita in BiH.

Materials and Methods: The research was based on the Foreign Trade Chamber of Bosnia and Herzegovina import data of oral hygiene products as well as on the Nielsen Trade Panel in BiH sales data on toothbrushes and toothpastes.

Results: The results showed that the consumption of toothbrushes in BiH per capita in the previous 2017 was 0.88 pieces, while consumption of tooth paste was 2.44 pieces. In Croatia, the consumption of toothbrushes per capita is 1.40 pieces, and in Serbia 0.84 pieces, while consumption of toothpaste per capita in Croatia was 3.13 pieces, and in Serbia 1.98 pieces.

Conclusions: If there were no adequate records of oral health products consumption, we could not be aware of the oral health status of the population. Data of oral hygiene products consumption among the Bosnian and Herzegovinian population are devastating, and are contrary to the recommendations and expectations.

THE STATE OF ORAL HEALTH IN CHILDREN AND ADOLESCENTES IN BOSNIA AND HERZEGOVINA

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Introduction: According to the definition of the World Dental Federation, oral health includes the ability to speak, laugh, smell, taste, touch, chew, swallow and transmit emotions with facial expressions reliably, and without pain, restlessness or disease of the craniofacial complex.

The World Health Organization specifically recommends that regular national population surveys are carried out every five years.

In the last 25-30 years, our national epidemiological study of oral health state was not conducted. Therefore, the aim of this descriptive study was to present the collected oral health parameters data for children and adolescents from certain parts of Bosnia and Herzegovina from previous period.

Materials and Methods: After searching the available recent literature according to the key words in the group of children and adolescents from Bosnia and Herzegovina, in the period from 2003 to date, a total of twenty literary sources have been found.

Results: In indexed age groups of children and adolescents, dmft ranged from 4.9 to 10.1 and DMFT ranged from 0.66 to 10.5, with up to 99.8% of prevalence. CPITN index was 1.28, with up to 85.4% of prevalence. The need for orthodontic treatment had 53.6% to almost 90% of respondents.

Conclusion: According to incomplete national epidemiological data, the oral health state in children and adolescents in Bosnia and Herzegovina is poor. It is necessary to conduct a comprehensive epidemiological research at national level, and after obtaining the results to work on the improvement strategy.

PREVALENCE OF MAXILLAR LATERAL INCISOR AGENESIS IN ORTHODONTIC PATIENTS

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Introduction: Irregularities in the number of teeth can occur in primary and in permanent dentition. In permanent dentition, after third molars and other mandibular premolars, most often missing are maxillary lateral incisors. When there is no expected tooth eruption and when its absence is confirmed radiographically, the lack of teeth is diagnosed as a congenital anomaly. The maxillary lateral incisor can be completely lacking (hypodontia), and it can occur as overdose (hyperdontia), and we can say that it is genetically labile tooth and is in the phylogenetic reduction. Phylogenetic reduction is an evolutionary process that has been going on for thousands of years, characterized by a reduction in the number and size of the teeth.

Materials and Methods: The research sample consists of 140 orthopthalmographic images and study models - persons with a chronological age from 12 to 27 years, of which 65 men and 75 girls. The records are taken from the archive of the Dental Clinic Dr.Pinjić, all records being encrypted, and there are data on the chronological age of patients, gender, name and surname. Using the research instruments, the frequency of the appearance of the agent, the frequency between the sexes and dental quadrants will be determined.

Results: All data obtained will be statistically processed.

Conclusion: By early detection of hypodontia, it is possible to plan a multidisciplinary approach to the patient and to achieve minimal complications of congenital anomalies and to preserve the aesthetic appearance and functionality of the system.

FREQUENCY OF THE TRANSITION STAGES E/F OF DENTAL DEVELOPMENT WITHIN THE DEMIRIAN METHOD

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Introduction: Dental age estimation has a significant role in pedodontics, orthodontics and forensic sciences, and development of teeth is a reliable parameter for dental evaluation especially in children. Studies have shown that dental age estimates by a radiological method are reliable and that the Demirian method is a simple and convenient method for determining dental age. The purpose of this study was to determine the frequency of the transition stages E/F of dental development within the Demirian method.

Materials and Methods: The study sample consists of 46 orthopantomographic images of chronological age 7 to 14 years of which 15 boys and 31 girls. The recordings are

from the archives of Orthodontics Department, Department of Dental Medicine with Clinics in Sarajevo, all the recordings are encrypted, and from the recordings there are data on the chronological age of patients, sex, name and surname. All the photographs were taken with a microscopic camera and measurements were made of all lower left quadrant teeth, which corresponded to the E and F stages at Demirian, in the ImageJ program using the linear measurement tool. The teeth were measured from the top of the crown and the top of the root to the cement-enamel junction, determining the length. Four measurements were made for each individual tooth.

All the data obtained will be statistically processed.

Conclusion: All processed statistical data will be used in the conclusion.

ATTITUDES, KNOWLEDGE AND AWARENESS OF THE UNIVERSITY OF SARAJEVO STUDENTS REGARDING TEETH WHITENING

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Introduction: White teeth have always been a proof of health and imperative of beauty. No matter how much we care about health of our teeth, the fact is that their color is mostly genetically determined, result of factors affecting during the time of teeth development, and it changes with ages. The possible solution is tooth whitening procedure. Despite the generally accepted view that it is a cosmetic surgery exclusively, tooth whitening is a serious dental procedure that requires a significant degree of dentist skills and knowledge, and often good preparation and adequate control period.

Aim: The aim of this work is to compare the knowledge, attitudes and awareness of the students of the University of Sarajevo about teeth whitening.

Materials and Methods: During the survey, the respondents filled out a questionnaire consisting of 20 questions.

Results: There are differences in the level of knowledge among students from different faculties. The students of medical science are more aware of the possible medical implications of tooth whitening procedures. Non-medical science students are not at all aware of this unwanted effects. A significant number of subjects would independently carry out the bleaching process, without any dentition or dental check.

Conclusion: The effect of education is obviously decisive for student attitudes. In order to avoid harmful unwanted effects on the teeth, it is essential that dentistry doctors provide additional information on oral health and teeth whitening procedures for population.

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Books:

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