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Stomatološki vjesnik

CONTENTS / SADRŽAJ

Dear Readers

we present to you another of issue of *Stomatološki vjesnik / Stomatological review*.

Unusually great pleasure for us is to introduce the new issue of the scientific journal, which is recognized in the following databases: ICI (Index Copernicus International), DOAJ (Directory of Open Access Journal), EZB (Electronishe Zeitschriftenbibliothek)

Without your valuable work we wouldn't have been able to accomplish that. Certainly we also have to thank our distinguished reviewers who, during the last year, contributed their valuable time and effort to make your articles get the necessary scientific assessment.

Thanks to that we have in front of us nine valuable original scientific and professional papers as well as the review of the book "The News From Dental Treasure Chest"(Neues aus der dentalen Trickkiste Band II, Die dentale Trickkiste) by Wolfram Bücking.

Believing that this issue will be an incentive for further cooperation in the coming period, we wish you a happy and successful year 2014.

Editorial

Cijenjeni čitatelji

predstavljamo vam još jedan broj našeg *Stomatološkog vjesnika*.

Neobično je zadovoljstvo predstaviti novi broj časopisa koji je prepoznat u bazama ICI (Index Copernicus International), DOAJ (Directory of Open Access Journal), EZB (Electronishe Zeitschriftenbibliothek)

Bez vaših vrijednih radova ne bismo uspjeli. Svakako moramo zahvaliti našim uglednim recenzentima koji su nam protekle godine darovali dio svog dragocjenog vremena i truda da bi vaši članci dobili potrebnu naučnu ocjenu.

Zahvaljujući tome danas ispred sebe imate devet vrijednih stručnih naučnih radova kao i prikaz knjige "The Dental Treasure Chest" Wolframa Bückinga.

Vjerujući da će vam i ovaj broj biti podsticaj za saradnju i u predstojećem periodu želimo vam sretnu i uspješnu 2014. godinu.

uredništvo

COMPARISON OF DENTAL AND CHRONOLOGICAL AGE IN CHILDREN FROM SARAJEVO WITH DIFFERENT SAGITAL SKELETAL MALOCCLUSIONS – A PILOT STUDY

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ABSTRACT

Background: The purpose of this study was to estimate chronological age of children with skeletal sagittal malocclusions, using dental age estimation methods, and to investigate whether dental age assessment methods produce comparable estimates of chronological age in skeletal Class I, II and III.

Methods: The sample consisted of panoramic dental images and lateral cephalograms of 231 orthodontic patients (127 girls and 104 boys) ageing from 5.9 to 15.8 years, collected at the Department for Orthodontics, Faculty of Dentistry University in Sarajevo. Dental maturation was evaluated according to the Willems and Demirjian methods, while saggital skeletal relationship was evaluated using the ANB angle from lateral cephalograms. The ANOVA was used to evaluate the relationship between skeletal malocclusions and dental age estimates.

Results: Dental age methods overestimated chronological age. The Demirjian method overestimated the age of girls by 1.24±1.03 years, and age of boys by 0.80±1.03 years. The Willems method overestimated the age of girls by 0.36±0.98 years, and that of boys by 0.44±0.98 years. No differences were found in estimates of chronological age using skeletal pattern methods ($p>0.05$).

Conclusions: Dental age methods overestimated chronological age of sampled children, the Willems method yielded smaller estimation errors and is therefore suggested to be more appropriate for chronological age estimation than the Demirjian method. Based on this pilot study, there is no difference between dental maturation among different sagittal skeletal growth patterns. However, further studies with larger sample are required.

Introduction

Dental age assessment (DAA) methods in children are important in clinical orthodontics and pedodontics for treatment planning and diagnostics [1]. They are particularly useful for legal cases when age should be obtained in criminal matters and procedures for processing cases of immigrants and can help in assessing the age and identification of the individual skeletal remains in forensic odontology and bioarchaeology [2].

DAA can be evaluated by observation of eruption and mineralization of the developing teeth. Calcification of teeth is more consistent for DAA given that mineralization of teeth is continuous process not influenced by external factors including extraction of deciduous teeth, underfeeding, orthodontic anomalies and others inherited and acquired conditions [3-5]. Regardless of the existence of different DAA methods, a perfect system of chronological age estimation has not been created and all methods have various over- or underestimation on different samples and for different populations.

Among different methods for DAA, the most used methods are these of Demirjian et al. [6,7], which evaluate mineralization of seven permanent teeth from left side of mandible. Because of great difference between dental age (DA) and chronological age (CA) when using Demirjian et al. method in different population reflected mostly by an overestimation, many authors suggested adjustment of original methods for their population [8]. Willems et al. [9] adopted and simplified original Demirjian methods. Willems' method was more accurate when compared to Demirjian methods in various populations [10-14]. If during growth and development, the various skeletal patterns influence the process of dental maturation this can be important factor in orthodontic treatment planning and for subdividing the populations when age assessment methods are tested.

The results of study by Celikoglu et al. [15] showed that DA, obtained using Demirjian method, at patients with sagittal skeletal malocclusions was approximately twice more advanced when compared to patients without sagittal skeletal anomaly patterns. Therefore, the purpose of this study was to investigate if the difference in estimation of the chronological age using two dental age methods can be found in various skeletal sagittal patterns.

Sample and Methods

The sample consisted of panoramic (OPG) and lateral cephalogram (LC) images of 231 pretreatment orthodontic patients (127 males and 104 females) ageing from 5.9 to 15.8 years from the Department for Orthodontics, Faculty of Dentistry University of Sarajevo, Bosnia and Herzegovina. All OPGs and LCs were taken and stored using KODAK 9000C Digital Panoramic and Cephalometric System (KODAK, USA). OPGs were analyzed for DAA.

For being introduced in this study, all examinees should have had all permanent mandibular teeth including the second molar, as well as complete dental and medical history without hereditary or systemic diseases. The development of all left permanent mandibular teeth with the exception of the third molar was rated on an 8-stage scale from A to H. Dental age assessment was performed according to the Demirjian's and Williems' method, separately for each gender [7, 9].

Sagittal skeletal pattern was evaluated on lateral cephalograms in AxCeph Cephalometric X-ray Analysis Software (AUDAX, Slovenia). The landmarks Nasion (N), Subspinale (A) and Supramentale (B) were determined on lateral cephalograms and ANB angle was measured. Subjects were classified as Class I skeletal pattern when ANB angle value ranged from 0 to 4 degrees, as Class II with ANB angle greater than 4 degrees, and as Class III with ANB angle under 0 degree.

Distribution of skeletal classes among the sample is presented in **Table 1**.

Gender	Sagital Skeletal Relationship		
	Class I	Class II	Class III
Male	25	45	34
Female	41	57	29
Total	66	122	63

Table 1. Distribution of sagittal skeletal patterns for all subjects

Null-hypothesis was that there is no difference in dental maturation in diverse sagittal skeletal growth patterns using both DAA methods. The comparisons between the DA and CA were made by means of the t-test. Analysis of Variance (ANOVA) was used to test the differences between DA and CA (DA-CA) among different skeletal patterns, separately for each gender. All statistical analyses were performed using the SPSS software package program (SPSS, version 16.0, SPSS Inc, Chicago, Ill). Statistical significance was set at 0.05.

Results

Both DAA methods overestimated chronological age for both genders (**Figure 1 and Figure 2**). The Demirjian method overestimated the age of girls by 1.24±1.03 years, and age of boys by 0.80±1.03 years ($p<0.05$). The Willems method overestimated the age of girls by 0.36±0.98 years, and that of boys by 0.44±0.98 years ($p<0.05$). Results of statistical analysis for sagittal skeletal pattern (Class), and two age assessment methods, Demirjian and Willems, are presented in **Table 2**. The null-hypothesis (no difference in dental maturation in different sagittal skeletal growth patterns) is confirmed because no statistically significant difference was found in the differences between dental and chronological age among different skeletal patterns ($p>0.05$).

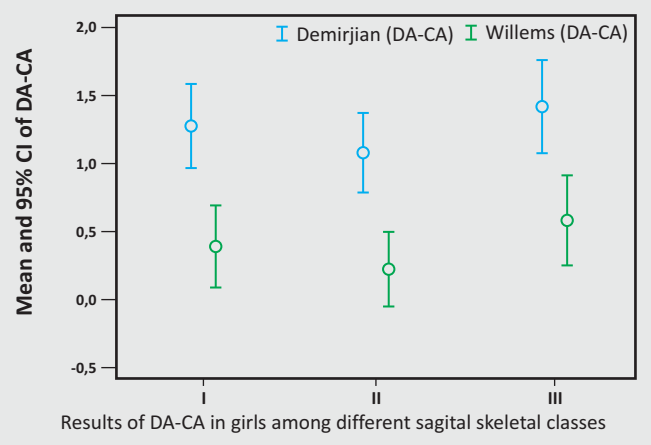

Figure 1. Mean values and 95% Confidence Interval (CI) of dental age (DA) and chronological age (CA) difference (DA-CA) in Class I, Class II and Class III for girls

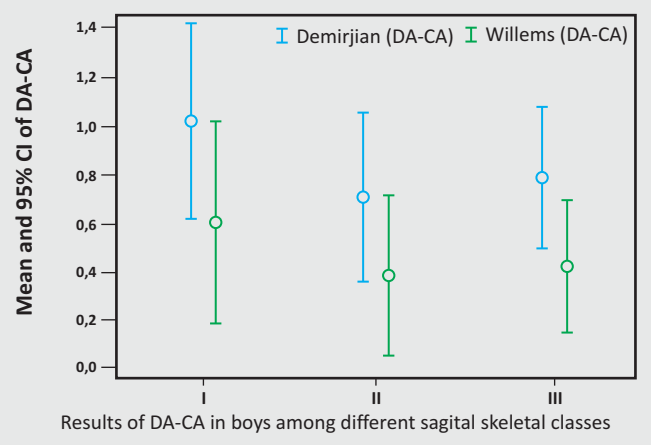

Figure 2. Mean values and 95% Confidence Interval (CI) of dental age (DA) and chronological age (CA) difference (DA-CA) in Class I, Class II and Class III for boys

Gender			Sum of Squares	df	Meanf Square	F	*p*
Boys	Willems	Between Groups	0,80	2	0.40	0.41	0.66
		Within Groups	98,66	101	0.98		
		Total	**99,46**	**103**			
	Demirjian	Between Groups	1,63	2	0.82	0.76	0.47
		Within Groups	108,24	101	1.07		
		Total	**109,87**	**103**			
Girls	Willems	Between Groups	2,58	2	1.29	1.35	0.26
		Within Groups	118,32	124	0.95		
		Total	**120,89**	**126**			
	Demirjian	Between Groups	2,43	2	1.21	1.15	0.32
		Within Groups	130,77	124	1.06		
		Total	**133,20**	**126**			

Table 2. Results of ANOVA test of between-subjects effects for difference between dental and chronological age (DA-CA) for sagittal skeletal pattern (Class) for Demirjian and Willems methods

Discussion

Dental age assessment methods in children have importance in clinical and forensic dental practice. Regardless of the existence of different methods, an integral system has not yet been created to address differences in ethnical and racial groups [8].The purpose of this study was to estimate the chronological age of children with various skeletal sagittal malocclusions, using two dental age estimation methods, and to investigate if skeletal Class I, Class II and Class III influence dental age. Chronological age was estimated using Demirjian and Williems methods for age estimation. Demirjian method is most commonly used for determination of dental age. In this study, the Demirjian method overestimated the age of girls by 1.24±1.03 years, and age of boys by 0.80±1.03 years. Results indicate that children form region and from the city of Sarajevo showed more advanced dental development when compared to French–Canadian standards. This is in compliance with the findings for different European and worldwide populations [13, 14, 16-20]. A possible explanation for this might be a result of secular trends in growth and development during the last 35 years but also might be attributed to the diversity and specificity among nations and ethnic groups. The Williams revised method by Demirjian and reported better accuracy of his method when compared to Demirjian. In this study Willems method overestimated the age of girls by 0.36±0.98 years and of boys by 0.44±0.98 years.

The result of this study showed no statistically significant differences among different skeletal malloclusion of mean results of differences between dental age and chronological age, Table 2. Results of this study do not coincide with previously published results by Celikoglu M et al. [15].They reported that patients with skeletal malocclusions showed more advanced dental age than subjects without skeletal malocclusions. The difference was highest in patients with mandibular prognathism.

Conclusions: Dental age methods overestimated chronological age of sampled children where the Willems method yielded smaller estimation errors and is therefore suggested to be more appropriate for chronological age estimation than the Demirjian method. Based on this pilot study, there is no difference between dental maturation among different sagittal skeletal growth patterns, however further studies with larger sample are required.

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INFLUENCE OF THE SEX ON THE DENTAL AGE ESTIMATION IN ADULTS

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ABSTRACT

Dental techniques for estimating age in adults over 20 are based on regressive changes on the teeth. Regressive changes on the teeth of adults, such as translucency of root dentin or the accumulation of secondary dentin decreasing the size of the cavum of the pulp, are directly dependent on age. The aim of this study is to ascertain if sex influences the estimation of dental age in adults. The sample includes 60 teeth, of which 37 came from male subjects, and 23 from female subjects extracted for other reasons (periodontal, prosthetic or orthodontic). All samples were subjected to 3 methods of age estimation: the Bang-Ramm method for intact teeth (dental method 1), the Bang-Ramm method for sectioned teeth – longitudinal tooth sections (dental method 2), and the Kvaal-Solheim method for extracted teeth – the radiological method (dental method 3). Results of the age estimation were compared to real chronological age of the persons from whom the teeth were extracted. The average dental ages estimated using dental methods 1, 2, and 3 significantly correlate with the chronological age for both men and women, with certainty of up to 99 %. However, the paired t-test showed that there is a significant difference between chronological age and dental age estimated by Kvaal-Solheim method ($p<0,01$) for males, while both Bang-Ramm methods proved to be reliable. In females, on the other hand, only dental method 2 (Bang-Ramm for sectioned teeth) proved to be reliable. From the obtained results it is reasonable to conclude that sex can influence the dental age estimation in adults.

Key words: dental age, adults

Introduction

Dental techniques for estimating age in adults over 20 are based on regressive changes on the teeth [1, 2, 3, 4]. These regressive changes may be the result of age, function or pathology.

In essence, dental tech-niques for age estimation in adults can be divided into three main groups:

- morphological techniques (observing regressive changes directly on the teeth),
- radiological techniques (observing regressive changes on X-rays of the teeth), and
- biochemical methods (racemisation of L- and D-determine acid in dentin collagen)

Morphological techniques can again be divided into those that observe changes on intact teeth and those that observe changes on teeth sections. Radiological dental techniques are always non-sectioned, and are especially applicable in the identification of living persons or in cases where teeth cannot be altered or invaded (e.g. in studies of anthropological samples). In 1970, Bang and Ramm [2,4,5,6] published their method, which takes into account only one regressive change, the translucency of the root dentine. After the measurement of translucent dentine, and depending on the resulting figure, the polynomial of the first or second degree was used. The constants used for age estimation were given in the papers published by these authors, and they differ depending on whether the measurements were carried out on intact or sectioned teeth. The appearance of translucent root dentin is still not fully explained phenomena but it is thought that of all the regressive changes it is most prominently linked to ageing. Another important contribution to the age estimation based on dentin translucency was the research of Vasilidis which indicated the fact that translucent dentin is created in "butterfly form", and that the manner of making cross-sections can affect the appearance of translucency [7]. In 1992, Lamendin [8] presented technique for age estimation in adults that uses two parameters, root translucency and resorption of the alveolar bone (periodontitis). For this method, the standard deviation between the estimated and real age is $\pm$10 years. Kvaal and Solheim worked on using dental radiography to estimate age and presented their "non-destructive" dental methods.

These non-sectioned or non-destructive methods of age estimation are highly regarded in archaeological studies and in identifying living persons where we cannot afford to "sacrifice" a tooth [9, 10, 11]. Prince and Ubelaker tested the Lamendin method on samples of various origin and came to the results that estimated age varies by ±8.2 years from actual age [12]. Wilems in his research also used only translucency as an indicator of age with an error margin of 9.04 – 11.26 years [13].

In 2005, Sarajlić et al. published the results of their research made on 847 single root teeth, where they tested the Lamedin and Prince methods and the formulae Sarajlić derived according to these methods when applied them to the Bosnain-Herzegovinian population [14].

In Croatia, Brkić et al. researched three dental methods, the Bang-Ramm for sectioned teeth, the Kvaal Solheim method and the Johanson method. By regression analysis they arrived to new formulae recommended for age estimation of deceased persons from the Croatian population [15].

There are many ongoing research projects in the world today dealing with issues of dental age estimation. It is believed that using statistical methods, subjective judgments by researchers are prevented thus enabling more precise age estimation. It is generaly accepted that dental methods give different accuracy in different populations. The aim of this study is to ascertain if sex influences the estimation of dental age in adults.

The material and methods

The research sample was stratified and made up of intact, single-root teeth from the upper and lower jaw. The sample contained a total of 60 teeth. All of the teeth were extracted in stomatological surgeries (general stomatology and oral surgery) following referrals by specialists (for parodontological, prosthe-

tic or orthodontic reasons). Each patient gave verbal consent for the extracted tooth to be used for research purposes. All the samples were subjected to 3 methods of age estimation:

- the Bang-Ramm method for intact teeth (dental method 1)
- the Bang-Ramm method for sectioned teeth – longitudinal tooth sections (dental method 2), and
- the Kvaal-Solheim method for extracted teeth – the radiological method (dental method 3)

Following extraction, the teeth were placed in individual containers and the sex and age of the patient at the time of extraction were noted, as well as the sample code. The information about the actual chronological age and sex were taped over in order to avoid researcher bias. The teeth were washed under a jet of running water and steeped in a disinfectant – 5% chlorhexidine (HibibosG, Bosnalijek, BiH) for 5 minutes, then rinsed and dried by dryer air.

Then, all of the teeth from the sample were individually X-rayed by an in vitro Philips Oralix X-ray at the Faculty of Dentistry in Sarajevo, using a film holder and parallel technique. The film holder was used to standardise the film-focus distance, and the exposition time was 0.32 seconds. The images were fixed and developed with the same high quality. The codes of the sample teeth were noted on their X-rays. Using a standard light sources, the length of the translucent zone of the root dentin was measured in millimetres for each tooth, starting from the apex of the root and going in a coronal direction to the edge of the translucent and opaque dentine (according to the Bang-Ramm method for intact teeth (Dental method 1) [6]. The measurement was performed by digital callipers with a precision of ±o, o1 mm. After the measurements of the intact teeth, cross-sections of teeth were made using the "half tooth" technique according to Solheim [16]. Translucency of the sectioned teeth was measured and obtained figures were inserted into age estimation formulae of the Bang-Ramm method for sectioned teeth [6]. The radiographs of the sample teeth were subjected to several other measurements and dental age was estimated according to method of Kvaal and Solheim for extracted teeth (Dental method 3) [9]

Results

The sample included 60 teeth, of which 37 came from male subjects, and 23 from female subjects.

The link between chronological age and dental age of samples obtained from male and female subjects respectively was tested using Pearsons' correlation (**Table 1, Figure 1, Table 2, Figure 2).**

As it can be seen, the average dental ages estimated using methods 1, 2, and 3 are clearly and significantly linked with the chronological age for both men and women, with certainty of up to 99 %.

The arithmetic median, standard deviation and standard error for chronological age and dental ages estimated by three methods were given separately for male and female (**Table 3, Figure 3, Table 4, Figure 4).**

However, paired t-test was used to compare the chronological age and the values obtained using three different methods in order to examine the impact of sex on accuracy of the dental methods used.

	Actual age
Age estimated using method 1	.91***
Age estimated using method 2	.84***
Age estimated using method 3	.65***

N = 37; *** p < .001

Table 1.
The link between chronological age and dental age estimated using different methods on teeth extracted from male subjects.

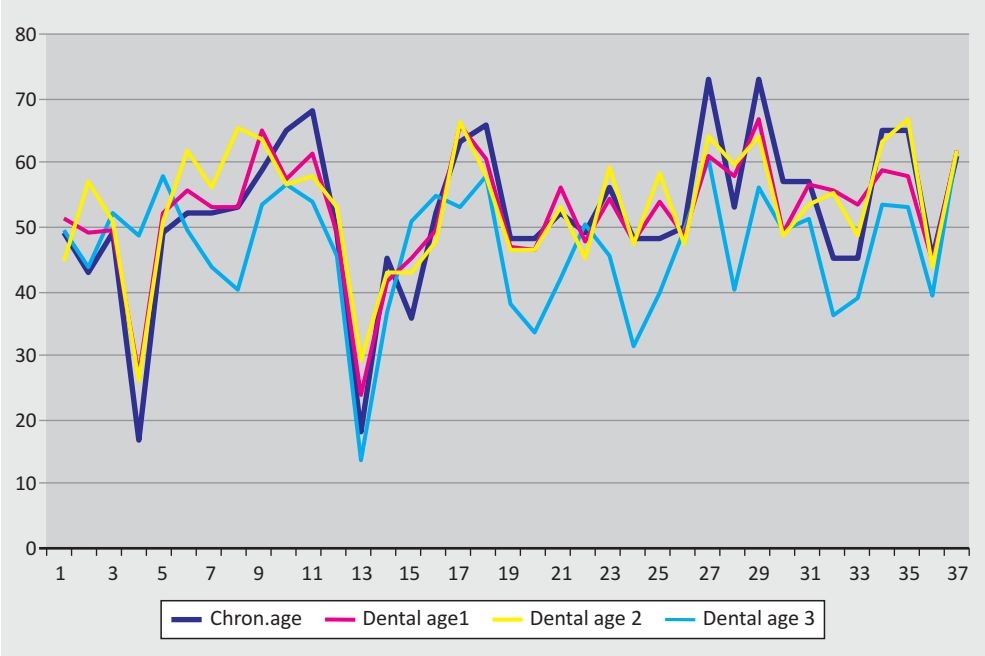

Figure 1.
The link between chronological and dental age (males)
– Dental age 1: age estimated by Bang-Ramm method for intact teeth;
– Dental age 2: age estimated by Bang-Ramm method for sectioned teeth;
– Dental age 3: age estimated by Kvaal-Solheim method for extracted teeth

	Actual age
Dental age estimated by method 1	.81***
Dental age estimated by method 2	.68***
Dental age estimated by method 3	.75***

N = 23; *** p < .001

Table 2.
The link between chronological age and dental age estimated using different methods on teeth extracted from female subjects

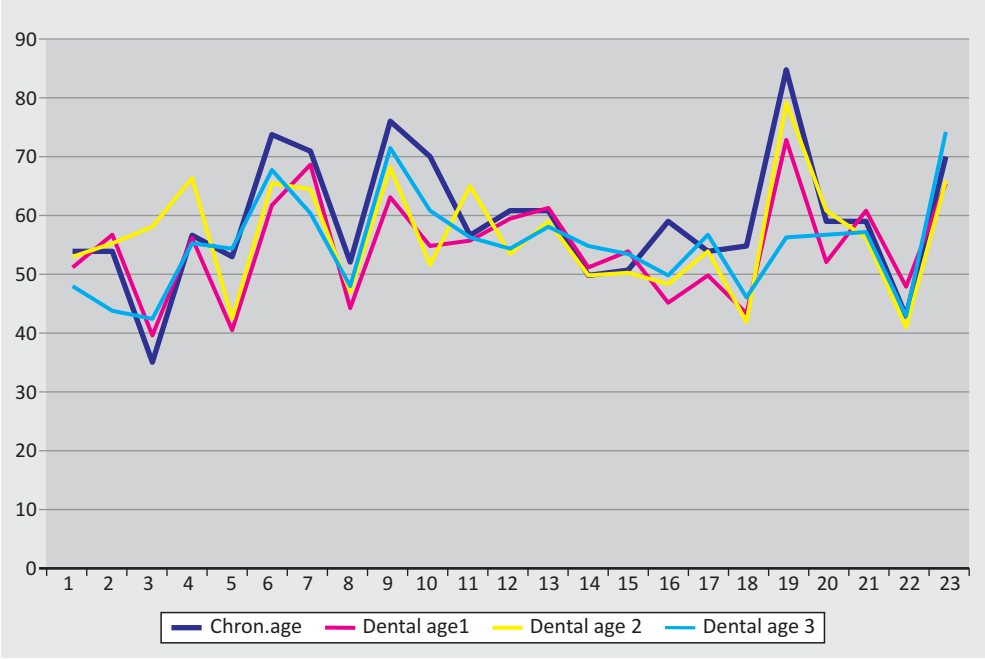

Figure 2.
The link between chronological and dental age (females)

Age	M	N	SD	S_e
Chronological age	51.97	37	12.00	1.97
Dental age estimated by method 1	52.32	37	9.00	1.48
Dental age estimated by method 2	53.03	37	9.56	1.57
Dental age estimated by method 3	46.82	37	9.66	1.59

Table 3.
Arithmetic median (M), standard deviation (SD) and standard error in the arithmetic median (Se) for chronological and dental ages of male subjects.

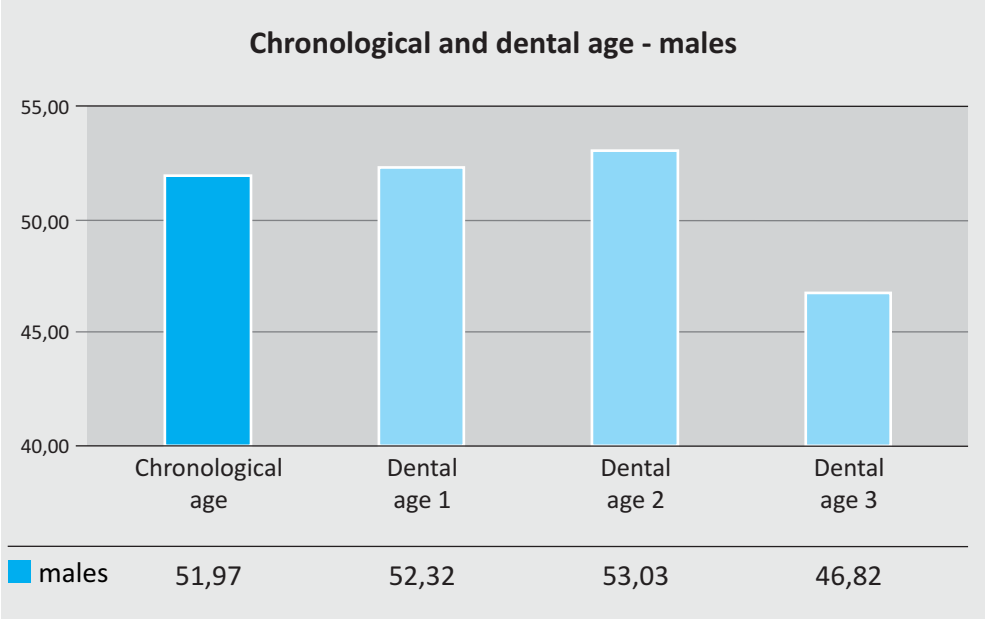

Figure 3.
Median value of chronological and dental ages of male subjects

The paired t-test confirmed that average values of the chronological age show statistically significant difference from the dental age estimated by dental method 3 (for male subjects). Methods 1 and 2 for estimation of dental ages showed no statistically significant difference when compared with chronological ages of male subjects, i.e. methods 1 and 2 proved to be accurate for male subjects, unlike method 3 **(Table 5).**

In samples obtained from females, the paired t-test showed that average chronological ages was statistically significant different when compared with dental ages estimated using methods 1 and 3. Dental ages obtained using method 2 show no statistically significant difference when compared with chronological ages of female subjects, i.e. only method 2 proved to be statistically accurate **(Table 6).**

Discussion

Regressive changes in teeth are the basis for numerous dental methods for estimating age in adult persons.

In their work, Bang and Ramm [6] calculated the correlation for each type of tooth and established a variation between 0.50 and 0.93. This corresponds to our results, where the Bang-Ramm dental methods 1 and 2 delivered the following results: for Bang-Ramm method 1, the correlation coefficient was 0.91 for male subjects and 0.81 for female subjects respectively. For Bang-Ramm method 2, in this research, the correlation coefficient was 0.84 for male subjects and 0.68 for female subjects.

Age	M	N	SD	S_e
Chronological age	59.13	23	11.17	2.33
Dental age estimated by method 1	54.63	23	8.88	1.85
Dental age estimated by method 2	56.46	23	9.65	2.01
Dental age estimated by method 3	55.20	23	8.31	1.73

Table 4.
Arithmetic median (M), standard deviation (SD) and standard error in the arithmetic median (Se) for chronological and dental ages of female subjects.

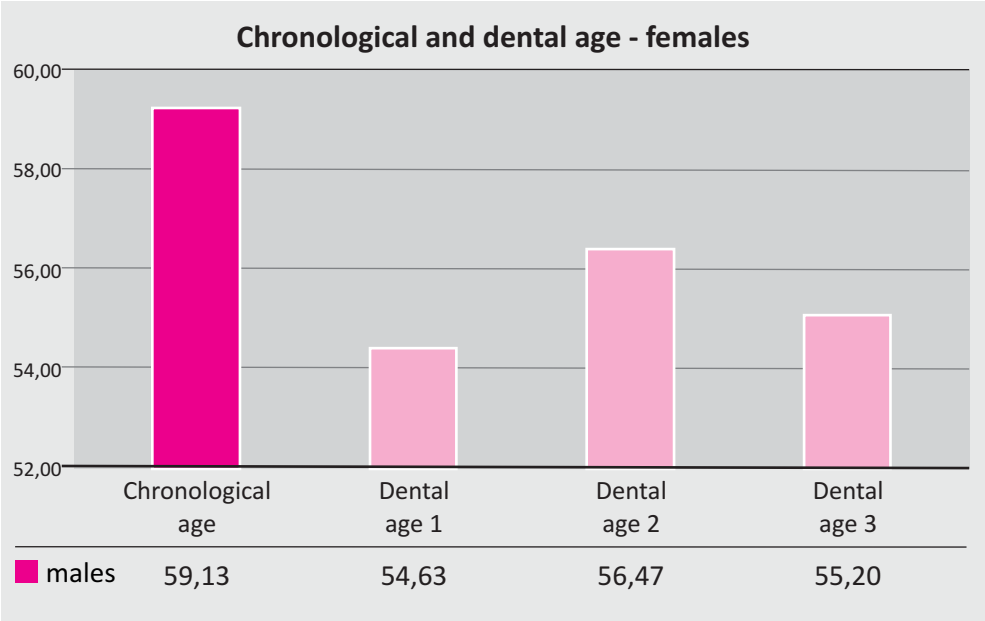

Figure 4.
Median value of chronological and dental ages of female subjects.

As for differences between chronological age and average dental ages estimated using different methods within a single sex group, the paired t-test showed that the average chronological age was statistically significantly different compared with the dental age 3 for teeth extracted from male subjects. Dental ages estimated by methods 1 and 2 proved to be accurate for estimating age for male subjects, unlike method 3. In the case of estimated dental age for teeth originated from female subjects, the paired t-test found that only method 2 proved to be statistically accurate. As it can be seen, methods 1 and 2 proved to be the most reliable for estimating dental age in male subjects, and method 2 was the most reliable for female subjects. In the case of dental age estimations made by Kvaal-Solheim method, sex had an influence on accuracy of the method.

Although our research used the so-called intact teeth (no decay or restorative work), they were used throughout the lifetime of the persons they were extracted from. The teeth were thus affected by abrasion and attrition, and erosion, though to a smaller extent. Also, there is a theoretical possibility for some of the teeth to have been exposed to different trauma during their functional time, as those persons could have suffered from systemic diseases. All this could impact regressive changes such as root dentin translucency or deposits of secondary dentin [17]. Vandevoort et al. [18] showed that new techniques should be introduced, such as micro-focus computer-based tomography, allowing for greater precision in estimating dental age on the basis of parameters of the secondary dentin (measured indirectly in terms of pulp-root ratio). Cameriere et al. [19] showed that it

Pairs of comparison	t-test						
	t	df	sig.	M_{diff}	S_e	95% conf. interval	
						low	high
DV_0 i DV_1	**-.39**	36	**.69**	-.35	.89	-2.17	1.47
DV_0 i DV_2	**-.96**	36	**.34**	-1.06	1.08	-3.26	1.14
DV_0 i DV_3	**3.37**	36	**.002**	5.15	1.53	2.05	8.25

Table 5.
Paired t-test to compare chronological age (DV_0) and dental age estimated by Bang-Ramm method for intact teeth (DV_1), Bang-Ramm method for sectioned teeth (DV_2) and Kvaal-Solheim method for extracted teeth (DV_3) for teeth of male subjects

Pairs of comparison	t-test						
	t	df	sig.	M_{diff}	S_e	95% conf. interval	
						low	high
DV_0 i DV_1	**3.31**	22	**.003**	4.50	1.36	1.68	7.32
DV_0 i DV_2	**1.51**	22	**.15**	2.66	1.76	-.99	6.32
DV_0 i DV_3	**2.54**	22	**.02**	3.93	1.54	.73	7.13

Table 6.
Paired t-test to compare chronological age (DV_0) and dental age estimated by Bang-Ramm method for intact teeth (DV_1), Bang-Ramm method for sectioned teeth (DV_2) and Kvaal-Solheim method for extracted teeth (DV_3) for teeth of female subjects

was possible to estimate the age using the pulp-root ratio by using only the x-rays of canine teeth. What makes their research interesting is the fact that when analysing x-rays, they evaluated the entire tooth area and the entire pulp area, and not just their width in certain levels, as Kvaal and Solheim did.

Saglam Atsu et al. [20] suggested that using of the ratio between the length of the translucent zone and the root length should be used instead of direct measurement of translucency, as well as the ratio between total translucency surface and total root surface.

In previously mentioned research of Brkić et al [15] the results showed a correlation between sex and the estimated age, but it was not a significant one. Our study showed that sex did impact the precision in two out of three dental methods tested.

In this research, the dental methods tested delivered the estimated age that was in clear correlation with the actual age, to the level of significance of $p<0.001$. For teeth extracted from male subjects, the correlation coefficient ranged from 0.65 to 0.91, depending on the method. For teeth extracted from female subjects, the correlation coefficient was between 0.68 and 0.81.

Reppien, Sejersen and Lynnerup [21] conducted a retrospective study which covered a period of 21 years examining all cases in which dental age was estimated in relation to the actual age. Their results showed that in all cases over those 21 years the estimated age was within the interval of ± 10 years in relation to the actual chronological age. Such results displayed a high level of utility of dental methods for estimating actual age. The same can be concluded

from this research. But one has to have in mind that many factors, including sex, could influence the reliability and accuracy of the methods used for age estimation in adults. So, further researches that could improve accuracy and reliability of age estimation methods in adults are needed [22].

Conclusions

1) In teeth obtained form male and female subjects, all three methods provide an estimated dental age that correlates considerably and highly with the actual chronological age.

2) The sex of the persons does not influence the estimation of dental age made by Bang-Ramm method for sectioned teeth, but can impact the age estimation made by Bang-Ramm method for intact teeth, and it does impact the estimation of dental age made with Kvaal-Solheim method for extracted teeth.

Acknowledgements:

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CORRELATION BETWEEN DENTAL HEALTH STATUS AND SALIVA

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ABSTRACT

Saliva is an important, local, predisposing factor for caries occurrence. The aim of this study was to compare salivary flow rate, pH, buffering capacity and calcium between caries free and caries active children.

Material and methods: The present study included 80 healthy children who were divided into two groups according to gender. Both groups were further divided into caries-free and caries-active groups, with 20 children in each group. Saliva was collected by suction method and flow rates were determined. The samples were then analyzed for pH, buffering capacity and calcium in saliva.

Results: The results revealed that when all these parameters were compared among the caries free and caries active children, the flow rate, pH and buffering capacity were slightly reduced in caries active children, but the total calcium decreased significantly in caries active children.

Conclusion: The obtained results confirm the importance of the physicochemical properties of saliva such as salivary flow rate, pH, buffering capacity, calcium; according to that, we can plan and take appropriate caries-preventive measures.

Key words: saliva, flow rate, pH, calcium, dental caries.

Introduction

Saliva plays an important role in oral health as it maintains the integrity of the oral hard and soft tissues, protects the oral tissue against immunologic bacterial, fungal and viral infections. Long-term decrease or complete top of salivary secretion is often followed by remarkably high caries rate. Such an influence of salivary is also present in patients with xerostomia. In contemporary knowledge of caries etiology, particular attention is paid to the role of saliva in demineralization and re-mineralization processes as well as to other factors that can influence the composition and quality of saliva [1, 2].

The composition of saliva (organic or inorganic), pH, its antimicrobial factors, quantity that is secreted in a given period of time, and viscosity, are factors that influence the etiology of caries [3]. The calcium and phosphate ions in saliva will help to prevent dissolution of dental enamel and help re-mineralization phases. Calcium is the most efficient pH buffer for regulating body fluids, while phosphates have additional advantage of being resistant to depression of plaque pH towards the critical pH [4].

Bicarbonate in saliva is the main buffer against acid, but it is only really effective at high salivary flow rates because its concentration increases significantly with the flow rate. On the average, non-stimulated salivary flow rate is 0.3 mL/min in the general population. The concentration of various components of saliva is mainly affected by variation in flow rate [5]. The variation of salivary constituents over time may reflect hormonal factors, external influences and systemic conditions. Previous investigations have shown that the salivary flow rate fluctuates with the circadian cycle. It has been suggested that the non-stimulated flow rate may be at its maximum in the mid - afternoon [6]. Moreover, variation of non-stimulated whole saliva flow rate over different timespans and at different times of the year yield changes in flow rate. To avoid the circadian effect, obtaining saliva in the same time period of a day is essential. Previous literature shows that the concentration of various components of saliva is mainly affected by variations in flow rate. For example, as the flow rate of the parotid gland increases above the non-stimulated rate, pH increases, but potassium, calcium, phosphate and protein decrease in adults [7].

Buffering capacity of saliva

Salivary buffering capacity is important in maintaining the pH level in saliva and plaque. The buffer capacity of non-stimulated and stimulated whole saliva involves three major buffer systems. The most important buffering system in saliva is the carbonic acid/ bicarbonate system. The dynamics of this system is complicated by the fact that it involves the gas carbon dioxide dissolved in the saliva. The complete simplified equilibrium is as follows:

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H^+ + HCO^-_3$$

The increased carbonic acid concentration will cause more carbon dioxide to escape from saliva. Saliva bicarbonate increases the pH and buffer capacity of saliva, especially during stimulation.

The purpose of this study was to compare salivary flow rate, pH, buffering capacity and calcium between caries free and caries active children.

Materials and methods

Eighty children at the age of 16 were included in the study. They were of good general health and not included in fluoride prophylactic program. They were divided into two groups according to gender. Both groups were further divided into caries-free and caries-active groups, with 20 children in each group. Caries status was assessed according to the WHO criteria [8]. Dental caries was diagnosed in permanent teeth with clearly formed lesions. Pigmentations in flat enamel surfaces with no enamel discontinuity were not registered. Caries distribution was verified using Kline-Palmer system. The first group (caries active children) had at least five decayed tooth surfaces. Caries free children (the second group) had no caries, DMFT=0.

Salivary analysis

Saliva samples were collected from the subjects before breakfast and before there usual morning teeth brushing and mouth rinsing. About 5 ml of saliva samples were collected in a tube. The sampling was carried on without stimulation during approximately 10 min between 8-10 am while they were sitting in the chair of the dental clinic.

Parameters/ element	Ca
Wavelength/nm	422.7
Slit/nm	0,5
Lamp current/mA	10

Table 1. Optimal instrumental parameters for Ca determination by FAAS

γ(Ca)/ μg/mL	A
0	0
1	0,010
3	0,031
5	0,045
10	0,089

Table 2. Absorbance for appropriate concentrations on calcium in saliva

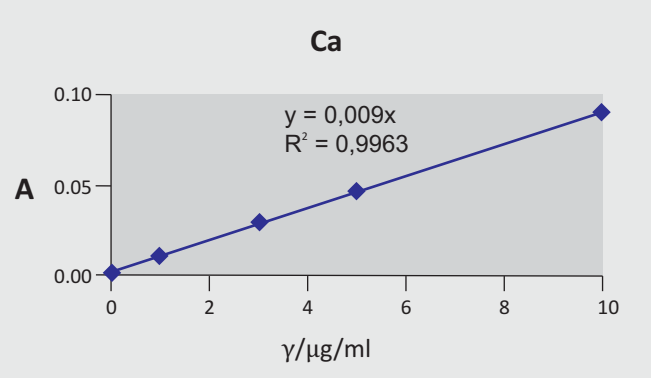

Figure 1. Absorbance for concentrations on calcium in saliva

After collection of saliva, five minutes for all individuals, the volume of the collected saliva was measured. The measurement should not include the foam which is formed during the collection and the result is expressed as milliliters per minute [9].

A digital pH-meter - MA 5722 with a combined electrode was used to measure hydrogen ion concentration. The accuracy of measurement was 0.002.

Estimation of salivary bicarbonates

Concentration of salivary bicarbonates was measured by using enzymatic colorimetric method with commercial kit from GmbH Diagnostic. For enzymatic test phosphoenolpyruvate carboxylase (PEPC) and a stable NADH analogue were used [10], using the principle:

$$Phosphoenolpyruvate + HCO_3^- \xrightarrow{PEPC+Mg^{2+}} Oxaloacetate + H_2PO_3^-$$

$$Oxaloacetate + Cofactor\ red. \xrightarrow{MDH} Malate + Cofactor$$

$$CO_2 + H_2O \longleftrightarrow H_2CO_3 \longleftrightarrow H^+ + HCO_3^-$$

The reduced cofactor concentration was measured at 405 or 415 nm and it was proportional to the concentration of total carbon dioxide in the sample.

Estimation of total calcium of saliva

Determination on Ca of saliva by flame atomic absorption spectrometry (FAAS) with Varian Spectra AA 55 B [11, 12] is described. Hollow cathode lamps were used as a source of electromagnetic radiation for element (Ca). Lamps are optimized 15 min prior to analysis. A mixture of acetylene and air was used for the flame. Prior to analysis, instrumental parameters for better precision and sensibility of analysis were optimized (**Table 1**).

Construction on calibration diagram

Calibration diagram was constructed by using the method of standard solutions. Using regression analysis, functional relationships between concentration and absorbance of Ca were obtained. For the construction of calibration diagram standard solutions of Ca with concentration of 1 mg/L was used. Means of absorbance for each calcium standard solution are given in **Table 2, Figure 1**.

Analytical dependence on absorbance of concentration on Ca is given by equation:

$$A = 0.009 \cdot \gamma(\mathrm{Ca})/\ \mu g/mL$$

Correlation coefficient is 0.996.

Statistical analysis

Results are presented as mean ± standard deviation values. Student "t" test was used to compare the mean values between caries free and caries active groups. A "p" value of 0.05 or less was considered for standard significance.

Gender	Caries Activity	Mean	SD	t-value	p
Girl(20)	CF	3.57	0.64	1.34	0.15
Girl(20)	CA	3.48	0.45		
Boy (20)	CF	3.63	0.74	0.28	0.76
Boy (20)	CA	3.58	1.28		

p < 0.05 Significant p > 0.05 Not significant

Table 3. The mean value of Flow Rate in caries active and caries free children

Gender	Caries Activity	Mean	SD	t-value	p
Girl(20)	CF	7.17	0.14	0.72	0.64
Girl(20)	CA	7.14	0.33		
Boy (20)	CF	7.26	0.55	0.29	0.68
Boy (20)	CA	7.22	0.23		

p < 0.05 Significant p > 0.05 Not significant

Table 4. The mean value of pH in caries active and caries free children

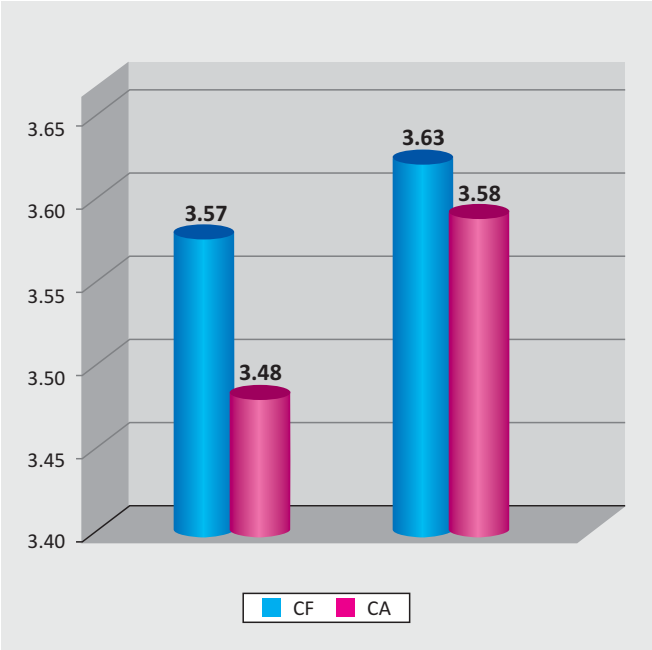

Figure 2. Comparison of flow rate between Caries free and Caries active children

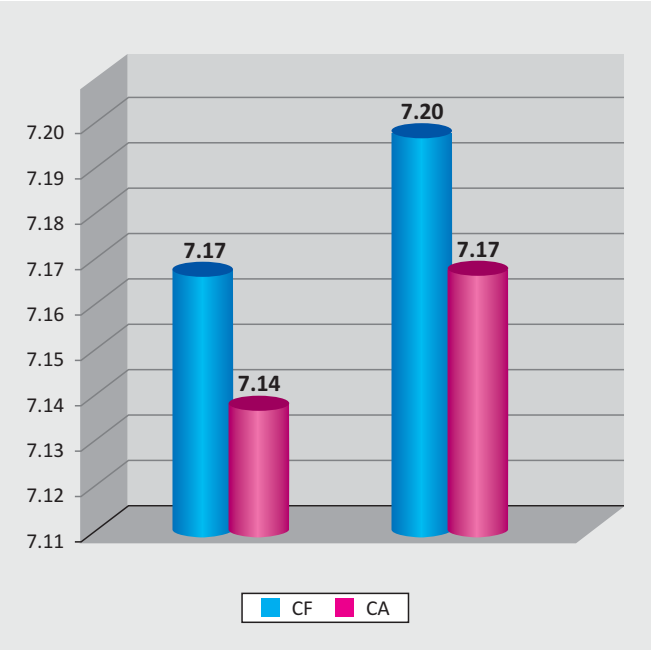

Figure 3. Comparison of pH between Caries free and Caries active children

Results

The examinations are presented in Tables (3-6) and Figures (2-5).

Salivary analyses revealed that mean value of flow rate in caries free children was 3.75±0.64 in girls and 3.63±0.74 in boys. In caries active children, this value was 3.48±0.45 in girls and 3.58±01.28 in boys (**Table 3**).

The mean value of flow rate was decreased in caries active children when compared to caries free children but is not having statistically significant differences according to gender between groups (**Figure 2**).

The mean pH value in caries free children was 7.17±0.14 in girls and 7.26±0.55 in boys. In caries active children, this value was 7.14±0.33 in girls and 7.22±0.23 in boys (**Table 4**).

The mean value of pH is decreased in caries active children when compared to caries free children but is not statistically significant (**Figure 3**).

The mean value of salivary bicarbonates in caries free children was 4.57±0.978 in girls and 5.25±0.978 in boys (**Table 5**). In caries active children, this value was 3.25±1.053 in girls and 4.57±0.958 in boys. This was statistically significant difference at p<0.05 (**Figure 4**).

The mean value of calcium in caries free children was 8.66±1.66 in girls and 8.90±1.39 in boys. In

Gender	Caries Activity	Mean	SD	t-value	p
Girl(20)	CF	4.57	0.978	5.946	p<.05
Girl(20)	CA	3.25	1.053		
Boy (20)	CF	5.25	0.978	4.426	p<.05
Boy (20)	CA	4.75	0.958		

p < 0.05 Significant p > 0.05 Not significant

Table 5. The mean value of salivary bicarbonates in caries active and caries free children

Gender	Caries Activity	Mean	SD	t-value	p
Girl(20)	CF	8.66	1.66	2.18	p<.05
Girl(20)	CA	8.08	2.09		
Boy (20)	CF	8.90	1.39	2.46	p<.05
Boy (20)	CA	7.41	1.89		

p < 0.05 Significant p > 0.05 Not significant

Table 6. The mean value of salivary calcium in caries active and caries free children

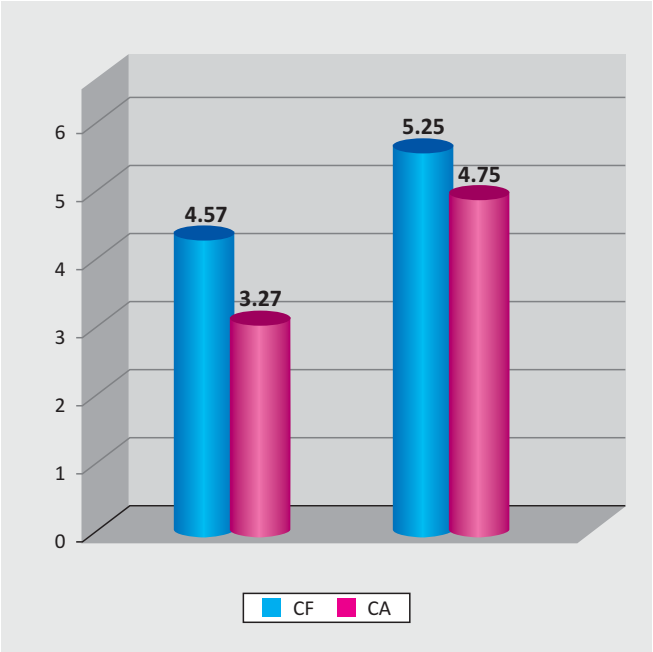

Figure 4. Comparison of salivary bicarbonates between Caries free and Caries active children

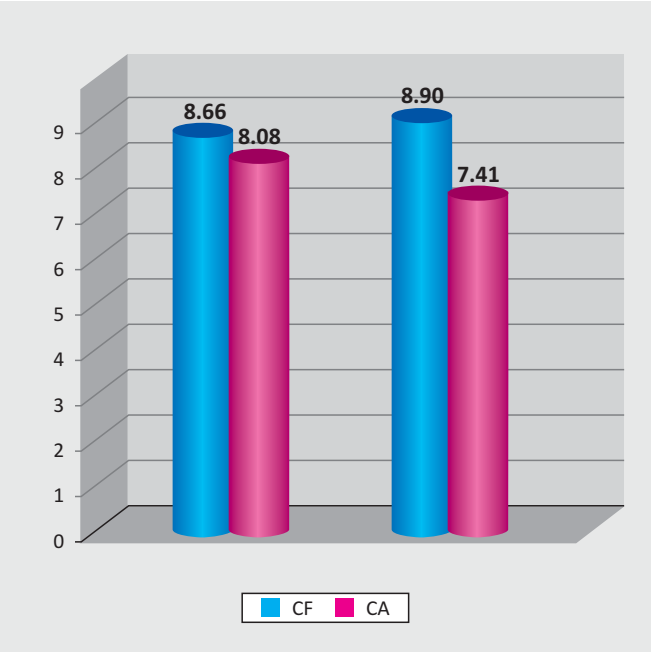

Figure 5. Comparison of value of salivary calcium between Caries free and Caries active children

caries active children, this value was 8.08±2.09 in girls and 7.41±1.89 in boys (**Table 6**).

Again, this difference was statistically significant at p<0.05 (**Figure 5**).

Discussion

Theoretically, saliva can affect incidence of dental caries in four general ways, firstly as a mechanical cleansing which result in less accumulation of plaque, secondly by reducing enamel solubility by means of calcium, phosphate, and fluoride, thirdly by buffering and neutralizing the acids produced by cariogenic organisms or introduced directly through diet and finally by anti-bacterial activity [13,14].

Saliva plays an important role in oral health as it maintains the integrity of the oral hard and soft tissues, protects the oral tissue against immunologic bacterial, fungal and viral infections. A critical role in the prevention of dental caries has been documented as saliva controls the equilibrium between demineralization and re-mineralization in a cariogenic environment. Salivary buffers can reverse the low pH in plaque and allows for oral clearance thus preventing demineralization of enamel. It has been suggested that in addition to these properties, the flow rate and viscosity of saliva may influence the development of caries because salivary flow rate less than 0.7 ml/minute can increase the risk for tooth destruction [15,16]. Mutans streptococci are the main cariogenic

microorganisms present in the oral cavity especially streptococcus mutans and streptococcus sobrinus. These pathogens can colonize the tooth surface and produce acids faster than it is the capacity of neutralization of the biofilm in an oral environment being below the critical pH value (less than 5.5) which results in destruction of the tooth enamel [17].

The results of our study showed that the salivary flow rate decreased in caries active children in comparison to those caries free but was not statistically significant. Dental caries is probably the most common consequence of hypo salivation [18].

In relation to pH, the outcome of the present study showed that in caries active children pH ranged from 6.15 to 7.80. It has been well documented that the dissolution of enamel occurs when the pH falls below critical pH i.e. 5.5, so the values obtained in the study are not adequate to cause demineralization of inorganic substance of the tooth. This study showed that pH and buffering capacity had weak correlation with caries activity. Hence, it can be speculated that other factors like micro flora, diet and retention of food might have dominated over the buffering capacity to initiate caries, which is multifactorial disease [19].

In present study, the mean salivary bicarbonate in caries active children decreased in comparison to caries free children. These results confirm the fact that salivary bicarbonate participates in neutralizing acids in saliva, keeping the pH value to a certain level. This finding is yet another confirmation of the direct role of salivary bicarbonates in maintaining the acid-base balance, which is important for oral equilibrium. Several studies have shown that bicarbonate is one of the salivary components that may modify the formation of caries by changing the environmental pH and possibly the virulence of bacteria that causes decay. Tanzer et al. tasted the efficacy of a sodium bicarbonate based dental power and paste with the addition of fluoride on dental caries and on *Streptococcus sobrinus* or *Streptococcus mutans* recoveries in rats. These authors observed that the caries reductions in these studies ranged from 42 to 50% in the rats treated with bicarbonate dentifrices when compared to the rats treated with water [20, 21].

In present study, the mean calcium concentration in caries active children decreased in comparison to caries free children. Decrease in caries experience in children with high calcium concentration in saliva is attributed to the process of re-mineralization of the incipient caries lesions. Furthermore, Preethi et al. study showed a lower mean value of calcium concentration in individuals with caries active children as compared to caries free [22]. Leone et al. reported that the findings of seven studies indicated a moderate correlation between the low level of calcium and phosphate concentration in saliva with caries susceptibility, whereas there was no such correlation in these two studies [23].

Conclusion

One of the most important factors which influence the development of dental caries is saliva. Alterations in the physicochemical properties of saliva such as decreased pH, buffering capacity, calcium play a major role in caries development.

Obtained results confirm the importance of physicochemical properties of saliva such as pH, buffering capacity, calcium; according to that, we can plan and take appropriate caries-preventive measures.

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GINGIVAL HEALTH IN PATIENTS WITH FIXED ORTHODONTIC APPLIANCES

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ABSTRACT

The aim of the study was to evaluate the gingival health status in 30 patients treated with fixed orthodontic appliances, selected from Orthodontic Clinic at University Dental Clinic Center in Skopje. The patients were 16 years of age. IDP, IGI and GBI indexes were performed before and six months after fixed orthodontic treatment. The patients were not educated in maintaining oral hygiene. Data was statistically analyzed using SPSS version 6.

The results showed that the condition of periodontium during orthodontic treatment is determinated by the level of oral hygiene. Orthodontic patients don't have enough information regarding the maintainance of appropriate oral hygiene. Instructions to patients are considered as an important factor for gingival health.

Key words: gingival health, fixed orthodontic appliance

Introduction

Periodontal disease includes gingivitis, alveolar bone loss (periodontitis) and loss of attached gingival support [1]. The periodontal reaction towards orthodontic appliances depends on multiple factors, such as host resistance, the presence of systemic conditions and the amount and composition of dental plaque. Bacteria present in dental plaque is the primary causative agent of periodontal disease [2]. Orthodontic treatment with fixed appliances is known to induce an increase in the volume of dental plaque. Therefore, fixed orthodontic treatment may result in localized gingivitis, which rarely progresses to periodontitis [3].

Plaque control is one of the key elements of orthodontic practice of dentistry. Maintaining oral hygiene during orthodontic treatment will help in good gingival health reflecting in final orthodontic treatment outcome. But the level of gingival health knowledge among orthodontic patients is not adequate. Poor maintenance of oral hygiene is due to either lack of knowledge or negligence by patients themselves. Patients are not given proper instructions and that may be one big reason for their noncompliance. It is always needed to assess the knowledge of orthodontic patients on gingival health.

The **aim of** our study was to assess the gingival health of the patients undergoing orthodontic treatment before starting the treatment and six months after the treatment.

Material and methods

30 children with fixed orthodontic appliances at the age of 16 years were selected from the Orthodontic Clinic at the University Dental Clinic Center in Skopje, Macedonia, and were included in the study. They had good general health and were divided into two groups according to the gender (15 male and 15 female). The patients were examined before starting the orthodontic treatment and six months after the treatment. They were not educated about maintaining oral hygiene. The plague and gingival inflammation indices (DPI, IGI) used in this study were a slight modification of the indices of Silness and Loe. i.e ., the mesial , labial and distal areas on the facial surfaces of the bonded teeth only, were involved [4].

GBI [5] was assessed around the gingival margin at the mesio-labial surfaces of the bonded teeth. The gingiva was lightly air-dried and the probe lightly inserted into the gingival crevice parallel to the long axis of the tooth until slight pressure was felt. Bleeding was recorded at 1, and no bleeding at 0. The number of elicited bleeding points was totalled and divided by the number of probed units.

Results

Plaque and gingival indices were calculated at the patients before the placement of the orthodontic fixed appliances to record the basic values for assessing gingival health and six months after the treatment.

Table 1 shows the comparison of dental plaque index (IDP) values before orthodontic treatment and six months after the treatment. p=0,000000 confirms that there is high statistically significant difference among these values.

Table 2 shows the comparison of gingival inflammation index values (IGI) before orthodontic treatment and six months after the treatment. p = 0,000307 confirms that the values are with high statistically significant differences.

Table 3 shows the comparison of gingival bleeding index values (GBI) before orthodontic treatment and six months after the treatment. p=0,096 confirms that there is no statistically significant differences among these index values.

The mean dental plaque index (IDP) before treatment was 0, 63, gingival inflammation index (IGI) was 0, 63 and gingival bleeding index (GBI) was 0,16. Six months after the appliance placement, the mean IDP was 1, 60, IGI was 1, 00 and GBI was 0, 30. All index values increased significantly from the base line. These results suggested that there is significant relation between progresses of gingival disease with orthodontic treatment.

Discussion

Orthodontics as a branch of dentistry is no exception. Nowadays, an increasing number of the young referred for orthodontic treatment as a necessity to

Orthodontic patients	X	SD	N	Diff	SD Diff	df	t	p
IDP (0)	0.63	0.49						
IDP (6)	1.60	0.49	30	-0.96	0.18	29	-29	0.000000

Table 1.
IDP (dental plaque index) values at examined groups (at the beginning and six months after orthodontic treatment) Analyzes of variance (ANOVA) shows statistically significant differences among dental plaque index values at examined groups (F= 184,8 p= 0,00000).

Orthodontic patients	X	SD	N	Diff	SD Diff	df	t	p
IGI (0)	0.63	0.49						
IGI (6)	1.00	0.64	30	-0.36	0.49	29	-4.09	0.000307

Table 2.
IGI (gingival inflammation index) values at examined groups (at the beginning and six months after orthodontic treatment) Analyzes of variance (ANOVA) shows statistically significant differences among index values for gingival inflammation at examined groups (F= 12,54 p= 0,000307).

Orthodontic patients	X	SD	N	Diff	SD Diff	df	t	p
GBI (0)	0.16	0.37						
GBI (6)	0.33	0.47	30	-0.16	0.53	29	-1.72	0.096

Table 3.
GBI (gingival bleeding index) values at examined groups (at the beginning and six months after orthodontic treatment) Analyzes of variance (ANOVA) shows that is no statistically significant differences among gingival bleeding index values at examined groups (F= 1,95 p= 0,096).

improve facial aesthetics. But they often suffer from plaque related gingivitis. Almost every fixed orthodontic patient develops gingival disease at some times during the treatment [6]. Adolescents have been shown to suffer worse gingivitis than adults during orthodontic treatment [7]. Clinical research on oral hygiene, and on origins of dental plaque, has intensified. According to Theilade [8] the presence of dental plaque can result in both, periodontal disease and decay. The dental plaque formation is often observed during orthodontic treatment with removable and orthodontic appliances [9]. Biofilm has a tendency to accumulate on retentive areas of springs, clasps and acrylic baseplates [10,11]. Furthermore, according to Mitchell [12] fixed orthodontic appliances also pose a threat, to both, patients and clinicians, by increasing the risk of biofilm formation.

In our study, the periodontal status before and six months after the placement the fixed orthodontic appliances was evaluated in the patients who were selected for orthodontic treatment. Study was performed to evaluate the periodontal status clinically, not only around the brackets, but also around the bands placed on the molars during the course of the orthodontic treatment. The hypothesis of the study was that there is a change in the periodontal status of the patients receiving fixed orthodontic treatment.

Our results supported the hypothesis and showed a significant change in periodontal status of the patients. There was remarkable change in the values of IDP, IGI and GBI after fixed appliances placement. This agrees with the results of Naranjo at all. who reported that the placement of brackets influenced the ecological environment by the accumulation of the biofilm at the retentive sites. There was remarkable increase in the plaque and gingival index, resulting in more bleeding and inflammation that deteriorated the periodontal condition [13]. Nomaan at

all. also reported the progressing of periodontal disease during orthodontic treatment [14]. Similar results were observed by Ristic at all. as there was remarkable increase in both, the clinical and microbiological parameters, 3 months after the fixed appliance placement [15]. Therefore, it was found that not only brackets but also the bands influence the periodontal health. Many authors reported the similar results [16,17]. This indicates that dental plaque accumulation is a risk factor for the increase in the clinical parameters i.e. IDP, IGI GBI.

So, the factor that determines the condition of the periodontal tissues during orthodontic treatment is the level of oral hygiene. Therefore, oral hygiene instructions should be given before the initiation of orthodontic treatment and reinforced during every visit. Primary aim before any orthodontic intervention should be to stabilize the periodontal condition. Regular tooth brushing is the first line of defense in controlling dental plaque. The use of interproximal brush in addition to the orthodontic brush is necessary [18]. Motivating and encouraging the patients to maintain oral hygiene measures at young age will certainly enhance the levels of oral hygiene standards [19,20]. Instructions to patients are considered as an important factor for planning good oral hygiene [21].

Conclusion

Orthodontic treatment, like any others treatment, can be associated with side effects. So, regular tooth brushing is the first line of defense in controlling dental plague and ideal for good gingival health.

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INFLUENCE OF DIABETES MELLITUS ON ORAL SURGICAL PROCEDURES IN GERIATRIC PATIENTS

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ABSTRACT

Introduction: Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Providing oral surgical treatment for geriatric patients is a challenge due to physiologic and patophysiologic changes connected with aging that are additionaly complicated by basic disease process and a pathophysiology of diabetes mellitus.

Aim: The aim of this study is to determine a prevalence of diabetes mellitus and its influence to oral surgical procedures and complications related with administration of local anesthesia and perioperative complications in geriatric patients undergoing oral surgical procedures at Department of Oral Surgery, Faculty of Dentistry, University of Sarajevo.

Methods: The current study is a prospective study of geriatric patients (aged >65 years) undergoing oral surgical procedures in Department of Oral Surgery, Faculty of Dentistry at University of Sarajevo, between January and June 2013.

Results: Higher incidence of postoperative haemorrhage is recorded in diabetic patients compared with healthy persons: 18,75% vs. 4,16% ($p<0,05$). Postoperative pain was more frequent in diabetic patients compared with health ones: 6,25% vs. 4,16% ($p>0,05$). Postoperative infection was more common in diabetic patients compared with health ones: 12,5% vs. 0% ($p<0,05$). Higher incidence of postextraction complications was noticed at patients with multiple systemic diseases and multiple drugs prescribed ($p<0,05$).

Conclusion: Physiological factors associated with aging and combined with compromising medical status of geriatric patients characterized by comorbidity and polypharmacy can complicate oral-surgical procedure.

Key words:diabetes mellitus, geriatric patients, oral surgery

Introduction

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.

Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The basis of the abnormalities in carbohydrate, fat, and protein metabolism in diabetes is deficient action of insulin on target tissues.

There are two types of diabetes:

Type 1, which accounts for only 5–10% of those suffering from diabetes, previously encompassed by the terms insulin-dependent diabetes, type I diabetes, or juvenile-onset diabetes, results from a cellular-mediated autoimmune destruction of the β-cells of the pancreas, usually leading to absolute insulin de-ficiency.

Type 2, which accounts for 90–95% of those suffering from diabetes, previously referred to as non-insulin-dependent diabetes, type II diabetes, or adult-onset diabetes, encompasses individuals who have insulin resistance and usually have relative (rather than absolute) insulin deficiency [1].

Adults with long-standing diabetes, especially those with poorly controlled hyperglycemia, may develop microvascular and macrovascular conditions that can produce irreversible damage to the eyes (retinopathy and cataracts), kidneys (nephropathy), nervous system (neuropathy and paresthesias), and heart (accelerated atherosclerosis), as well as recurrent infections and impaired wound healing [2].

The prevalence of diabetes mellitus is increasing at alarming rates and is becoming a global epidemic issue thus representing a large public health problem. In Federation of Bosnia and Herzegovina, according to records of ambulatory-policlinical morbidity, the prevalence is 240,3% which is probably underestimated since there is a tendency of growth regarding prevalence rate (**Figure 1**).

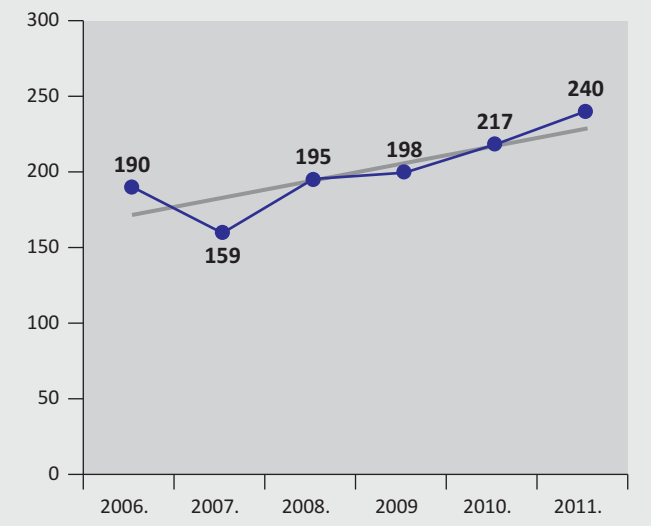

Figure 1. Prevalence of diabetes mellitus in Federation of Bosnia and Herzegovina for the period 2006 – 2011. (number of cases per 10.000 people) [3]

Figure 2 shows morbidity of geriatric population (65+) in Bosnia and Herzegovina in period from 2008 to 2011 year. Diabetes is the third most frequent disease in geriatric patients (patients aged >65) with prevalence rate 767,9 per 10.000 persons (2011 year) and the third most common cause of death [3].

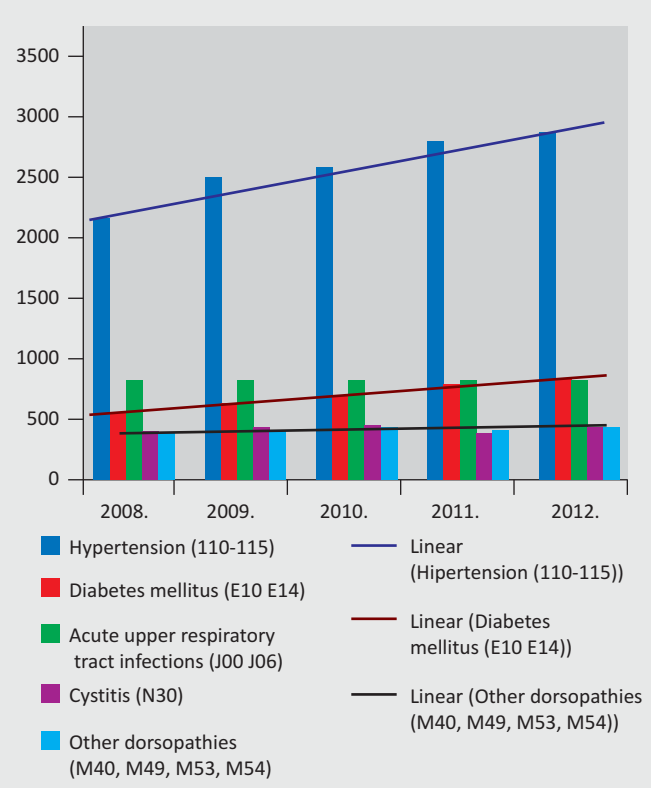

Figure 2. Morbidity of geriatric population (65+) in Bosnia and Herzegovina, 2008-2012, rate/10.000 people.

It is expected for the number of diabetes cases to continue to rise for the following reasons:

1. the population is increasing,
2. life expectancy is increasing,
3. the number of people with obesity is increasing and
4. persons with diabetes are living longer because of better medical management, and they have children who will pass the disease [4, 5].

Since the prevalence of diabetic patients and the number of performed oral surgical procedures are increasing, management of patients with diabetes is becoming an important issue in oral surgical practice. Providing oral surgical treatment for geriatric patients is a challenge due to physiologic and patophysiologic changes connected with aging that are additionaly complicated by basic disease process and a pathophysiology of diabetes mellitus. Presence of systemic complications from diabetes mellitus (arterial hypertension, cardiovascular diseases, renal insufficiency or failure) or multiple systemic diseases (comorbidities) and possible drug interactions as a consequence of polytherapy can additionaly complicate oral surgical procedures.

To ensure patients' health and safety,dental care for diabetic geriatric patients is complicated, requiring competent specialist who know how to provide best possible care and avoid potential complications. Implications of diabetes on oral health and practical guidance of diabetic patients in dental office are described in literature, but studies concerning effect of systemic diseases on oral surgical treatment in geriatric patients are lacking. Althought application of local anesthetic containing epinephrine is considered to be safe in diabetic patients, studies conducted in general population show that diabetes mellitus is associated with significant increase in introperative and postoperative local surgical complications [6,7].

Aim

The aim of this study is to determine a prevalence of diabetes mellitus and its influence on oral surgical procedures and complications related with administration of local anesthesia and perioperative complications in geriatric patients undergoing oral surgical procedures at Department of Oral Surgery, Faculty of Dentistry, University of Sarajevo.

Methods

The current study is a prospective study of geriatric patients (aged >65 years) undergoing oral surgical procedures in Department of Oral Surgery, Faculty of Dentistry at University of Sarajevo between January and June 2013. After diagnostics that includes complete medical and dental history, clinical and radiographical examination and blood laboratory tests, the surgical treatment is indicated. Medically compromised patients underwent internistic preparation if needed and internistic agreement was necessary for dental treatment. Study participants include volunteering and consenting patients. All procedures were performed by the same surgeon in local anesthesia 1,8 ml Lidocain 2% Adrenalin 1:80000 in the same operating room under same conditions.

Data were recorded into specially designed forms containing the following information: age, gender, health condition, diagnosis, prescribed medications, oral surgical procedure, complications related to the administration of local anesthesia, perioperative complications. To facilitate the analysis and presentation of data in tables, numerical codes were asigned for each variable. Data were analyzed using Statistical package for Social Sciences SPSS (SPSS Inc, Chicago, USA) version 20.0. Mann Whitney U Test was used for the statistical analysis at significance level of $p<0.05$ to compare variables between groups. All data regarding patient identification and medical history were kept confidental.

Results

The total of 107 patients were included in this study: 48 (45%) males and 59 (55%) females, gender ratio 1:1,2 in favor of females. The age ranging from 65 to 81 years, with mean age ± SD= 69±4 years. Health condition of geriatric patients is shown in **Figure 3.**

A total of 67 patients (n=62%) has more then one disease (comorbidity). The most common diseases

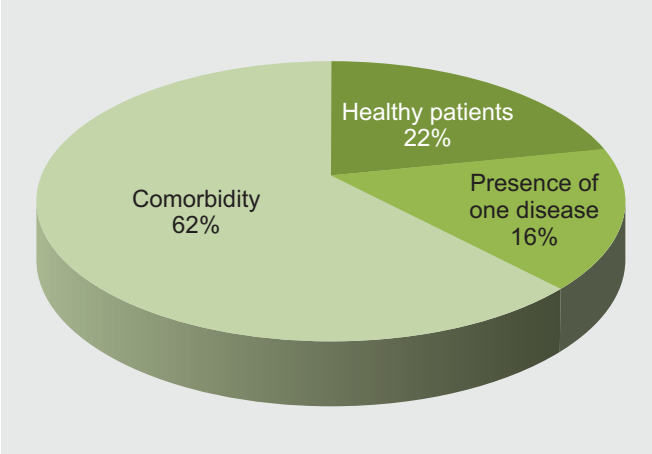

Figure 3. Health condition of geriatric patients who underwent oral-surgical procedures

were hypertension (n=71; %=66), diabetes (n=16; %=15) and cardiovascular diseases (n=14; %=13). Diabetes (n=16; %=15) is the second most frequent disease in geriatric population.

A total of 83 patients (%=77) use at least one medication on daily basis and 65 (%=60) patients have multiple medications prescribed (polytherapy). 14 (%=13) of patients use more then 5 medications daily. Majority of patients are taking prescribed medications regurarly (n=105; %=98). The most common prescribed medications in geriatric patient are shown in **Figure 4.**

Figure 5 shows the frequency of clinical diagnoses in geriatric patients undergoing oral-surgical procedures. The most common diagnoses were dental caries (n=24; %=22), periodontal diseases (n=32; %=29), retained root tips (n=26; %=24), alveolar ridge atrophy (n=5; %=4), benign oral lesions (n=10; %=9) and exostoses (n=20; %=19).

The most common oral surgical procedure was tooth extraction (n=82; %=77), followed by pre-prosthetic surgery (n=15; %=14) and excision of lesions of oral mucosa (n=10; %=9). Surgical extraction with reflection of soft-tissue flaps and bone removal was performed in 23 (%=22) of patients.

Fracture of tooth was the most common complication during extraction (n=15; %=18), and the higher incidence of tooth fracture is recorded in posterior region of mandible. Risk of tooth fracture is increasing with aging ($p<0,05$). The most common postextraction complication is dry socket with incidence of 8,4%. Major of dry socket occured in mandible in cases of surgical extraction. Prevalence of dry socket shows no association with age, gender and disease ($p>0,05$). Prevalence of postextraction

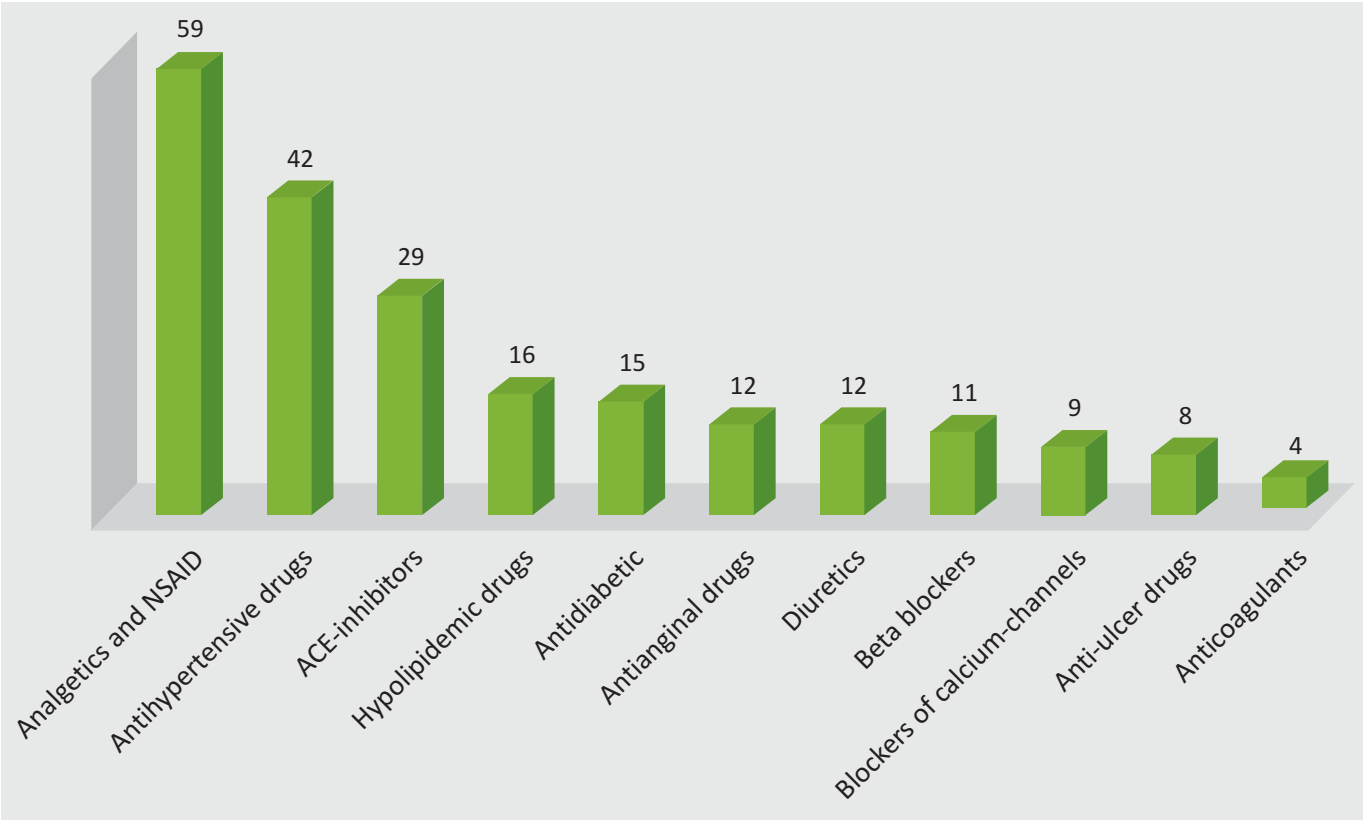

Figure 4. Most commonly prescribed medications in geriatric patients.

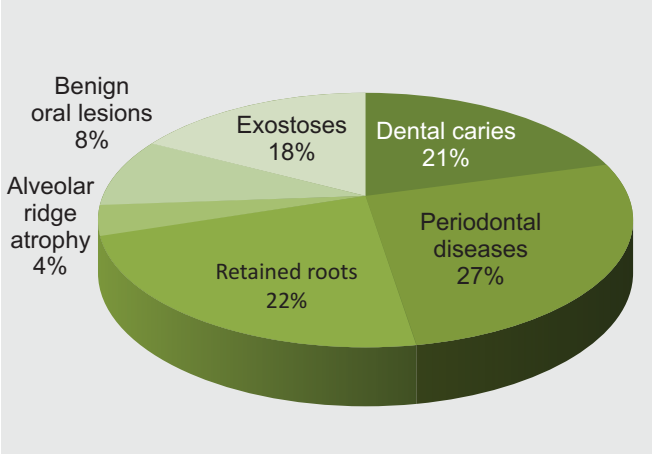

Figure 5. Clinical diagnoses of geriatric patients who underwent oral-surgical procedures

complications is not increasing with aging (p>0,05).

Higher incidence of postoperative haemorrhage is recorded in diabetic patients compared with healthy persons: 18,75% vs. 4,16% (p<0,05). Postoperative pain was more frequent in diabetic patients compared with health ones: 6,25% vs. 4,16% (p>0,05). Postoperative infection was more common in diabetic patients compared with the health: 12,5% vs. 0% (p<0,05). Higher incidence of postextraction complications was seen in patients with multiple systemic diseases and multiple drugs prescribed (p<0,05).

Discussion

Results of present study show that postoperative infections are more common in diabetic patients, suggesting diabetic patients are at higher risk of developing infections of oral and maxillo-facial region which is in accordance with findings of other authors [8, 9,10,11,12]. Clinical studies clearly demonstrate that diabetes mellitus-complicated infections become severe because of neutrophil suppression and consistent defects of neutrophil chemotactic, phagocytic and microbicidal activities [13,14].

The severity of infections in diabetic patients is exemplified with cases of life-threatening infection including deep fascial spaces and fatal palatal ulcers [8,9,10,11]. Study of Zheng et al. shows that diabetics have infections involving more spaces and more frequent complications compared with nondiabetic patients [15]. Because of this, dental practitioner must establish severity and stability of diabetes mellitus. Complete information about general health and systemic conditions of geriatric diabetic patients anticipating surgical procedures must be required. That includes a complete medical history, prescribed medications, regimen and the degree of glycemic control. In the case of uncontrolled diabetes mellitus, consultation with patients' physician is required to discuss any modifications to the dental treatment plan. Standard antibiotic prophylaxis and medical supervision are essential for these patients. It is necessary to consider that empirical antibiotic therapy should cover Klebsiella pneumoniae in diabetic patients [9].

Impaired wound healing is common for diabetic patients. Studies concerning molecular events on tooth socket healing show that uncontrolled, insulin-dependent diabetes, inhibits the formation of the collagenous framework in the tooth extraction socket, resulting in delayed healing and increased alveolar destruction [16]. Healing of bone in uncontrolled diabetes is prolonged because of a delay in the onset of cell proliferation and osteoblast differentiation. Insulin treatment has a direct effect on the expression of TGFβ-3 and IGF-1R, which accelerate healing of the socket [17].

The importance of general health is crucial for maintaining oral health, and vice versa. Studies show that full-mouth tooth extraction resulted in an improvement in glycemic control among diabetic patients [18]. On the other hand, glycemic control in diabetes management is the key to reducing the impact of acute oral infections [19]. This emphasizes the need for multidisciplinary and holistic approach in dental managment of geriatric patients with sy-stemic diseases such as diabetes mellitus. Health care that incorporates promotion of general and oral health can increase the quality of life, which is especially important in geriatric patients.

Conclusion

Appropiate preoperative assesment of geriatric patients should always include complete medical history, analysis of their medical condition and prescribed medications, so as the consultation with patient's physician if needed. Physiological factors associated with aging and combined with compromising medical status of geriatric patients characteri-

zed by comorbidity and polypharmacy, can complicate oral-surgical procedure.

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A REVIEW OF CALCIFYNG NANOPARTICLES – CNPs

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ABSTRACT

Introduction: CNPs are the only particles being discovered in the human body so far that calcifies under normal physiologic conditions. The question is why this is so significant? Pathological calcification is one of the most pervasive yet least understood medical diseases. This is not the healthy calcification that creates bones and teeth; it is disease-related calcification of soft tissue. It blocks blood vessels and organs and is associated with chronic inflammation.

Aim: The aim of this study is, by review, to suggest the importance of calcifying nanoparticles - CNPs.

Material and methods: The systematic literature review was completed using the electronic databases: Pubmed, Medpilot and Medline. The main notions for search were: nano-bacteria, calcifying nano-particles, pathological calcification.

Studies which met the inclusion criterion were studies conducted between1990 to 2012 and which were retrospective or prospective controlled studies.

Results: Through the results of this study we obtain the message that CNPs can founder Dr. Olavi Kajander. Due to new revelations, both with those of Dr. Neva Ciftcioglu, these particles have been given a new name by Dr be reason for creating pathological calcification.

Key words: calcifying nanoparticles, nanobacteria, pathological calcification.

Introduction

The type of calcifying nanoparticles, present in mammals, including humans, until recently, have been informally classified as "nanobacterium" by the. Kajander – Calcifying nanoparticles (CNPs); yet not excluding the term nano-bacterium. These CNPs have been the first identified to exist in mammals, formerly in a geological form or the surroundings [1, 2, 3].

Other scientists independently confirmed this invention, including Miller, Kullar and associates, as well as the stomatologist Cisar and associates who has been quoted very often because of the great critics related to some characteristics of CNPs. These scientists have independently observed calcifications of CNPs using the techniques of Kajander, Ciftcioglu and associates [4, 5, 6, 7, 8].

As a result, researchers recorded and documented calcification as a disease.

The nanometric scale of the particles is similar to that described as nano-bacterium isolated from geological samples and kidney stones in humans and it can also be observed in a culture of cardiovascular tissues in humans [9,10].

Khullar and associates observed and presented in an apatite form, ultra filterable, gram-negative coccid microorganism in 62% of the renal stones in 65 patients in the Northern Indian population [6]. It has been observed that there were apatite forms, ultra filterable, gram-negative coccid microorganisms.

The negative coloring of the nano-bacterium reveals 80-250 nm particles, 500 nm in length. They appear in the shape of bacillus and cocci, either as independent particles or grouped as local clusters, attached to other separate ones. Most of these elementary particles are partially or fully coated in a thick, "igloo"-light hydroxyapatite.

Some of the published studies have been made independently on the CNPs discovered. These independent studies only claimed that CNPs generate calcified media [11].

Puskas and associates popularized NB-particles in 26 of the 42 sclerotic aortas and carotid samples [12].

In 2004, it was acknowledged that cysts in polycystic renal diseases contained CNPs that contribute to the forming of a cyst.

In a culture of CNPs of FBS, formerly proven that such particles could be contaminated in FBS, elements with Koch's postulates of CNPs in kidney stones were proven [11].

In 2003, Kajander gave report on CNP-relation with calcification of the mitral valve, as well as CNPs cultures of kidney stones [13].

In 2004, there was an epidemiologic study that showed CNPS as coronary arterial calcification to be a risk indicator [14]. In the same year, not only the presence of CNPs in HIV infected mothers and babies were confirmed, but also CNPs agents in cultures of human atherosclerotic plaque were discovered [13].

Calcium connective proteins, mapped on CNPs, were connected to the gum, the saliva and the nasal mucosa [11].

In 2006, it was proved that CNPs cause renal calcifications after intravenous administration in rats, as well as anti - CNP antibodies whose concentration is highly significant independent risk factor for coronary arterial calcification [11].

Characteristics of CNPs

Calcified particles with a variable quantity of carbonate apatite are stained, gram-negative, sterile - filtered (0.22 mgr with small porosity). They are coated with 80-500nm in diameter depending of the size of the calcified spot.

By light and electron microscopy, apatite "igloos" have a central chamber occupied by one or more nanobacteria.

Under low-nutrient conditions (serum-free) CNPs tend to have a form of microscopic colonies in liquid media, surrounded by a thick coat of calcium apatite; calcified colonies that can reach over 1 mm in diameter.

They are characterized by quite extreme and unique features such as endurance at 90°C for 1 hour and 15 kGy gamma irradiation **[**8**]**.

Growth: Serum forms have a generation period of around three days. Serum-free forms have double time, around six days. The passage in the DMEM culture can be indefinite with or without the serum. They incorporate uridine and methionine into DNA and protein, respectively. They grow fastest under aerobic conditions.

Structure: CNPs contain or tie proteins and polysaccharides. Some of these proteins are bacterial porin proteins.

It has been identified that the muramic acid is the main component of the bacterial peptidoglycans.

Monoclonal antibodies, porin proteins and peptidoglycans can recognize intact CNPs as stated on the immunogold label. Monoclonal antibodies of chlamidial lipopolisaccharidi (endotoxin) react with CNPs **[**8**]**.

Effects on the cells: CNPs bind with cells of mammals in vitro with endocytosis.

In human and animal tissues, the transmission electronic microscopy reveals the intracellular set CNPs.

Intravenously administered CNPs have been excreted through the urine in rodents. In rats they have caused apoptosis and the Chlamydia can break the reaction with CNPs leading to confusion, regardless of whether the CNPs are bacterial or not.

The entire research of the extensive characteristics of CNPs reveals that some characteristics are similar to those of bacteria, viruses and prions and yet separate from them **[**7).

Observed forms of CNPs

Similarly to many pathological agents, CNPs have more than one way of growing, depending on the environment, and the surroundings in which they develop and grow.

They also have different stages of development and show different characteristics, depending on their stadium of development.

These stadiums are not a necessary sequence. For instance, CNPs' colonies may form inside or outside the protective coat, depending on the environment.

Three basic ways of CNP replication have been observed by way of an electronic and light microscopy: regardless of whether or not this replication is completely autosomal, or with the use of nucleic acid and protein fragments from the cells or the surrounding area, it is not familiar.

Notwithstanding the type of replication, these development phases have been observed as a formation of mucous luminous material on the surface of the individual CNP, superficial calcification of the individual CNPs with calcium phosphate and/or calcium carbonate, invasion of proteins, bacteria and cells.

At beginning, colonies are formed, and after that, biofilm formation builds around the colony. The third stage is formation of calcium "igloos" in the colonies out of which CNPs grow and replicate.

These "igloos" can be present in hundreds, can be present for long period in the individual CNP and under light microscopy they can resemble to renal stones. "Igloos" may also have empty space so CNPs can be excreted, which proves they are alive.

According to the published literature, CNPs are found in cells of mammals (humans and animals).

In the blood of mammals, organs of mammals, in the big bacteria, CNPs can be cultivated in the serum or under free protein conditions **[**7**]**.

Differences between CNPs and the organic apatites in the bone

CNPs are firm in the soft tissues and blood, whereas bone apatite is not. Microscopically, the structure of the matrix of CNP apatite differs from that of bone apatite.

Differences between CNPs and inorganic apatite crystals

Microscopically, the differences are noticeable. Inorganic apatite crystals are made up of peaked and flat particles with a variable size, whereas CNPs are round or oval (egg-like) and often with a uniformed size, coated with biofilm.

Inorganic apatite crystals do not have a phospholipid coating and CNPs do. Inorganic apatite crystals do not have a biofilm formation or a mucous membrane whereas CNPs do.

Inorganic apatite crystals grow chemically, but are not exposed to a biological growth as CNPs are.

Biogenic apatite crystals of CNPs have more inorganic apatite crystals than the bone structure does.

Apatite crystals merely collapse under super-saturating conditions, whilst CNPs multiply under normal (standard) physiological conditions, such as those in the human body.

Apatite and CNPs can separately generate calcium phosphate in the form of their own calcium phosphate coating with calcium and phosphorus – rich serum [8].

Numerous experiments, published by Kajander, Cifcioglu and associates, show that CNPs can be inactive in vitro with different variations of chemicals and radiation, although simulatneously CNPs have proved as extremely resistant to doses that normally kill viruses, bacteria, and other pathogen microorganisms **[**15,16,17,18,19,20,21**]**.

Their ability to self-replicate under inprecipitated conditions has been confirmed, as well as their ability to be infectious **[**22**]**.

Thrombosis is the cause of death in many patients on hemodialysis. Calcified nano-particles have been confirmed to exist in human blood that can provoke thrombosis but can be prevented **[**23, 24, 25, 26**]**.

Discovery on calcifying nano-particles (CNP) in blood and blood products in the beginning of 1990 resulted in the creation of a sensitive issue in biology.

CNPs were shown as bacterium-nanobacterium, pleomorphic, infectuous particles that posses unique characteristics including their ability to pass through the sterilizing filters due to their small size and heat resistence and ɣ-irradiation of doses typically fatal for the conventional bacterium [2,27,28,29,30].

They are calcium and phosphate deposits in a phisiological pH and mineral concentrations [2,31].

CNPs have been associated with various clasifying relations with health issues such as arteriosclerosis, renal stone, dental stone, prostatitis, Alzheimer, polycystic kidneys [23, 26, 32, 33, 34, 35, 36, 37, 38].

Hence, the importance of CNPs as possible etiologic factors for the occurrence and development of many pathological conditions and disorders in the body is extreme.

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THE INCIDENCE OF ROOT FRACTURES DURING EXTRACTION OF PERMANENT TEETH IN THE CITY OF BANJA LUKA, BOSNIA AND HERZEGOVINA

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ABSTRACT

Aim: The aim of this research is to determine the incidence of root fractures during the extraction of permanent teeth in adult patients (18 years old and above) on the territory of the city of Banja Luka in the year 2012.

Materials and methods: This study included 249 adult patients out of the total number of patients who were treated at the Clinic for Tooth Extractions at the Dental Health Care Department of Banja Luka's Health Centre in 2012. Details on the age and sex of the patients as well as localisation and the type of tooth undergoing fracture were taken from the dental records (after written consent of the Institution's Director).

Results: Out of the total number of patients treated, 51.41% were male and 48.59% female patients. Patients with the highest rate of root fractures belong to the age group 65 and above (23.29%) followed by patients belonging to the age groups 45-54 (19.68%) and 55-64 (19.28%). Patients under 45 years suffer from fractures less frequently while those from the age group 35-44 have the lowest rate of fractures (11.65%). Root fracture occurred in the lower jaw in 57.83% of the cases, having the highest incidence rate on the first molar tooth (28.51%), and the lowest on the lateral incisor (0.40%). In the upper jaw, root fractures most frequently occur on the upper first premolar (32.38%), while in the lower jaw, root fractures are most common on the lower first molar (35.42%).

Conclusion: A careful extraction and separation of teeth is recommended during the extraction of multi-rooted teeth, especially with older patients and patients receiving endodontic treatment. Given the impossibility to extract the fractured part of a tooth, it is necessary to refer the patient to an oral surgery specialist. Control X-ray is recommended in the case of any doubts referring to the presence of retained parts of tooth roots.

Key words: root fracture, incidence, post-extraction fracture

Introduction

Teeth are calcified organs that are located at the beginning of digestive tract, in the mouth cavity. They are placed in dental sockets (alveoli) of alveolar extensions in the upper and lower jaws [1]. Humans normally have 32 permanent teeth.

We can distinguish three main parts of every tooth [2]:

1) the crown (lat. Corona dentis)
2) the neck (lat. Collum s. Cervix dentis)
3) the root (lat. Radix dentis)

The number and size of roots varies from tooth to tooth [2]:

- *Single-rooted teeth* are incisors, canines and premolars (with the exception of the first upper premolar).
- *Teeth with two roots* are the first upper premolar and all lower molars.
- *Teeth with three roots* are the upper molars (the first and second).

Tooth fracture represents one of the most frequent complications in tooth extraction, and its causes can be manifold:

- Tooth anomalies (slant, extended and irregularly placed roots)
- Inadequate extraction techniques
- Pathological reasons (treated tooth, hypercementosis).

Given the anatomical anomalies are the causes of root fracture, these complications can hardly be prevented and the so-called "complicated extraction" appears, when we firstly remove the crown and then the roots. Root fractures that occur due to anatomical anomalies can sometimes be foreseen. By using X-ray images we can notice if the root is bent more than it is usual, if tooth has gracile and cylindrical roots or endodontically treated multi-rooted tooth that is prone to fracture. In such case, it is necessary to extract the tooth carefully, with minimum trauma for the surrounding tissue and the separation of roots. The technique of root extraction over the alveolar bone by means of pliers, lever or gracile instruments can be attempted with single-rooted teeth if the fracture occurs at the level or a bit below the alveolar rim. In other cases, it is necessary to apply alveolectomy, and when it comes to multi-rooted teeth, the separation of tooth roots has to be done if the fracture occurs at the level of the alveolar rim [3, 4].

The incidence rate of root fractures ranges from 2% to 7%. They are sometimes undiagnosed and most often a part of the root may stay in the alveolar bone. These roots are often asymptomatic until the emergence of infection or irritation under the mechanical pressure of brace appears, and they are often randomly diagnosed on X-ray images. Undiagnosed retained parts of the root and teeth in the upper and lower jaw can represent a focal point and one of the potential causes of consecutive diseases. When people speak about oral focal points they commonly mention perapical lesions and impacted teeth, and do not pay attention to toothless parts of the jaw in which an asymptomatic retained root can often be found. The number of surgical and complicated extractions that could have been avoided gets higher because of the failure in diagnosing them on time and because of the symptoms that emerge later in life [5, 6, 7].

The aim of this research is to draw attention to the incidence rate of tooth fractures, urging the attention that is to be paid during extraction, and to point out the importance of planned extraction and time diagnosing the retained parts of the teeth.

Materials and methods

The research was conducted through monitoring patients treated at the Dental Health Care Department of Banja Luka's Health Centre, and in particular, at the Clinic for Tooth Extraction. Out of the total number of patients (3024) in 2012, 249 patients who suffered from root fracture (horizontal and vertical) during extraction are relevant to our topic.

All data related to extraction of certain teeth was obtained from the dental records, with written consent by the Institution's Director. Patients' personal

data are protected and their privacy was not violated in any case.

We have kept records for every patient who suffered from root fracture during extraction, paying attention to data related to age, gender (male/female) and the type of teeth with precise localization (e.g. upper first molar, lower first or second molar etc).

Results

Of the total number of patients who were treated at the Clinic for Tooth Extraction in 2012, 8.23% suffered root fracture (**Figure 1**).

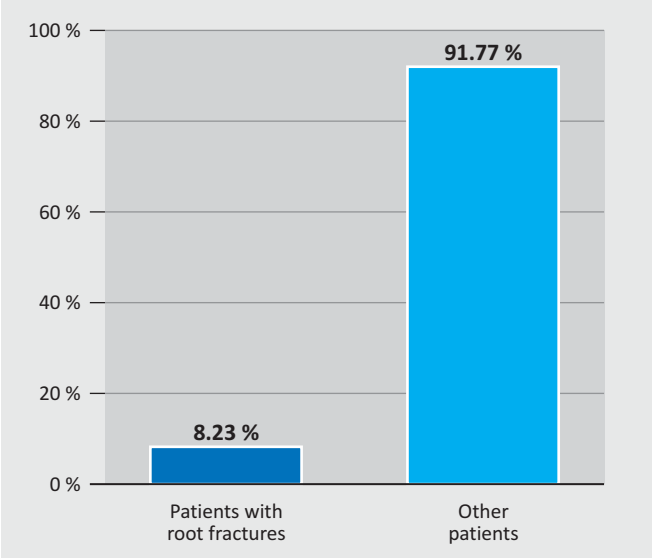

Figure 1. The incidence rate of root fractures in relation to all patients in 2012 (in percentages)

This research included 249 patients suffering from root fracture. Out of the total number of patients treated, 51.41% were male and 48.59% female patients. The difference in the incidence rate of fractures in male and female patients is not statistically significant.

Patients with the highest rate of root fractures belong to the age group 65 and above (23.29%) followed by the patients from the age groups 45-54 (19.68%) and 55-64 (19.28%). Patients younger than 45 suffer from fractures less frequently while those belonging to age group 35-44 have the lowest rate of fractures (11.65%). Greater incidence rate of fractures in "older" age groups is statistically significant (**Figure 2**).

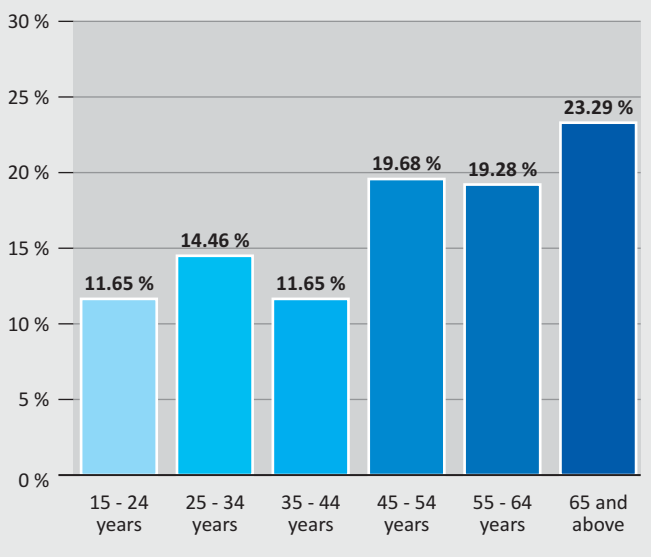

Figure 2. The incidence rate of patients by age groups

Root fracture occurred in the lower jaw in 57.83% of the cases (**Figure 3**). Greater incidence rate of root fractures in the lower jaw is statistically important.

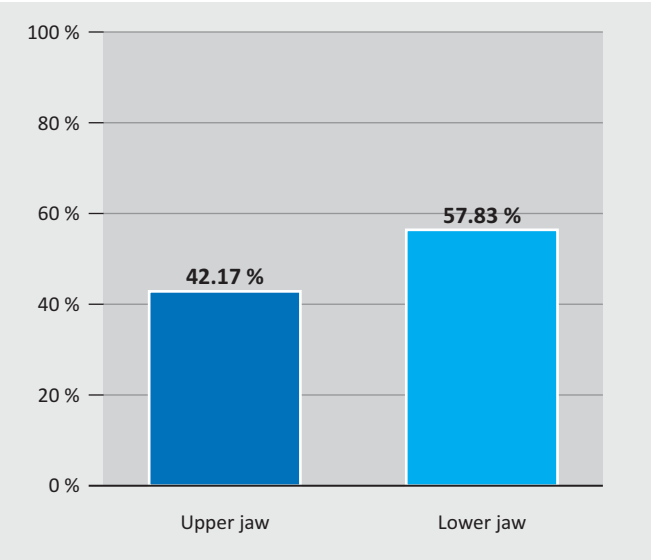

Figure 3. The incidence rate of patients by the jaw in which root fracture is present (in percentages)

The highest rate of root fractures from all teeth is related to the first molar (28.51%), while the fewest number of root fractures occurred on the lateral incisor (0.40%). Not a single occurrence of root fracture on the central incisor was observed. The difference in the incidence rate of root fractures by teeth is statistically important (**Figure 4**).

A comparative overview of the incidence rate of root fractures on particular teeth in the upper and

lower jaw by gender and age group is given in **Tables 1 and 2**.

Statistically significant differences in the incidence rate of root fractures were not recorded in either case.

In the upper jaw, root fractures most frequently occur on the upper first premolar (32.38%), while in the lower jaw, root fractures are most common on the lower first molar (35.42%).

Discussion

The results of this research have shown that the anatomy of teeth and jaws, as well as the patient's age, had an impact on tooth fracture. The incidence rate of root fracture during extraction is higher on multi-rooted teeth (in the upper jaw it is the highest

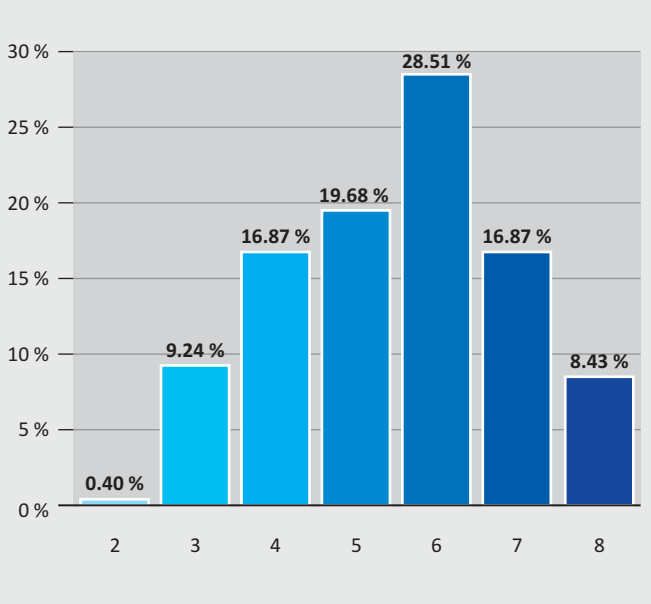

Figure 4. The incidence rate of patients by the tooth in which root fracture is present (in percentages)

Jaw	Tooth	Gender					
		Male		Female		Total	
		n	%	n	%	n	%
Upper	3	9	16.98	5	9.62	**14**	**13.33**
	4	16	30.19	18	34.62	**34**	**32.38**
	5	9	16.98	12	23.08	**21**	**20.00**
	6	12	22.64	8	15.38	**20**	**19.05**
	7	2	3.77	7	13.46	**9**	**8.57**
	8	5	9.43	2	3.85	**7**	**6.67**
	Total	**53**	**100.00**	**52**	**100.00**	**105**	**100.00**
Lower	2	0	0.00	1	1.45	**1**	**0.69**
	3	5	6.67	4	5.80	**9**	**6.25**
	4	5	6.67	3	4.35	**8**	**5.56**
	5	16	21.33	12	17.39	**28**	**19.44**
	6	26	34.67	25	36.23	**51**	**35.42**
	7	15	20.00	18	26.09	**33**	**22.92**
	8	8	10.67	6	8.70	**14**	**9.72**
	Total	**75**	**100.00**	**69**	**100.00**	**144**	**100.00**

Upper jaw			Lower jaw		
c^2	*df*	*p*	c^2	*df*	*p*
6.544	5	0.257	2.515	6	0.867

Table 1. The frequency and incidence rate of root fractures by gender, in the upper and lower jaw separately (in percentages)

Jaw	Tooth	Age group											
		15 - 24 years		25 - 34 years		35 - 44 years		45 - 54 years		55 - 64 years		65 and above	
		n	%	n	%	n	%	n	%	n	%	n	%
Upper	3	0	0.00	2	10.00	1	10.00	0	16.67	4	16.67	7	36.84
	4	4	30.77	4	20.00	5	50.00	8	41.67	10	41.67	3	15.79
	5	4	30.77	5	25.00	3	30.00	3	16.67	4	16.67	2	10.53
	6	3	23.08	7	35.00	1	10.00	4	8.33	2	8.33	3	15.79
	7	2	15.38	1	5.00	0	0.00	3	4.17	1	4.17	2	10.53
	8	0	0.00	1	5.00	0	0.00	1	12.50	3	12.50	2	10.53
	Total	13	100.00	20	100.00	10	100.00	19	100.00	24	100.00	19	100.00
Lower	2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	2.56
	3	0	0.00	0	0.00	1	5.26	2	6.67	2	8.33	4	10.26
	4	0	0.00	0	0.00	1	5.26	0	0.00	2	8.33	5	12.82
	5	1	6.25	3	18.75	3	15.79	8	26.67	5	20.83	8	20.51
	6	10	62.50	6	37.50	9	47.37	13	43.33	4	16.67	9	23.08
	7	2	12.50	5	31.25	4	21.05	6	20.00	8	33.33	8	20.51
	8	3	18.75	2	12.50	1	5.26	1	3.33	3	12.50	4	10.26
	Total	16	100.00	16	100.00	19	100.00	30	100.00	24	100.00	39	100.00

Upper jaw			Lower jaw		
c^2	*df*	*p*	c^2	*df*	*p*
31.744	25	0.166	30.428	30	0.444

Table 2. The frequency and incidence rate of root fracture by age groups, in the upper and lower jaw separately (in percentages)

(32,38%) on the first premolar, and in the lower jaw it is highest on the first molar (35,42%); and in general, it is higher in the lower jaw due to greater presence of the bone compact part (57,83%). The upper first premolar is specific as it mostly has two gracile roots that are prone to fracture during extraction. Great number of root fractures of the lower second premolar (19,44%) is recorded. Lower premolars could be extracted by easy rotation moves and attention should be paid to the phenomenon of the "cylindrical" root, which is narrower in the coronary and middle part of the root, and wider in the apex part. The reason for the occurrence of greater number of root fractures in the lower jaw is caused by the fact that older patients have reduced vascularisation and thereby elasticity of bones and teeth. The occurrence of hypercementosis is also more frequent at older age. A greater resistance occurs during the extraction of teeth from alveolus and leads to the fracture of teeth and bone lamellae of the alveolus alike. Multi-rooted teeth, which are endodontically treated, can make tooth extraction harder due to the bent roots and the presence of interradicular septum. Also, wrong extraction techniques and the avoidance of the method of tooth separation are frequent causes of fracture.

The incidence rate of root fractures ranges from 2% to 7% worldwide. This research showed a greater incidence rate than the average (8.23%). One of the reasons is the fact that we are talking about a clinic for tooth extraction with higher number of patients, but we must not ignore the speed of extraction as a possible reason being the characteristic of such specialist clinics and leads to a higher rate of tooth fractures.

Although they are spotted and subsequently extracted, retained tooth parts, many roots and tooth fragments are diagnosed only after several years, often by means of X-ray finding or the appearance of symptoms. Several radiographic researches have been done on toothless patients and showed a higher incidence rate of retained roots – even more than 30% of toothless patients had retained roots in their jaws [8-10].

In this research, the incidence rate of root fracture is higher in the lower jaw. Other, radiographic researches that involved toothless patients showed that the unspotted (retained) root is more frequent in the upper jaw. Despite being the locality of a greater number of fractures, the lower jaw is better visible due to the compactness of the very jaw and the cylindrical roots of the premolars; this makes easier to spot fractured root parts. The upper jaw is less visible due to a higher number of multi-rooted teeth and variations in the number of tooth roots. All these reasons lead to a higher rate of undiagnosed fractures of tooth roots and the appearance of retained root in the jaw, the symptoms of which can show up after a longer period; and although they are asymptomatic, they represent a focal point in the jaw for the emergence of consecutive diseases. Once retained roots are spotted, a surgical extraction of the same is highly recommended, though it is harder in older persons due to reduced vascularization of the bone and chronic diseases [11].

All this points to the importance of proper technique of tooth extraction and control X-ray imaging of post-extraction alveolus in case of uncertainty about the presence of retained root parts after extraction [12, 13].

Conclusion

The incidence rate of root fractures during tooth extraction is higher in the lower jaw and on multi-rooted teeth. That is why the separation of multi-rooted teeth is recommended, particularly with older patients whose bone elasticity is generally reduced, and in patients with endodontically treated teeth. If root fracture occurs, it is necessary to proceed to the extraction of the retained parts using proper technique, and in case this is impossible, the patient should be referred to an oral surgery specialist. Control X-ray image is recommended after complicated extractions and in case of any doubts about the presence of retained parts of tooth roots.

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CONSERVATIVE-PROSTHETIC REHABILITATION MAY BE A TREATMENT SOLUTION FOR ELDERLY PATIENT WITH ENDODONTICALLY POORLY-TREATED TOOTH

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ABSTRACT

Aim: To represent the possible rehabilitation of the partial edentulous elderly with endodontically affected tooth.

Summary: A female patient (68) with broken fragment of lentulo, passing through the root apex of the second lower premolar was treated. Premolar was endodontically and conservative restored and the patient was rehabilited with partial overdenture and complete denture, in lower and upper jaw respectively.

Key learning points

- The combination of endodontic treatment and partial overdenture can neutralize pathological damages of periodontical tissue and restore, in some degree, previous masticatory function ;

- In order to avoid the possible surgical complication, the lentule may be left in the periapical tissue if it doesn't overloaded by stronger occlusal stimulus of the cast partial denture or fixed prostheses;

- Sometimes the most simple therapy choice is the best choice for elderly patient.

Keywords: denture, endodontic treatment, conservative treatment

Introduction

In daily clinical practice, during endodontic treatment of teeth, possible complication may result with the breakage of endodontic instruments with very frequent retention in root canal [1]. These instruments can sometimes be removed [2] by conservative i.e. bypass-nonsurgical [3,4,5] or surgical [6,7,8] procedures. But sometimes, attempting to remove them may result in tooth loss or complicated damage of the adjacent structures such as inferior alveolar nerve [9] in terms of infection and injuries ranging from neuropraxia to neurotmesis [10]. Regarding dilema whether to leave or remove broken instruments from the canal, many scientists have been argued in the literature and different approaches for treatment of these obstructions have been presented [11, 12, 13].

Safe removing of broken instruments (lentulo) usually depends on the diameter, length, and curvature of the canal, and additionally is limited by root morphology, including the thickness of dentin and the depth of external concavities. The instrument position in the root canal is also very important [6, 7]. If the broken instrument is positioned more apically, then classic removal is usually not possible and, in the presence of signs or symptoms, surgery or an extraction will be required. However, there is a possibility for conservative-prosthetic rehabilitation of damage tooth and preventing the inevitable surgical complications in the case of absence of the signs or symptoms.

Case report

The following report represents the case of a female patient 68 years of age, with maxillar complete edentulous and mandibular partial edentulous (Kennedy class III). At careful history examination, the patient stated that she got root canal treatment done for left mandibular second premolar for the purpose of prosthetic treatment. Furthermore, patient denied presence of any systemic disease or pain within the region of interest (left lower second premolar, left posterior mandible). In addition, there were no swelling or any neurological problems. Orthopantomografic radiogram (**Figure1**) revealed breakage and prolapse of lentulo, passing through the root apex of the second lower premolar. The lentulo spiral was broken and separated instrument was displaced just above the inferior alveolar canal during endodontic treatment (sealing) of the second lower premolar. The lentulo couldn't be bypassed because of its periapical position.

Given the fact that the end of the lentulo extends to the top of the x-ray limit of the inferior alveolar canal, surgical removal was not recommended due to possible damage of alveolar nerve and consequently inferior alveolar nerve paresthesia. According to that, root canal of the second lower praemolar was filled with endomethason and gutta-percha (Spident). The remaining tooth (third part of it) was restored with a composite restoration-Herculite XRV (**Figure 2**). A week after, partial acrylic overdenture was made. Practically, after impression procedure with alginate in standard tray, the acrylic partial overdenture and complete denture in the lower and upper jaw were obtained. As for partial denture, gingival part of the denture saddle (**Figure 3**) was placed over the residual alveolar ridge in the region of the first lower premolar and restored tooth-second lower premolar in order to establish adequate occlusion and articulation between posterior mandibular and maxillar segments (**Figure 4**).

Retroalveolar radiograms (**Figure 5**) were taken immediately after the rupture of the instrument, and 5 years after prosthetic rehabilitation. Periradicular chronic inflammation was found in both radiograms, except the fact that this lesion was less expressed 5 years after. Patient had no symptoms over 5 years. No signs of periodontitis were found during clinical inspection.

Discussion

Endodontic instrument breakage during root canal treatment and the displacement of its separated fragment next to (or into) inferior alveolar canal is rare and has been reported only once in current literature [8]. The prevalence of fracture of nickel-titanium rotary instruments is more frequent than that of hand instruments [14] and is commonly associated with aberrant root canal anatomy, canal calci-

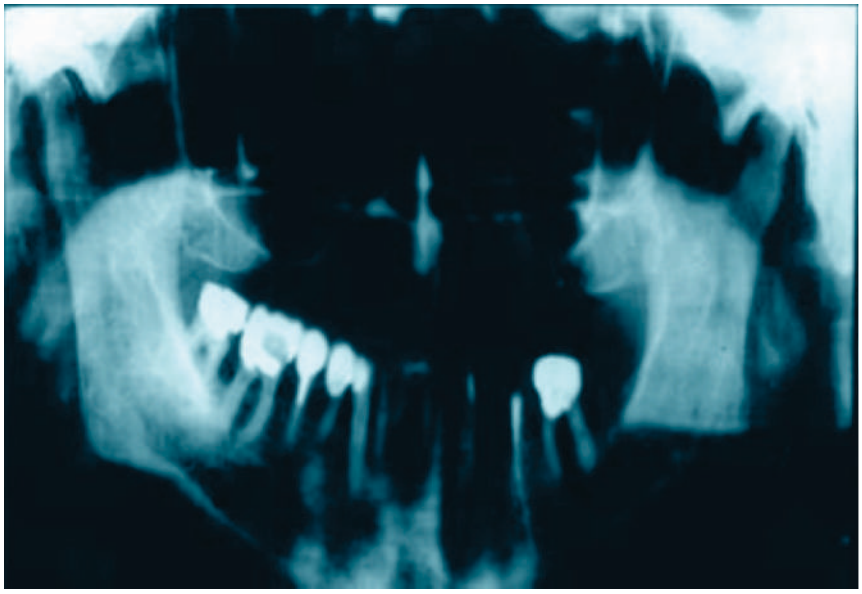

Figure 1.
Orthopantomografic radiogram

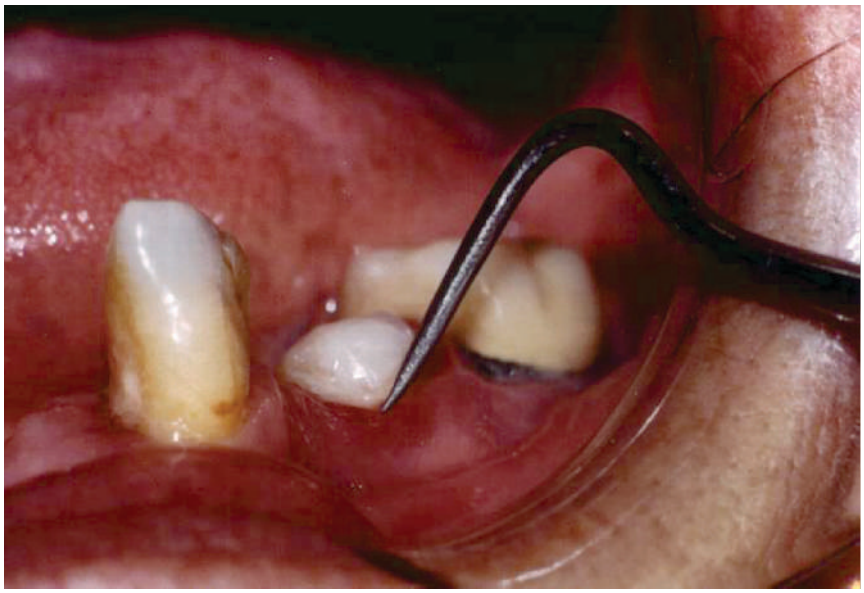

Figure 2.
Composite restoration of the lower second premolar

Figure 3.
Denture saddle that cowers lower second premolar and residual alveolar ridge

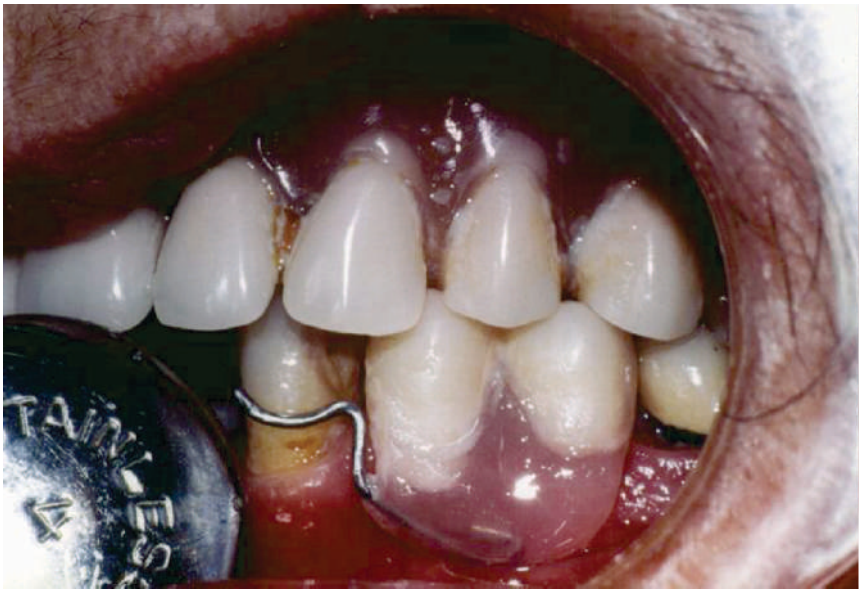

Figure 4.
Adequate occlusion of the posterior maxillar and mandibular segments

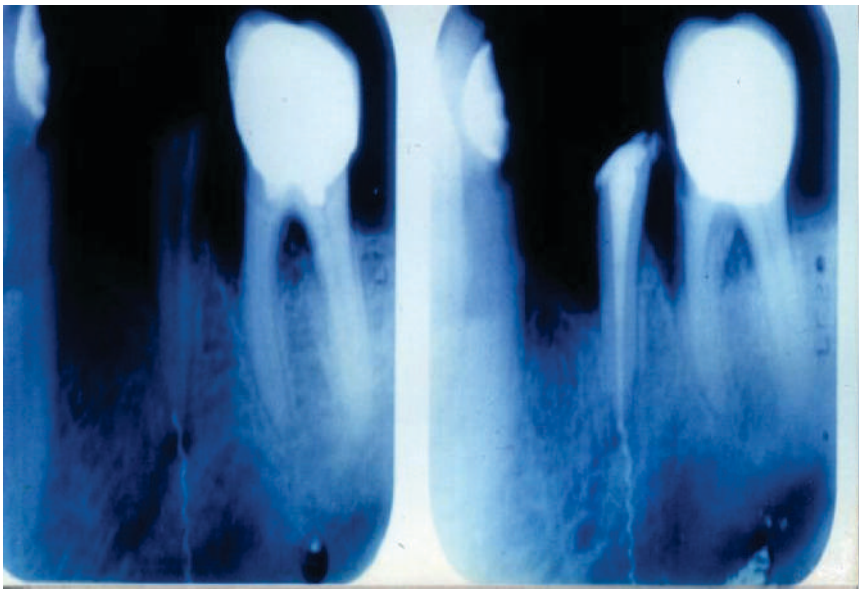

Figure 5.
Retroalveolar radiograms before and after treatment

fication, anomalous root shapes, and severe root curvatures. Due to difficult canal morphology or endodontist inattention treatment may result in root perforation, or inadvertent instrument fracture within the canal.

The separated instruments may not require retrieval but they can get displaced into inferior alveolar canal (nerve compression) and thus lead to various symptoms and neurological problems [6,7]. In the above-mentioned case there were no signs or symptoms that include pain or swelling or neurological disorders. Thus, removing of the broken lentulo was not an ultimatum.

The root canal was filled and two weeks after, the patient was able to wear partial denture in the lower jaw and maxillar complete denture. In this way, the patient became functionally rehabilited with two acrylic dentures. After 5 years, the patient had no signs neither symptoms of the restored teeth and extension of periapical lesion, with acceptable masticatory performance.

Although, acrylic partial denture isn't the best prosthetic choice for restoring the present edentulousness, the resilience, based on the viscoelastic properties of acrylate, has better effect for periapical tissue of the second lower premolar and inferior alveolar nerv [15]. It must be considered that the healing process in elderly patients is slower and any potentially undesirable occlusal load must be eliminated to preserve the already damaged periodontium. Cast

denture or fixed prosthesis may cause adverse effects on the aforementioned mandible structures because of alloy presence. In order to avoid the possible surgical complication and restore previous masticatory function, we did the simple procedure with no complications.

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DENTURE- INDUCED FIBROUS HYPERPLASIA (EPULIS FISSURATUM)

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ABSTRACT

Denture-induced fibrous hyperplasia (epulis fissuratum) occurs in complete denture patients, because of constant irritative action that induces the mucosa to grow under poorly fitting dentures. The epulis fissuratm usually occurs in the vestibular mucosa, where the denture flange contacts the tissue. It consists of painless folds of fibrous connective tissue that are firm to palpation. These lesions must be removed, and to avoid a relapse, new complete dentures should be made to maintain healthy surgical tissues.

Aim: The purpose of this study was to present a case report of the surgical treatment of epulis fissuratum, as a support to clinical diagnosis with histopathological finding, and to provide satisfactory results of rehabilitation in oral function and tissue health with new denture.

An epulis fissuratum is a benign condition but, if ulcerated, it can mimic more serious conditions like oral cancer. Thus, microscopic histopathological examination of the removed tissue is an imperative to be accomplished in order to confirm the doctor's clinical diagnosis.

Key words: denture induced fibrous hyperplasia, surgical treatment

Introduction

Denture-induced fibrous hyperplasia (*epulis fissuratum*), also called as fibrous inflammatory hyperplasia, denture hyperplasia, granuloma fissuratum, is caused by intense chronic trauma usually from illfitting dentures or even parafunctional habits.

The epulis fissuratm usually occurs in the vestibular mucosa, where denture flange contacts the tissue. As the bony maxillary and mandibular alveolar ridges resorb over a prolonged period, the flanges extend further into the soft tissue of the vestibule, causing chronic irritation and trauma, which can lead to an exuberant fibrous connective tissue response. The usual reason for this is the fact that the bony ridge, to which the denture originally fit, changes over time. The edge of the denture often divides the growth tissue. This same response occurs in traumatic fibromata, but the denture is specifically defined there as the causative agent [1].

Lesions typically appear as a single or multiple hyperplastic tissue folds or as folds of hyperplastic connective tissue, covered with stratified squamous ephitelium in the alveolar vestibule. In the bottom of the fissures, severe inflammation and ulceration may occur. Epulis fissuratum tend to be asymptomatic, but can become very tender if acutely injured [2].

Epulis fissuratum consists of painless folds of fibrous connective tissue that are firm to palpation and into which the denture flange conveniently fits. The lesion is not usually highly inflamed, but may be irritated or even ulcerated in the base where the edge of the denture flange fits [3]. The size of the lesion varies from a localized hyperplasia of less than 1 cm in size to massive lesions that involve most of vestibule lenght. It has been reported to occur at 5-10% of jaws fitted with dentures and is more prevalent in maxilla than mandible [4]. Then, denture induced hyperplasia becomes clinically manifested, usually in conditions of upper denture and present teeth in the mandibular font.

Denture hyperplasia occurs predominantly in females and most studies have shown that two thirds to three fourths of all cases submitted for biopsy occur in women. It is suggested that this formation may be affected by hormonal alterations in the menopause [5].

The anterior regions of the jaws are more often affected by epulis fissuratum than are the posterior regions and it occurs at a higher rate in the maxilla than in the mandible [3].

Inflammatory fibrous hyperplasia has no malignant potential so recurrences following excision are almost the result of failure to eliminate the specific chronic irritation involved. Thereby, researchers should treat them by the surgical removal of the lesion and elimination of the chronic irritant and causing factors [6].

The purpose of this study was to present a case report of the surgical treatment of epulis fissuratum, as a support of clinical diagnosis with histopathological finding, and providing satisfactory results of rehabilitation in oral function and tissue health with new denture.

Case report

The fifty six years old patient came to the Clinic for oral surgery at the Dental Clinical Centre "St. Pantelejmon" concerned about a soft tissue enlargement of the maxillary mucolabial fold area. The patient reported that the lesion has been presented for at list one year and it was large now than first noticed. The patient stated that the lesion was traumatized by his denture during prolonged chewing. The soreness was resolved when he takes out the denture at night. He has not noticed bleeding in association with the lesion (**Figure 1**).

The lesion was firm to palpation, had a smooth surface, and was fixed to the surface mucosa and to underlying structures (**Figure 2**).

The diagnosis was based on history of the patient, thoroughly made on clinical examination with acceptance of clinical observation of morphology of the lesions, as well as its character/behavior (painless, tendency of bleeding). Panoramic radiographic examination was carried out (orthopanthomographic X-ray), in order to analyze the qualitative and quantitative characteristics of residual bone fundament.

In order to eliminate the reason for chronic irritation and trauma, the patient was suggesting not to wear the dentures for two weeks period. During this period, chronic inflammation abdicated, which

Figure 1.
Overgrowth of fibrous connective tissue around the edges of ill-fitting denture

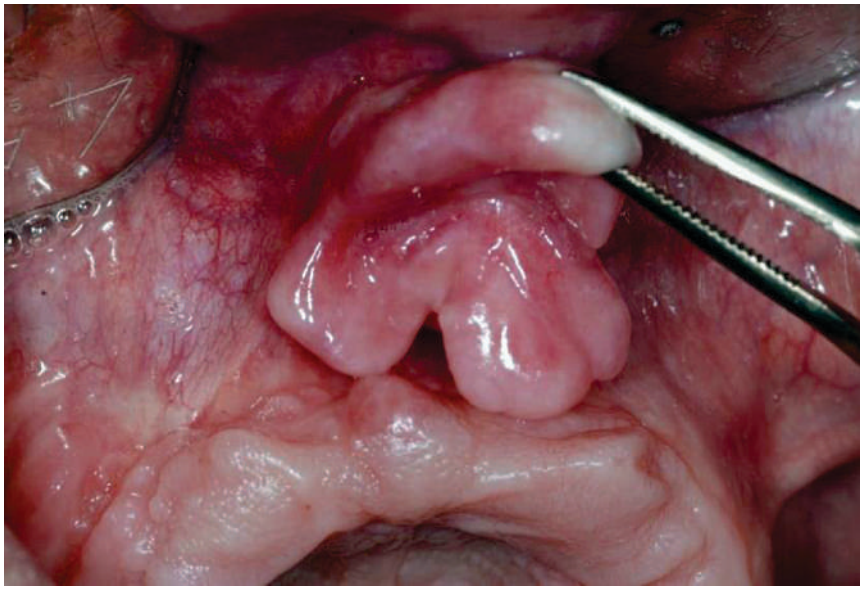

Figure 2.
The lesion made up of excess tissue which one part is found under the denture while the rest protrudes into the labial area. The internal and external parts of the lesion were separated by a deep groove in which the denture flange sits.

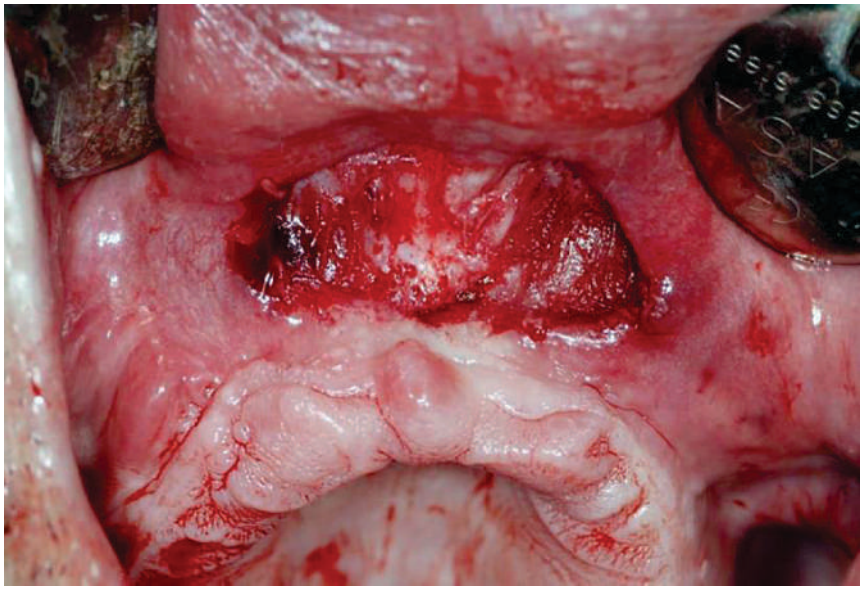

Figure 3.
Aspect of surgical wound after scalpel removal of epulis fissuratum

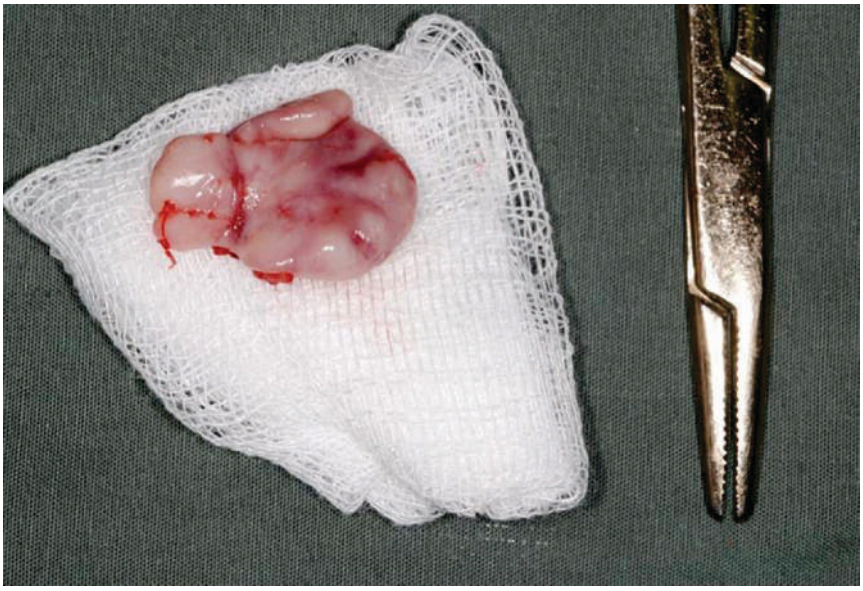

Figure 4.
Excised hyperplastic tissue

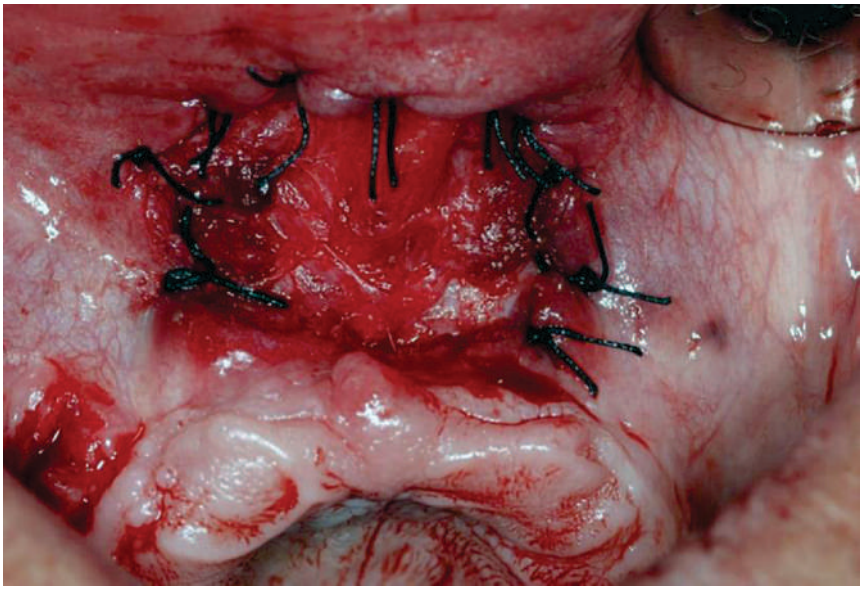

Figure 5.
Surgical wound and interrupted sutures

involved some regression of the lesion, and on the other side, better situation for making the planning surgical intervention.

It was concluded that the patient should have a new denture constructed, because the old one had retention and disrupted stability, as a result of physiological process of alveolar bone fundament atrophy (perennial use of denture), and from the hyperplastic tissue.

With block anesthesia, the anesthetic field holding the whole anatomic region was secured. Mobile tissue was held firmly with surgery forceps, so the wedge shaped excision of the soft tissue was made (**Figure 3**).

Excised tissue was submitted for routine histopathological examination in the Institute for Histopathology of the Faculty of Medicine, Skopje, because although epulis fissuratum is benign, overgrowth can also be a sign of malignancy (**Figure 4**).

The periost of wound margins was sutured by interrupted sutures and ZnOOCH package was placed on the place of the bone from which the tissue was removed (**Figure 5, 6**).

In postoperative period, no significant complications were registered, so postoperative morbidity (swelling, pain, and bleeding) was in the borders of expectations, having in mind the seriousness of the surgical intervention. After complete consolidation

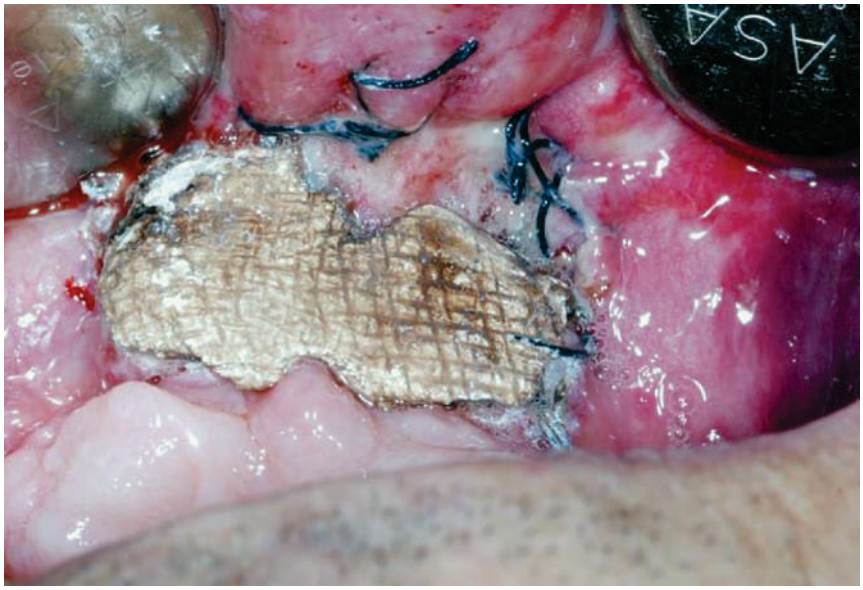

Figure 6.
ZnOOCH package placed on the surgical wound

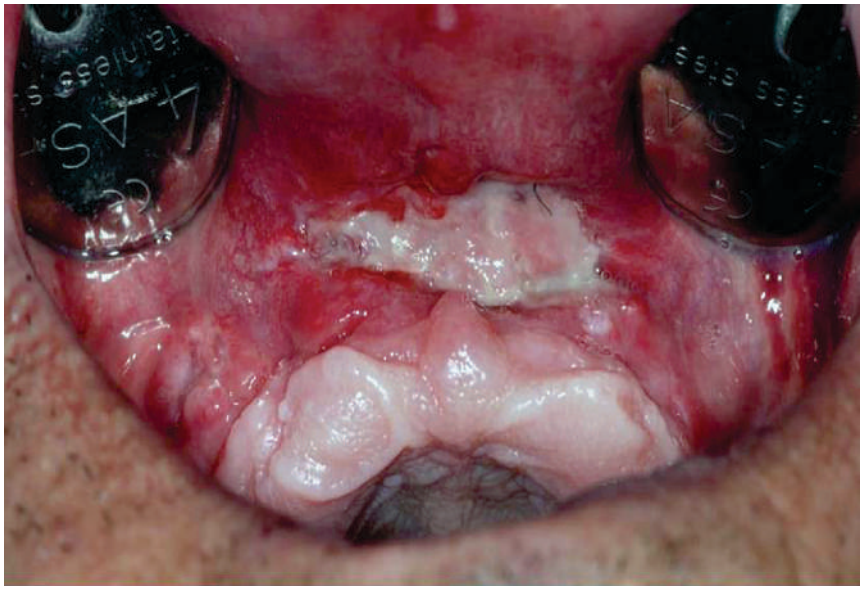

Figure 7.
Clinical aspect of the surgical field 1 week after surgery

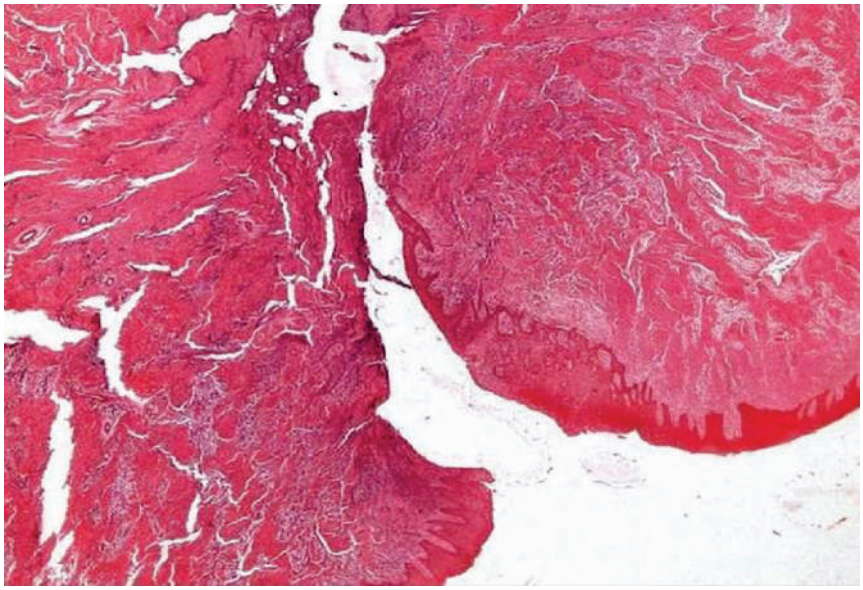

Figure 8.
Histopathological finding of inflammatory fibrous hyperplasia

Figure 9.
Complete new denture

of the soft tissue in the surgical field, the new denture was made (**Figure 7**).

The histopathological report confirmed the presurgical diagnosis. Macroscopic finding showed soft tissue fragment from gingivae, lobular fragment with dimensions 1,8 x 1,2 x 1 cm, covered with mucosa.

According to microscopic intersections, superficial papilomatous proliferated multilayer platelet epithelium was confirmed. Subepithelialy, there was multiple connective and collagen tissue, small blood cells and rear focuses of lymphocytes cells (**Figure 8**).

The last clinical examination (one year after oral surgery) showed no relapse of new hyperplasic tissue (**Figure 9**).

Discussion and conclusion

Inflammatory fibrous hyperplasia, also referred to as epulis fissiuratum, is a generalized hyperplastic enlargement of mucosa and fibrous tissue in the alveolar ridge and vestibular area, which mostly results from ill-fitting dentures. In the early stages, when granolomatose tissue is present, elimination of the source of chronic trauma (dentures) is often stretching for fully regression of hyperplastic tissue. But, in the latest developing stages, when this granulomatose tissue changed into a fibrouse tissue, the alteration has irreversible character. Then, the only way for resolving this problem is surgical treatment, excision of the hyperplastic tissue.

Canger et all., found that the incidence of epulis fissiuratum was higher in individuals who had used their dentures for more than 10 years This was explained by the possible longer traumatic effect of a defective denture, and by the fact that defects might be more severe in old dentures than new ones. However, in addition to the wearing period, denture cleansing and the denture base material must be taken into account. It is well known that hyperplasia related to denture use originates from chronic irritation. To avoid denture induced hyperplasia, dentures must be examined more often after their construction and delivery, the patients must be informed about cleansing and disinfection measures, and warned not to wear them a whole day at a time [7].

Denture wearers should be educated of the importance of periodic examination due to changes of supporting tissues and early detection of mucosal lesions to maintain their oral and denture hygiene in optimum level [8].

Treatment of such kind of lesion includes elimination of the causing factors and surgical removal of the lesion. If the causal factor persists, the tissue becomes more fibrous over time. The most common techniques used for removing the hyperplastic lesions are surgical scalpel, electrical scalpel, carbon dioxide laser, Erbium: YAG laser, Neodymium: YAG laser and diode laser.

The advantages of using a CO2 laser has been clinically demonstrated in the study of Jose de Arruda T et all. [6], presenting minimal bleeding during the surgery with no need of sutures while also presenting a good healing response, with minimal wound contraction, less inflammatory reaction, and good reepithelialization with no scar formation (which is directly determined from the size of hyperplastic tissue).

Frame [9] believes that there is a delayed healing with CO2 laser surgery because of less wound shrinkage and secondary wound healing, which takes longer.

An epulis fissuratum is a benign condition but, if ulcerated, it can mimic more serious conditions like oral cancer and it is imperative that microscopic histopathological examination of the removed tissue be accomplished to insure that the doctor's clinical diagnosis is correct.

Epulis fissuratum tend to be asymptomatic, but can become very tender if acutely injured. Epulis fissuratum and squamous cell carcinoma are not causally related, but a patient can have more than one unrelated oral lesion at the same time. Induration and persistent pain despite avoidance of trauma are dangerous signs that squamous cell carcinoma may have developed [2, 10].

As a component of the treatment, new dentures must be made, patients should ask for information about maintaining them, including recommendations on the timing of checkups for fit and comfort [11].

Dentists are in the best position to detect and diagnose relatively rare and life threatening oral lesions such as carcinoma. The dental team should therefore always maintain a high index of suspicion [12].

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TITLE: **The News From Dental Treasure Chest (Neues aus der dentalen Trickkiste Band II, Die dentale Trickkiste)**

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Author of "The Dental Treasure Chest", Wolfram Bücking, prepared a long-awaited continuation. This book also contains a wealth of tips being helpful in solving problems within all branches of dentistry, along with the application of modern, tried and tested treatment methods and new techniques and materials.

The Book is divided into nine chapters.

First chapter is dedicated to the first aid in prosthodontics, and deals with the treatment of incidental conditions, such as fracture of implant screw, stuck telescope prosthesis, fracture of the crown abutments telescope crowns, or repair of dentures.

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This book is a kind of alternative tutorial laying on the concept of problem based learning. The book is extremely useful not only for specialists of particular branches of dentistry, but also for general dental practitioners.

Anita Bajsman

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