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# STOMATOLOŠKI GLASNIK SRBIJE

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# Contents / Sadržaj

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<b>REČ UREDNIKA</b> .....	133
<b>ORIGINAL ARTICLES / ORIGINALNI RADOVI</b>	
Marija Nikolić, Mina Golubović, Ivana Veličković, Antonije Stanković, Jelena Popović, Aleksandar Mitić, Radomir Barac	
Dentistry in the eyes of medical students .....	135
Stomatologija u očima studenata medicine	
<b>REVIEW ARTICLE / PREGLED LITERATURE</b>	
Minja Miličić Lazić, Jovana Marković, Danica Popović, Vojkan Lazić	
Treatment planning in implant-prosthodontics – prosthodontic aspect .....	144
Implantatno-protetski plan terapije – protetski aspekt	
<b>CASE REPORT / PRIKAZ BOLESNIKA</b>	
Nikola Milošević, Suzana Stojanović-Rundić, Srđan Milanović, Marko Dožić	
Primary intraosseous leiomyosarcoma of the nasal and paranasal cavities – a case report. ....	154
Primarni intraosealni lejomiosarkom nosnih i paranazalnih šupljina – prikaz bolesnika	
Tina Pajević, Jovana Juloski, Marija Živković	
Class II Division 1 malocclusion treatment using TADs – case report. ....	159
Terapija malokluzije II klase 1. odeljenja kod odraslih pacijenata primenom mini-implantata – prikaz bolesnika	
Igor Radović, Lado Davidović, Smiljka Cicmil, Slavoljub Tomić, Dragan Ivanović, Ljiljana Bjelović	
Maxillary bone necrosis following the use of formaldehyde containing paste – case report. ....	165
Nekroza maksilarne kosti posle primene devitalizacione paste na bazi formaldehida – prikaz bolesnika	
<b>DA LI STE PAŽLJIVO ČITALI RADOVE?</b> .....	171
<b>UPUTSTVO AUTORIMA ZA PRIPREMU RADA</b> .....	174
<b>INSTRUCTIONS FOR AUTHORS</b> .....	176



*Ono što silom postignete  
samo se silom može sačuvati.  
Mahatma Gandhi*

U aktuelnoj imitaciji života mentalno nasilje izvire iz svake medijske slike i svakog novinskog teksta. U društvu „poremećenih vrednosti“ isključena je svaka „normalnost“ i teško je ostati samosvestan i svoj. Logorično praznoslovlje, laž i besprizorni izlivi mržnje su sinonim svekolike nekulture koja nas okružuje. Elementarna pristojnost se doživljava kao slabost, a bahatost, primitivizam i „bezgranična“ količina falsifikata natkriljuje svaku kreativnost i pokušaj iskoraka iz ideološkog i moralnog bezizlaza.

Svedoci smo da se glupost sprda razumu, svirepost ismeva dobrotu, ružnoća ponižava lepotu, a nekompetentni i nesposobni sa puno emocionalnih, intelektualnih i zdravstvenih hendikepa jedini su vlasnici istine i sigurne „vode“ u neizvesnost.

U „imaginarnoj stvarnosti“ dominiraju laž, obmane i neistina u svim segmentima života. Neistina (čitaj laži) „ispaljuje“ se iz svih raspoloživih oružja (čitaj mediji) bez ikakve bojazni da će se „lažljive“ kule kad-tad srušiti a odgovorni izbeći moralnu i svekoliku odgovornost. Predstava u medijima je često „od reči do reči“ upravo suprotno onome što se stvarno dogodilo. Galimatijas neznanja partijski podobnih i nestručnih oblikuje stvarnost u društvo političke narkoze, gde je sve moguće i gde jedino ne možete ukinuti sami sebe.

Vrhunsko dostignuće „kriznog štaba“ tokom šest meseci trajanja pandemije je saznanje da je neophodno nositi masku i držati fizičku distancu, a sve ostalo je nepoznanica. U ovoj teškoj situaciji segment društva kome smo uglavnom verovali postao je „instrument“ onih koji nam oblikuju život, pa sada „sumnjamo“ u svaku reč i svaku brojku koju nam saopšte.

U društvu poremećenih vrednosti besmisleno je da o gašenju vatre govore oni čiji je etički kodeks vrlo upitan, da o statistici govore oni koji ponešto znaju o brojevima, da o pravdi govore oni koji svakog minuta krše zakone, da o vojsci govore ljudi bez ikakvog vojnog obrazovanja, da o naučnim potvdama i dokazima odlučuju oni koji čitaju „isključivo“ dnevne novine.

Da bi društvo iskoračilo iz takvog vrednosnog sistema i da bi se smanjila količina „falsifikata“ i eliminisala „nekultura kao model ponašanja“, neophodno je da svaki pojedinac bitiše isključivo sa osećajem sopstvenog morala i elementarne savesti. Treba biti hrabar, odgovoran i čestit. Treba hodati uspravno i težiti ka istini i biti kreativan u svakom segmentu života. Jedino se tako može „spasti“ sopstveni život, a društvu dati mogućnost da bezizlaz zameni „novom izvesnošću“.

Završiću citatom princeze Dajane: „Zlo pobeđuje kada mu se dobri ljudi ne suprotstave“ jer je paradigma našeg aktuelnog trenutka, ali i jedini putokaz iz aktuelnog mraka sopstvenog bitisanja.

*Prof. dr Slavoljub Živković*



# Dentistry in the eyes of medical students

Marija Nikolić<sup>1</sup>, Mina Golubović<sup>2</sup>, Ivana Veličković<sup>2</sup>, Antonije Stanković<sup>2</sup>, Jelena Popović<sup>1</sup>, Aleksandar Mitić<sup>1</sup>, Radomir Barac<sup>1</sup>

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## SUMMARY

**Introduction** It is known that patients primarily come to general practitioners asking for help with oral disease. Although the matter falls out of the frame of `traditional` medical practice, ethical guidance suggests that doctors should examine one`s oral cavity with the aim of recognizing symptoms which treatment could improve the quality of oral and general health leading to an early discovery of potentially severe diseases.

The aim was to examine the habits and attitudes of medical students and graduates who are interns related to oral health care, their knowledge of oral cavity diseases and systematic diseases with symptoms manifested in oral cavity, as well as their knowledge of patients who are at risk from dental interventions.

**Material and methods** The survey was conducted on the sample of 100 subjects. The questionnaire consisted of 16 questions. The results were collected and statistically analyzed.

**Results** The majority of subjects go to the dentist only after the toothache starts. Although 84% of medical students make sure to check oral cavity while taking medical history, more than half of the examined medical students would not send the patient to dentist for consultation. Every tenth student was not able to state other local disease of oral cavity apart from tooth decay. Even 6% of examined students classified the tooth decay as an aesthetic problem. Half of examined students considered their study program needed course in the field of dentistry.

**Conclusion** Medical students are not well informed about the field of oral hygiene and pathology of oral cavity. Interdisciplinary cooperation of General Practitioners and Dentists is important.

**Keywords:** dentistry; medicine; oral health; pathology of oral cavity; interdisciplinary approach

## INTRODUCTION

The first data on the influence of oral diseases on general health is dated back to Babylon (2500 BC) and Hippocrates. In the records of ancient Egyptians, Greeks and Romans there is written evidence of the link between toothache and related headache and pain in legs, as well as successful treatment of such diseases after removing the diseased teeth [1, 2].

General definition of oral health implies the state of oral cavity without any changes, which not only makes people prettier but also provides normal functioning through the ability to chew, swallow, speak, laugh and kiss and through senses- the sense of taste and touch [3].

Oral health is a precondition for the maintenance of general health. Oral changes can be initial symptoms of systematic diseases, and in some cases it has been proven that there is a link between oral diseases and diseases such as diabetes, digestive disorders, cerebrovascular stroke, cardiovascular diseases, metabolic syndrome and cancer [2, 3]. Studies have shown a connection between the periapical tooth abscess and the occurrence of extra systoles and rheumatoid arthritis [1, 2]. Some studies have also indicated the relationship between odontogenic infections and skin diseases, such as alopecia areata combined with cutaneous systematic lupus [4]. The existence of "key

types" of microorganisms in the ecosystem of the upper part of gastrointestinal tract can be associated with the increased risk of aero-digestive tract cancer [5]. Periodontal diseases are the risk factor for cardiovascular diseases, diabetes, cancer and hypertension. Inflammation followed by increased level of IL 1, TNF, IL6 in plasma can have a negative influence on CNS, leading to the impairment of cognitive functions [6-9].

It is interesting that a patient, instead of going to the dentist, often goes to the general practitioner for dental and oral diseases [10]. Reasons are likely the following: the first one is availability of general medical health services covered by health insurance for the majority of patients. Secondly, patients are convinced that the examination and treatment by the general practitioner are, unlike dental intervention, painless and therefore less stressful [11, 12]. Even though it lies outside of the scope of "traditional" medicine, ethical principles require doctors to examine oral cavity and possibly notice some of the symptoms that can be cured with an adequate and timely treatment thus improving oral and general health and leading to an early discovery of potentially serious diseases [11, 13]. The knowledge of a doctor about etiology and pathogenesis of three most common oral cavity diseases (caries, periodontal diseases and oral cavity cancer) can decrease

the prevalence of these diseases (incidence of oral cavity cancer is increasing) [13, 14].

The therapy given by doctors with the aim of curing a certain disease can also cause some changes to the oral cavity. One of the examples is reduction in salivary secretion (xerostomia) that is important caries risk and should involve a dentist [14, 15, 16]. On the other hand, it is necessary for dentists to be familiar with the diseases that cause oral symptoms, sometimes these are the first signs of a disease, and to be able to refer patient to a specialist.

Population aging is global phenomenon and life expectancy of humans has been increasing. Preservation of natural dentition that contributes to good health and quality of life should be the aim of medical community comprised of doctors of medicine and dentistry [17].

The aim of the current study was to examine the habits and attitudes of medical students and graduates of medicine who are interns related to oral health care, their knowledge of oral cavity diseases and systematic diseases with symptoms manifested in oral cavity, as well as their knowledge of patients who are at risk from dental interventions.

## MATERIALS AND METHODS

The research comprised 100 people (54 female and 46 male) 21 to 27 years of age who signed the written consent to participate in the survey. Respondents were fourth, fifth and sixth year students of Medical Faculty in Nis, as well as doctors who graduated from the Medical Faculty of Nis and are currently interns.

The research was conducted by means of modified questionnaires: *Questionnaire for medical and dental students* [14] and *Oral health behavior and knowledge survey* [3] in accordance with the aims set in this research. Mixed type survey (*self-reported survey*) consisted of 16 questions to which respondents answered anonymously without time limits and with no access to the Internet. Responses were summarized and statistically analyzed by non-parametric descriptive statistics (frequency and percent).

## RESULTS

The results of the survey are presented in the tables 1–16.

**Question 1** – How do you choose a toothbrush? (Table 1)

**Question 2** – Do you use any other oral hygiene aids besides a toothbrush? (Table 2)

**Question 3** – What technique of brushing teeth do you use? (Table 3)

**Question 4** – When do you go to see a dentist? (Table 4)

**Question 5** – Have you ever had any of your teeth taken out (extracted)? (Table 5)

**Question 6** – How many molars do humans have? (Table 6)

**Question 7** – When would you refer your patient to a dentist? (Table 7)

**Question 8** – Do you always examine oral cavity when taking a medical history (tongue, teeth, oral mucosa)? (Table 8)

**Table 1**  
**Tabela 1**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Dentist's recommendation Preporuka stomatologa	34	33
TV Commercial TV reklama	9	9
Based on the appearance Zasnovano na izgledu	29	28
Based on the price Zasnovano na ceni	20	20
Pharmacist's recommendation Preporuka farmaceuta	4	4
I think that all the toothbrushes are equally good Mislim da su sve četkice za zube iste	6	6
Total number Ukupno	102	100

**Table 2**  
**Tabela 2**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Dental floss Konac za zube	30	25
Interdental toothbrush Interdentalna četkica	18	15
Mouthwash Tečnost za ispiranje usta	52	43
I do not use anything else Ne koristim ništa dodatno	20	17
Total number Ukupno	120	100

**Table 3**  
**Tabela 3**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
I do not have a special technique Nemam posebnu tehniku	49	49
I follow the advice of my dentist Slušam savet stomatologa	48	48
According to the advice found on the Internet Po savetu sa interneta	1	1
Other Drugo	2	2
Total number Ukupno	100	100

**Question 9** – Do you think that any oral cavity disease can manifest itself on a distant organ? (Table 9)

**Question 10** – Do you think that your current knowledge of tooth and oral cavity diseases is satisfactory? (Table 10)

**Question 11** – Do you think that medical students need a special subject on oral health and oral cavity diseases? (Table 11)

**Question 12** – Do you consider caries to be: (Table 12)

**Question 13** – Do you think that caries is a contagious disease? (Table 13)

**Question 14** – Do you think that certain groups of patients are at risk from dental interventions? (Table 14)

**Table 4**  
**Tabela 4**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Preventative examination (twice a year) Preventivni pregled (dvaput godišnje)	39	39
The moment I have a tooth ache or I notice something on my tooth Zubobolja ili neki problem sa zubima	46	46
When I have a tooth ache for a long time or I have noticed something on my tooth Zubobolja ili neki problem sa zubima već duže vreme	15	15
When the pain becomes unbearable Nepodnošljiva bol	0	0
Total number Ukupno	100	100

**Table 5**  
**Tabela 5**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Only wisdom tooth (teeth) Samo umnjak(e)	21	21
Yes, one Da, jedan	13	13
Yes, one to three Da, 1–3	14	14
Yes, more than three Da, više od tri	4	4
No, I have all of my teeth Ne, imam sve svoje zube	48	48
Total number Ukupno	100	100

**Table 6**  
**Tabela 6**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
8	48	48
12	38	38
16	12	12
20	2	2
Total number Ukupno	100	100

**Table 7**  
**Tabela 7**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
When you feel bad breath Loš zadah	40	20
Due to a great lack of teeth Nedostatak zuba	45	22
For a checkup Pregled uopšte	60	29
For a medical consultation Medicinska konsultacija	46	23

Other Drugo	13	6
Total number Ukupno	204	100

**Table 8**  
**Tabela 8**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Yes Da	84	84
No Ne	16	16
Total number Ukupno	100	100

**Table 9**  
**Tabela 9**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Yes Da	93	93
No Ne	3	3
I do not know Ne znam	4	4
Total number Ukupno	100	100

**Table 10**  
**Tabela 10**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Yes Da	34	34
No Ne	24	24
No, but I would like to learn more Ne, ali bih voleo/la da naučim više	42	42
Total number Ukupno	100	100

**Table 11**  
**Tabela 11**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Yes Da	53	53
No Ne	20	20
I think that we gain enough knowledge within the existing study program Mislim da steknemo dovoljno znanja tokom studiranja	27	27
Total number Ukupno	100	100

**Table 12**  
**Tabela 12**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Exclusively localized disease Samo lokalizovano oboljenje	57	57
Exclusively an aesthetic problem Samo estetski problem	6	6
Total number Ukupno	100	100

**Table 13**  
**Tabela 13**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Yes Da	16	16
No Ne	75	75
I do not know Ne znam	9	9
Total number Ukupno	100	100

**Table 14**  
**Tabela 14**

Answer Odgovor	Frequency Učestalost	Percentage Procenat
(frequency of repeated answer) (učestalost ponovljenog odgovora)		
Yes Da	76	76
No Ne	9	9
I do not know Ne znam	15	15
Total number Ukupno	100	100

**Table 15**  
**Tabela 15**

Answer Odgovor	Frequency Učestalost	Percentage Procenat	
(frequency of repeated answer) (učestalost ponovljenog odgovora)			
Correct answers Tačan odgovor	Sjögrenov syndrome Sjogrenov sindrom	12	9
	Systematic sclerosis Sisematska skleroza	7	5
	Systemic lupus ery- thematosus Sistemski eritematozni lupus	6	5
	Crohn's disease Kronova bolest	2	1
Incorrect answers Netačan odgovor	91	71	
I do not know Ne znam	11	9	
Total number Ukupno	129	100	

**Table 16**  
**Tabela 16**

Answer Odgovor	Frequency Učestalost	Percentage Procenat	
(frequency of repeated answer) (učestalost ponovljenog odgovora)			
Correct answers Tačan odgovor	Periodontal disease Parodontopatija	19	16
	Gingivitis Gingivitis	15	13
	Candidiasis Kandida	12	10
	Aphthous stomatitis Aftozni stomatitis	19	16
	Tonsillitis Upala krajnika	5	4
	Herpes Herpes	4	3
	Glossitis Upala jezika	4	3
	Stomatitis angularis Angularni stomatitis	4	3
	Other Drugo	26	22
	Incorrect answers Netačan odgovor	1	1
I do not know Ne znam	10	9	
Total number Ukupno	119	100	

**Question 15** – Are you familiar with any systemic disease that can manifest itself in the oral cavity? (Table 15)

**Question 16** – Are you familiar with any localized disease of oral cavity besides caries? (Table 16)

## DISCUSSION

Survey techniques can be used for descriptive and explanatory research. The advantages are the possibility of investigating ethically sensitive topics and the possibility of repeating and combining research. On the other hand, the establishment of cause and effect relationships is susceptible to subjective interpretation. Disadvantages of this survey are the facts that the respondents could choose to give socially acceptable responses and a report on behavior is obtained instead the observation of behavior. A survey as an instrument of psychometry represents an irreplaceable method of quantifying and analyzing differences among people [18].

The future profession of medical and dentistry students involves the promotion of general and oral hygiene; therefore it is expected for students to be familiar with appropriate ways of maintaining oral health. Beside the fact that oral hygiene influences their health and quality of life, it reflects the attitude that they as future medical professionals have toward oral health, as they should set an example for other people [3]. In the conducted survey almost half of the respondents stated that they do not have any special techniques of brushing teeth. This represents a less favorable result than the one found in the study

conducted by Ke Yao et al. on the sample of 202 medical students in China, where 35% of students did not have a special technique for brushing teeth [3].

As far as the choice of a toothbrush is concerned, when buying one, the price represents the main factor in one fifth of students, which is not in accordance with the results obtained by Dolar Doshi et al. who found that only in 2.5% of examined students at the private college in India the price of a toothbrush played the key role [19]. The possible difference in socio-economic status of students in these two studies may be the reason for the discrepancy of results. Six out of 100 medical students considered that all toothbrushes are equally efficient, which is less than the number of students in the study of Dolar Doshi et al. [19]. Twenty eight percent of students chose toothbrush based on its appearance that is similar to the percentage in the study of Dolar Doshi et al. [19]. Only one third of the future doctors would seek an advice from a dentist regarding which toothbrush to choose, and one half of them would ask for advice regarding the technique. This only proves that a dentist is seen more as someone who provides the treatment and not someone who plays a big role in the prevention of diseases.

The majority of students in this research (43%), mentioned mouthwash as an additional aid that they use to maintain oral hygiene, which is concurrent with results obtained by Dolar Doshi et al. [19]. Modern science gives preference to the use of interdental toothbrushes that are used by 15% of medical students in this study, while liquids are recommended for prevention of infections in people with weakened immune system, undergoing radio and chemotherapy. These agents can be harmful to healthy people because of some substances they contain (alcohol), while some can color teeth due to the presence of chlorhexidine [20–24].

The use of dental floss for maintaining dental hygiene is justified if interdental space is narrow [20]. Dental floss was used by almost one third of the respondents, which is not in accordance with the results of Ke Yao et al. who found that 6.4% students used floss to remove plaque from the tooth surfaces [3]. Different preventative programs specific for different schools promote different aids in maintaining oral hygiene and that can be the reason for the variation in the prevalence of dental floss use.

Loker et al. indicated that 15% of general population goes to the dentist only when they feel pain [25]. The results of that research are in accordance with the results of our research since the same percentage of the respondents confirmed that the pain was the main reason for visiting dentist. This information also indicates no difference in the attitude of general population and medical students [25]. However, the obtained results significantly differ from those found by Dolar Doshi et al. [19]. In their study, 68% students visit dentist only when they have a toothache, while 20% go to the dentist on regular basis as a part of prevention. Found data also showed larger percent of respondents (39%) went to dentist twice a year.

Tooth loss causes changes in occlusion and articulation in stomatognathic system as well as masticatory function and impaired aesthetics [26]. The survey revealed that

students had preserved dentition while approximately one third of respondents have had one tooth or more extracted, not including third molars. Given that this is young population, modern dentistry cannot justify early teeth loss. This study did not have the aim of investigating the reasons of an early tooth loss in this population, however, the lack of information and care for one's oral health impose possible reasons for it.

Oral cavity serves as a mirror of general health since it is a place where changes caused by some systematic disease and general diseases can primarily occur. Swollen lips, gingiva and a tongue as well as the appearance of oral aphthous ulcer, bumps on oral mucosa, loss of papilla are some of the changes that can be noticed during routine examination of the oral cavity [2, 27]. The results of the conducted research indicated that 84% of the students did a routine examination of oral cavity; however, more than one half of them (55%) would ignore missing teeth in a patient.

According to the research conducted by Lachlana et al. 28% of medical students performed a routine examination of oral mucosa, 48% of those who did not perform the examination would not even examine the oral cavity of a patient with a high risk of oral cavity cancer [14]. The same authors stressed out the habit of patients to turn to a general practitioner first when oral lesions appear [4]. Most of the respondents of the same study (71%) would not refer a patient to a dentist for consultation. Both studies confirmed the lack of interdisciplinary collaboration, at the cost of patients.

One fifth of the patients could name systemic diseases that have manifestations in the oral cavity. The most common response was Sjögren's syndrome (9%), in addition to systematic lupus erythematosus (6%), systematic sclerosis (7%) and Crohn's disease (1%). Answers such as measles, anemia, and diabetes were considered to be incorrect, since they cannot be classified as systematic diseases. Some medical students (16%) named fungal diseases, which even though incorrect, was the most frequently given answer. There is a possibility that the reason for such a great number of incorrect answers lies in the fact that the respondents did not pay attention that the question only referred to systemic diseases.

Caries is a local tooth disease which if not treated can lead to a number of complications that may be life threatening [28]. Thirty seven percent of medical students were aware of this fact. Six respondents considered caries as an entirely aesthetic problem. The majority of respondents (75%) thought that caries is not contagious. Ke Yao et al. presented similar results, they stated that more than 40% of the participants in their study were unaware of the crucial role that bacteria plays in the etiology of caries [3].

Among localized diseases, the respondents often named periodontal disease, gingivitis, candidiasis and canker sores besides caries. Less frequent responses were glossitis, pulpitis, herpes and tonsillitis. Approximately 9% of medical students could not name any of the localized diseases of oral cavity, however, the majority of respondents (93%) thought that an oral cavity disease could manifest itself on a distant organ, which can be helpful for establishing a diagnosis and successful treatment of primary disease.

The results of the survey showed that 9% of medical students thought there are no patients who are at a risk of dental interventions, while 15% stated that they were unaware of the existence of such a group of patients. A research conducted by Sandra et al. in Lithuania showed somewhat better but certainly not encouraging results where only 36.4% of respondents (medical students, doctors and nurses) thought that some dental interventions may be life threatening.

One third of respondents categorized their knowledge in the field of tooth and oral diseases as satisfactory, while 42% wanted to learn more. Approximately one half of respondents claimed that they did not need a special exam on oral health, teeth and oral cavity diseases, and the fact that every human has 12 molars only 38 respondents out of 100 medical students knew. These results are different from ones obtained in the study conducted by Lachlan et al. who revealed that 93% of the final year medical students considered to have insufficient knowledge of prevention and detection of the changes which occur in mouth [14]. Different study programs most likely cause the differences in the results.

## CONCLUSION

Habits and attitudes related to preservation of oral health of the majority of medical students and newly graduated doctors, as professionals are not different from those of general population. The lack of knowledge about oral diseases as well as some systemic diseases that have manifestations in mouth is observed among medical students. There are some final year medical students who did not know any other localized oral disease besides caries. A great number of medical students were unaware of the diseases that represent a risk for dental intervention. Interdisciplinary cooperation of doctors and dentists should be a prerequisite for good health of all patients.

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# Stomatologija u očima studenata medicine

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## KRATAK SADRŽAJ

**Uvod** Pacijenti se često primarno obraćaju lekaru opšte prakse zbog bolesti zuba i usne duplje. Iako to ispada iz okvira 'tradicionalne' medicinske prakse, etička načela nalažu lekarima pregled usne duplje u cilju uočavanja simptoma, čije lečenje može poboljšati kvalitet oralnog i opšteg zdravlja i dovesti do ranog otkrivanja potencijalno teških bolesti.

Cilj rada bio je da se ispituju navike i stavovi studenata medicine i svršenih doktora medicine na stažu vezani za brigu o oralnom zdravlju, njihovo poznavanje bolesti koje se javljaju u usnoj duplji i sistemskih bolesti sa manifestacijama u oralnoj regiji, kao i njihova informisanost o rizičnim pacijentima za stomatološke intervencije.

**Materijal i metode** Istraživanje je sprovedeno na uzorku od 100 ispitanika putem anketiranja. Upitnik se sastojao od 16 pitanja. Rezultati su sakupljeni i statistički analizirani.

**Rezultati** Većina ispitanika kod stomatologa odlazi tek kada ih zub zaboli. Iako 84% studenata medicine pregleda usnu duplju prilikom uzimanja anamneze, više od polovine ne bi poslalo svog pacijenta stomatologu radi konsultacije. Svaki deseti student nije znao da navede lokalno oboljenje usne duplje osim karijesa. Čak 6% ispitanika klasifikuje karijes kao isključivo estetski problem. Polovina ispitanih studenata medicine smatra da je njihovom studijskom programu potreban poseban predmet iz ove oblasti.

**Zaključak** Nedovoljna informisanost studenata medicine iz oblasti oralne higijene i patologije usne duplje ukazuje na postojanje prepreke u saradnji dve neodvojive zajednice. Interdisciplinarna saradnja opštih lekara i stomatologa predstavlja preduslov za dobrobit naših pacijenata.

**Ključne reči:** stomatologija; studenti medicine; oralno zdravlje; patologija usne duplje; interdisciplinarni pristup pacijentu

## UVOD

Prvi zapisi o uticaju oralnih bolesti na opšte zdravlje potiču iz doba Vavilona (2500 godina p. n. e) i Hipokrata. U zapisima starih Egipćana, Grka i Rimljana ostali su pisani tragovi o postojanju veze između zubobolje, nastanka bolova u glavi ili u nogama, kao i o uspešnom lečenju takvih tegoba vađenjem obolelih zuba [1, 2].

Opšta definicija oralnog zdravlja podrazumeva stanje oralne duplje bez promena, koje ne samo da čini ljude lepšim već im pruža normalno funkcionisanje kroz mogućnost žvakanja, gutanja, govora, smeha i ljubljenja, i putem čula – ukusa i dodira [3].

Oralno zdravlje je preduslov za očuvanje zdravlja čitavog organizma. Oralne promene mogu biti početni simptomi sistemskih oboljenja, a u nekim slučajevima je dokazana veza između oralnih oboljenja i bolesti poput dijabetesa, digestivnih tegoba, cerebrovaskularnog insulta, kardiovaskularnih oboljenja, metaboličkih sindroma, kancera [2, 3]. Istraživanja pokazuju povezanost periapexnog procesa na zubu sa pojavom ekstrasistolata i reumatoidnim artritisom [1, 2]. Pojedine studije ukazuju na vezu odnotogenih infekcija i kožnih bolesti, poput alopecije udružene sa kutanim tipom sistemskog lupusa [4]. Prisustvo „ključnih vrsta“ mikroorganizama u ekosistemu gornjeg dela gastrointestinalnog trakta može biti u vezi sa povećanim rizikom za kancer aerodigestivnog trakta [5]. Parodontalna oboljenja predstavljaju faktor rizika za kardiovaskularne bolesti, dijabetes, karcinom i hipertenziju. Inflamacija praćena povećanim nivoom IL1, TNF, IL6 u plazmi može uticati na CNS, dovodeći do poremećaja kognitivnih funkcija [6–9].

Zanimljivo je da se pacijenti, umesto stomatologu, neretko obraćaju lekaru opšte prakse zbog bolesti zuba i usne duplje [10]. Prvi razlog je dostupnost zdravstvenih usluga opšte medicine, koje za većinu pacijenata u svetu pokrivaju osnovno zdravstveno osiguranje. Drugi razlog je uverenje pacijenata da su pregled i lečenje opšteg lekara, za razliku od stomatoloških intervencija,

bezbolni, pa je i strah manji [11, 12]. Iako to ispada iz okvira 'tradicionalne' medicinske prakse, etička načela nalažu lekarima pregled usne duplje pri čemu mogu uočiti neki od simptoma, čije adekvatno i pravovremeno lečenje može poboljšati kvalitet oralnog i opšteg zdravlja i dovesti do ranog otkrivanja potencijalno teških bolesti [11, 13]. Upućenost lekara u etiologiju i patogenezu tri najčešća oboljenja usne duplje (karijes, parodontalna oboljenja i rak usne duplje) može smanjiti učestalost ovih oboljenja [13], što je od posebnog značaja kod raka usne duplje, čija je incidenca u porastu [14].

Terapije koje lekari propisuju u cilju lečenja nekog oboljenja takođe mogu biti uzrok pojava promena u usnoj duplji. Primer je smanjenje lučenja pljuvačke (kserostomija), koje zahteva uključivanje stomatologa u lokalnu terapiju, a predstavlja i faktor rizika za nastanak karijesa [14, 15, 16]. Sa druge strane, potrebno je da stomatolozi budu upućeni u oboljenja koja daju oralne manifestacije, koje su ponekad prvi znak bolesti, kako bi uputili pacijenta kod lekara koji će lečiti osnovnu bolest.

Starenje populacije je globalni fenomen, životni vek čoveka je produžen i očuvanje prirodne denticije, koja doprinosi očuvanju zdravlja i kvaliteta života, trebalo bi biti cilj medicinske zajednice koju zajedno čine doktori medicine i stomatologije [17].

Cilj ovog naučno-istraživačkog rada bio je da se ispituju navike i stavovi studenata medicine i svršenih doktora medicine na stažu vezani za brigu o oralnom zdravlju, njihovo poznavanje bolesti koje se javljaju u usnoj duplji i sistemskih bolesti sa manifestacijama u oralnoj regiji, kao i njihova informisanost o rizičnim pacijentima za stomatološke intervencije.

## MATERIJAL I METODE

U istraživanju je učestvovalo 100 ispitanika (54 žena i 46 muškaraca) starosti od 21 do 27 godina koji su dali pismenu saglasnost

za učešće u anketiranju. Ispitanici su bili studenti četvrte, pete i šeste godine Medicinskog fakulteta Univerziteta u Nišu, kao i svršeni doktori medicine na stažu nakon završenog Medicinskog fakulteta Univerziteta u Nišu.

Istraživanje je sprovedeno putem anketiranja modifikovanim upitnicima *Questionnaire for medical and dental students* [14] i *Oral health behavior and knowledge survey* [3] usklađenim sa ciljevima postavljenim u ovom istraživanju. Upitnik mešovito tipa (*self reported survey*) sastojao se od 16 pitanja na koja su ispitanici anonimno odgovarali bez vremenskog ograničenja i bez mogućnosti pristupa internetu. Odgovori su sumirani i statistički obrađeni metodama neparametrijske deskriptivne statistike (frekvencija i procenat).

## REZULTATI

Rezultati ankete su predstavljeni u tabelama 1–16.

**Pitanje 1** – Na koji način birate četkicu za zube? (Tabela 1)

**Pitanje 2** – Da li pored četkice koristite još neka sredstva za čišćenje zuba? (Tabela 2)

**Pitanje 3** – Koju tehniku pranja zuba koristite? (Tabela 3)

**Pitanje 4** – Kada odlazite kod stomatologa? (Tabela 4)

**Pitanje 5** – Da li ste izvadili neki svoj zub? (Tabela 5)

**Pitanje 6** – Koliko molara ima čovek? (Tabela 6)

**Pitanje 7** – Kada biste svog pacijenta poslali stomatologu? (Tabela 7)

**Pitanje 8** – Da li prilikom uzimanja anamneze uvek pregledate usnu duplju? (jezik, zube, sluzokožu usne duplje)

**Pitanje 9** – Da li mislite da se neko oboljenje usne duplje može manifestovati na nekom drugom udaljenom organu? (Tabela 9)

**Pitanje 10** – Da li smatrate svoje trenutno znanje o bolestima zuba i usne duplje zadovoljavajućim? (Tabela 10)

**Pitanje 11** – Da li smatrate da je studentima medicine potreban poseban predmet o oralnom zdravlju i bolestima usta i zuba?

**Pitanje 12** – Da li smatrate da je karijes...? (Tabela 12)

**Pitanje 13** – Da li mislite da je karijes zarazna bolest? (Tabela 13)

**Pitanje 14** – Da li mislite da pojedine grupe pacijenata predstavljaju pacijente rizika za stomatološke intervencije? (Tabela 14)

**Pitanje 15** – Da li znate za neko sistemsko oboljenje koje ima manifestacije u usnoj duplji? (Tabela 15)

**Pitanje 16** – Da li znate za neko lokalno oboljenje osim karijesa u usnoj duplji? (Tabela 16)

## DISKUSIJA

Tehnike anketiranja se mogu koristiti kako za deskriptivna, tako i za eksplanatorna istraživanja. Prednosti su mogućnost istraživanja etički osetljivih tema i mogućnost ponavljanja i kombinovanja istraživanja. Sa druge strane, utvrđivanje uzročno-posledičnih odnosa je izloženo subjektivnoj interpretaciji. Nedostaci su i to što ispitanici pribegavaju socijalno poželjnim odgovorima i dobija se izveštaj o ponašanju umesto opservacije ponašanja. Anketiranje kao instrument psihometrije ipak predstavlja nezamenljivu metodu kvantifikovanja i analize razlika između ljudi [18].

Buduća profesija studenata medicine i stomatologije podrazumeva promovisanje opšte i oralne higijene, pa se od njih očekuje da poznaju adekvatne načine održavanja zdravlja usne duplje. Osim što oralna higijena utiče na njihovo zdravlje i kvalitet života, ona predstavlja i refleksiju stava koji oni, kao budući profesionalci iz oblasti medicine, imaju o oralnom zdravlju, i koji bi trebalo da bude primer ljudima izvan medicinske sfere [3].

U sprovedenoj anketi gotovo polovina ispitanika se izjasnila da nema posebnu tehniku pranja zuba, što predstavlja manje povoljan rezultat od rezultata studije koju su sprovedeli Ke Yao i sar. na uzorku od 202 studenta medicine u Kini, gde 35% ispitanika nema posebnu tehniku pranja zuba [3].

U izboru četkice, pri kupovini, cena predstavlja glavni faktor kod petine ispitanika, što nije u saglasnosti sa rezultatima koje su dobili Dolar Doshi i sar. ispitivanjem studenata medicine na privatnom fakultetu u Indiji, kod kojih cena igra presudnu ulogu kod svega 2,5% ispitanika [19]. Eventualna razlika u socioekonomskim statusima ispitanika ova dva istraživanja, bi mogla biti razlog nepodudarnosti rezultata. Šest od ukupno 100 ispitanika studenata medicine smatra da su sve četkice za zube jednako efikasne, što je duplo manje nego u studiji koju su sprovedeli Dolar Doshi i sar. [19]. Na osnovu izgleda četkicu bira 28% ispitanika i približno isti procenat ispitanika u studiji koju su sprovedeli Dolar Doshi i sar. [19]. Savet stomatologa kod izbora četkice potražiće svega trećina budućih lekara, a kod izbora tehnike pranja zuba oko polovina, što govori da stomatologa posmatraju prvenstveno kao terapeuta, a manje kao preventivca.

Najveći broj ispitanika u ovom istraživanju (43%) izdvojio je tečnost za ispiranje usne duplje kao dodatno sredstvo koje najčešće koriste u održavanju oralne higijene, što je u saglasnosti sa rezultatima koje su dobili Dolar Doshi i sar. [19]. Savremena naučna shvatanja daju prednost upotrebi interdentalnih četkica, koje koristi 15% studenata medicine ispitanika u ovom istraživanju, dok se po ovim shvatanjima tečnosti preporučuju u prevenciji stvaranja infekcija kod osoba sa narušenim imunitetom, kod osoba na radioterapiji i hemioterapiji. Kod zdravih osoba ova sredstva mogu biti štetna zbog supstanci koje ulaze u njihov sastav (alkohol), dok neka dovode do prebojavanja zuba zbog prisustva hlorheksidina [20–24].

Upotreba konca, kao pomoćnog sredstva za održavanje higijene, opravdana je ukoliko je interdentalni prostor sužen [20]. Konac, kao pomoćno sredstvo, koristi skoro trećina ispitanika ankete, što nije u saglasnosti sa rezultatima koje su u svom istraživanju pokazali Ke Yao i sar., koji navode da 6,4% studenata uklanja naslage sa aproksimalnih površina zuba na ovaj način [3]. Preventivni programi karakteristični za određeno podneblje, koji mogu promovisati različita pomoćna sredstva u održavanju oralne higijene, mogu biti razlog za različitu zastupljenost upotrebe zubnog konca.

Loker i sar. su u ispitivanju sprovedenom na opštoj populaciji ukazali da 15% ispitanika odlazi kod stomatologa samo kada oseti bol [25]. Rezultati sprovedenog istraživanja su u potpunosti u saglasnosti sa ovim jer je isti procenat anketiranih studenata medicine naveo bol koji traje duže vreme kao ključni faktor za posetu stomatologu. Ovaj podatak može da ukaže na nepostojanje razlike u stavu između opšte populacije i studenata medicine o tome kada bi trebalo da zatraže pomoć stomatologa [25]. Dobijeni rezultati se, sa druge strane, značajno razlikuju od rezultata koje su dobili Dolar Doshi i sar. [19], a odnose se takođe na populaciju studenata medicine. Naime 68% studenata

posećuje stomatologa samo kada se javi dentalgija, dok 20% odlazi kod stomatologa preventivno. Podaci koje smo dobili u istraživanju pokazuju da veći procenat ispitanika (39%) odlazi kod stomatologa dva puta godišnje.

Gubitak zuba uzrokuje promenu okluzije i artikulacije u stomatognatom sistemu, kada se javlja poremećena mastikatorna funkcija uz narušenu estetiku [26]. Anketiranjem je dobijen podatak da 48% studenata medicine ima očuvan zubni niz, dok je približno trećina ispitanika izvadila jedan ili više zuba, ne računajući treće molare. S obzirom na to da se radi o mladoj populaciji, savremena stomatologija ne nalazi opravdanje za tako rani gubitak zuba. Ova studija nije imala za cilj da ispita razloge ranog gubitka zuba ove populacione grupe, ali se nedovoljna informisanost i briga o sopstvenom oralnom zdravlju nameću kao mogućí odgovori.

Usna duplja predstavlja ogledalo opšteg zdravlja jer je ona mesto gde se promene uzrokovane nekom sistemskom bolešću i opštim oboljenjima mogu primarno javiti. Pojava otoka usana, gingive, jezika kao i pojava ulceroznih afti, bula na oralnoj mukozi i zbrisanost papila samo su neke od promena koje se lako mogu uočiti rutinskim pregledom usne duplje [2, 27]. Rezultati sprovedenog ispitivanja ukazuju na to da 84% studenata medicine obavlja rutinski pregled usne duplje, ali sa druge strane, više od polovine ispitanika (55%) ignorisalo bi veliki nedostatak zuba kod pacijenata.

U rezultatima istraživanja koje su sprovedeli Lachlan i sar. rutinski pregled oralne mukoze obavlja 28% studenata medicine, a 48% onih koji ne obavljaju rutinski pregled ne bi pregledali usnu duplju ni kod pacijenata sa visokim rizikom za pojavu raka usne duplje [14]. Isti autori u svom istraživanju ukazuju na navike pacijenata da se prilikom pojave oralnih lezija najpre konsultuju sa lekarom opšte prakse [14]. Većina ispitanika (71%) sprovedenog israživanja ne bi prosledila pacijenta stomatologu radi medicinske konsultacije. Oba istraživanja potvrđuju nedostatak interdisciplinarnе saradnje, na štetu zajedničkih pacijenata.

Petina ispitanika znala je da navede sistemsku bolest koja se manifestuje u usnoj duplji. Najčešći odgovor bio je Sjogrenov sindrom (9%), pored koga su pominjani sistemski lupus eritematodes (6%), sistemska skleroza (7%) i Kronova bolest (1%). Odgovori poput morbila, anemija, dijabetesa svrstani su u netačne odgovore, jer se ne mogu klasifikovati u sistemsku oboljenja. Najveći broj studenata medicine (16%) naveo je gljivična oboljenja, što ovaj odgovor čini najfrekvencijim iako je netačan. Postoji verovatnoća da je razlog za veliku frekvenciju netačnih odgovora bio neobraćanje pažnje da se pitanje odnosi isključivo na sistemsku oboljenja.

Karijes predstavlja lokalno oboljenje zuba koje u slučaju nelečenja može dati brojne komplikacije koje mogu ugroziti život

[28] i ta je informacija poznata za 37% anketiranih studenata medicine. Šestoro ispitanika kategoriše karijes isključivo kao problem estetske prirode. Najveći broj anketiranih (75%) smatra da karijes nije zarazno oboljenje, a slične podatke predstavljaju i Ke Yao i sar., koji navode da više od 40% ispitanika nije znalo za kritičnu ulogu bakterija u etiologiji karijesa [3].

Od lokalnih oboljenja u usnoj duplji, osim karijesa, anketirani su najčešće navodili parodontopatiju, gingivitis, kandidijazu i afte. Manje frekventni odgovori bili su glositis, pulpitis, herpes, upala krajnika. Približno 9% studenata medicine nije znalo da navede nijedno lokalno oboljenje u usnoj duplji, ali najveći broj ispitanika (93%) smatra da se neko oboljenje usne duplje može manifestovati na udaljenom organu, što može pomoći ranom postavljanju dijagnoze i uspešnom lečenju primarnog oboljenja.

Rezultati ankete pokazuju da 9% studenata medicine smatra da ne postoje rizični pacijenti za stomatološke intervencije, dok se 15% izjasnilo da ne zna za postojanje ove grupe pacijenata. Istraživanje koje su sprovedeli Sandra i sar. [16] u Litvaniji pokazuje nešto bolje ali ne i ohrabrujuće rezultate, prema kojima 36,4% anketiranih (studenata medicine, lekari i medicinske sestre) smatra da neka od stomatoloških intervencija može uzrokovati po život opasna stanja.

Trećina ispitanika kategoriše svoje znanje iz oblasti bolesti zuba i usne duplje kao zadovoljavajuće, dok 42% želi da nauči više. Približno polovina ispitanika tvrdi da im ne treba poseban predmet o oralnom zdravlju i bolestima usta i zuba, ali je podatak da čovek ima 12 molara znalo 38 ispitanika od ukupno 100 anketiranih studenata medicine. Ovi rezultati se razlikuju od istraživanja koje su sprovedeli Lachlan i sar., u kojem navode da se 93% studenata završne godine medicine izjasnilo da nema dovoljno znanja o prevenciji i detekciji promena u usnoj duplji [14]. Razlika u rezultatima najverovatnije je uzrokovana različitim programima studija.

## ZAKLJUČAK

Navike i stavovi vezani za očuvanje oralnog zdravlja najvećeg broja studenata medicine i tek diplomiranih lekara ih, kao profesionalce, ne odvajaju u odnosu na opštu populaciju. Zapaža se nedovoljna informisanost studenata medicine o oboljenjima usne duplje kao i sistemskim oboljenjima koja daju oralne manifestacije. Postoje studenti završne godine medicine koji osim karijesa ne poznaju nijedno drugo lokalno oboljenje usne duplje. Veliki broj studenata medicine ne poznaje oboljenja koja predstavljaju rizik za stomatološke intervencije. Interdisciplinarna saradnja lekara opšte prakse i stomatologa bi trebalo da bude preduslov za dobro zdravlje svih pacijenata.

# Treatment planning in implant-prosthodontics – prosthodontic aspect

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## SUMMARY

Properly implemented treatment plan implies adaptation to each individual case. The anatomical and morphological limitations of edentulous and partially edentulous jaws present a challenge for the clinician in the context of establishing an adequate implant position, retention and stabilization of dental restoration. On the other hand, highly aesthetic patient requirements play a significant role in achieving overall satisfaction with implant-prosthodontics treatment. From the perspective of the complexity of implant therapy, the first clinical phase of planning requires detailed sublimation of the criteria that define the treatment plan, among which the most important are: degree of regressive bone remodelling, type of prosthodontic restoration, loading time, type of retention, as well as aesthetic criteria. The ideal position of the implant is an important prerequisite for successful tissue integration. The aim of this paper was to present the complexity of the therapeutic plan based on the collected literature through the analysis of factors related to prosthodontic aspect.

**Keywords:** implant-prosthodontics rehabilitation; treatment plan; planning in implantology

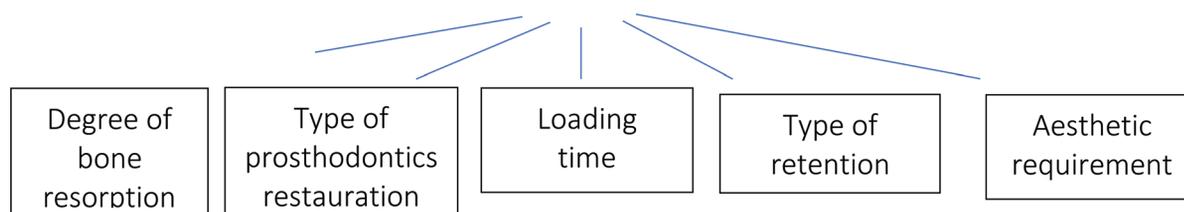
## INTRODUCTION

The last two decades have been characterized by rapid technological development, which has directly affected the planning aspect. The “surgically guided” approach has given its place to “prosthodontics guided” approach. The statement that digitalized methods guarantee therapeutic success should not be taken as absolute, given that the best-planned work can result in patient-dependent failure and specific conditions in mouth. Of particular importance are the constant cyclic loads to which prosthodontic components and implants are exposed during functional, or even more unfavorable, parafunctional movements of the lower jaw. The clinician is given the task to include the analysis of potential biomechanical problems in the preoperative plan. The authors will emphasize the importance of a precise

prosthodontic protocol to the final therapeutic success through the available data from the literature.

Modern implantology requires a multidisciplinary approach to planning in order to reduce the frequency of complications. Given that the prosthodontic component is an integral part of implant-prosthodontic therapy, the frequency of complications of mobile and fixed dental restorations, from a technical point of view, is more significant in relation to complications related to the implant itself [1]. It is evident that the failure of therapy is not always iatrogenic in nature. However, the complexity of the etiology and pathogenesis of the treatment plan implies the analysis of each individual case. In the era of modern implantology, new methods of digitization have become an integral part of planning because they guarantee exceptional precision and predictability of the therapeutic outcome.

## CRITERIA DEFINING THE IMPLANT-PROSTHODONTIC TREATMENT PLAN



**DEGREE OF BONE RESORPTION**

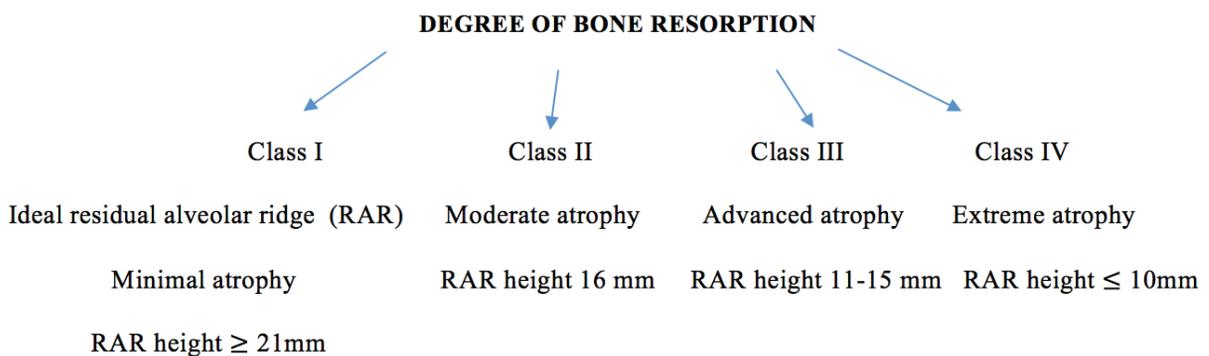
The dynamics of regressive bone remodelling after the loss of natural teeth is an individual parameter. The most intense changes, 70% of the total bone resorption, take place in the first 6 months after tooth extraction. The mechanism of bone resorption is well known today and occurs due to the lack of stimulation of osteoblast activity, which is related to the lack of stimulation of proprioceptive periodontal receptors. In the wearer of conventional complete dentures, one of the main reasons for the accelerated resorption of the residual alveolar ridge is inadequate pressure transfer to the bone tissue. As compact and cancellous bone structures have different directions of resorption, resulting in final different forms of residual alveolar ridges, different therapeutic concepts have also been mentioned. Clinicians, often faced with the challenge of poor retention in complete denture wearers, compensate for this deficiency by applying stronger pressure to the supporting tissues. However, this decision is conducive to even greater resorption in the long run, as the tensile forces transmitted to the cells of the bone tissue lead to activation of prostaglandins, which is a known indicator of bone resorption. Beumer et al. found that patients with excellent neuro-muscular control have the ability to function successfully with conventional complete dentures [2].

In the recent years, numerous authors have made recommendations for the classification systems of edentulous jaws [3–6]. One of the newer ones, published in January 2020 [7], combines four parameters and gives recommendations for a prosthodontic treatment plan. The concept of this so-called “ABCD” classification is based on the following parameters:

A (age) - Prosthodontics rehabilitation should be adapted to the patient’s age, with special emphasis on avoiding extensive surgical interventions and long-term prosthodontic protocols in elderly patients. B (bone) - If intensive bone resorption requires augmentation, it is recommended to give priority to mobile over fixed dental restorations in elderly patients. C (cosmetic display) - Under this term, the aesthetic parameters PES (Pink aesthetic score) and WES (White aesthetic score) are analyzed. These aesthetic indicators are especially important in the middle and high smile lines. An important segment of the aesthetic moment is the need for the transition of the acrylic edge of the denture to the alveolar ridge not to be in the zone that is

visible during laughter and speech. The visibility of the transition line at maximum lip mobility is an indicator of the necessity of surgical preparation of the alveolar ridge. D (eng. Degree of resorption) – the degree of resorption is related to the interalveolar distance and space necessary for the placement of dental restoration. The authors categorized the intermaxillary space based on the degree of resorption into the four classes: D1 minimal 10–12 mm; D2- moderate 12–15 mm; D3-moderate 15–18 mm; D4- pronounced (< 18 mm) [7].

Evaluation of the remaining available bone affects two therapeutic factors. The first is related to the characteristics of the implant and the second to the type of prosthodontic restoration. The ridge is assessed on the basis of available dimensions in all three spatial planes, and the bucco-lingual bone dimension must be a minimum of 1 mm more bone than the diameter of the implant on the vestibulo-oral side of the alveolar ridge. Often, dental restorations in extensive resorption should compensate not only for the loss of natural teeth but also for the resorbed part of the alveolar ridge and connective tissue. The practice is unanimous - it is absolutely unacceptable to compensate for the loss of supporting tissues by enlarging the teeth. Thus, the first postulate of aesthetics would be violated, which would compromise the final therapeutic result. The restorative available space is defined as the space needed to accommodate dental restoration located between the ridge and future occlusal plane [8]. In the case of a smaller vertical dimension of the restorative available space, it is a mistake to thin the material of the future replacement because this will result in a fracture of the denture base, i.e. bridge construction if fixed restoration is planned. The structural durability of each prosthodontic restoration is defined by the required thickness of the restorative material of which the restoration will be made. Thus, for example, the thickness of acrylate should not be less than 2.5 mm. Based on the intensity of bone resorption, the upper and lower edentulous alveolar ridge are divided into four classes, and diagnostic criteria of the classification system are: mandibular body height, residual alveolar ridge morphology of mandible and maxilla, muscle attachments, and inter maxillary relations [9]. With increased inter alveolar distance it is possible to make both removable denture and screw-retained bridge. The best aesthetic results are achieved with removable denture, since it would be difficult to provide prophylactic cleaning requirements in situations with fixed restoration.



## TYPE OF PROSTHODONTIC RESTORATIONS

The number of implants, dimensions and their arrangement must be adjusted to the implant-prostodontics treatment plan, the shape of edentulous jaw and bone volume. Based on the mentioned parameters, prostodontic restorations can be implant-supported or retained [2].

When we talk about the treatment of edentulous jaw, the tendencies go in the direction of rehabilitation with fixed restoration that will be carried with as fewer implants as possible. If the situation still requires mobile work, would an identical tendency apply? The answer lies in different load transfer in bridges and removable dentures. The smaller number of implants in the case of mobile work speaks in favor of more intensive bone resorption, and two to three times more intense in implant-retained dentures compared to implant-supported ones, so frequent relining and occlusal correction are necessary. Implant-retained dentures are prostodontic replacements in which the occlusal load is distributed to the implant/(s) and mucoperiosteum. This includes combined tissue and implant support for dental restorations. Those restorations are always removable (mobile). This concept requires the installation of a minimum two implants in the lower and four in the upper jaw. Cases of dentures retained on one implant only in the lower jaw can be found in the literature [2]. Although this concept is reported to be minimally invasive with good five-year implant survival, data on the beneficial retentive effect of dentures and patient satisfaction with such restorations are scarce. The answer to the weak retentive force lies in the inability of the attachment system on the implant carrier to resist forces acting from different directions. During the action of masticatory forces, the retention element acts as a fulcrum around which the denture tends to rotate. The active force arm becomes too large, while the retention force arm is absent. Although retention systems for implants can be different, the most commonly used are bars, individually made attachments, locators and double-crowns. The decision on the type of precise connecting element to be used is made by the clinician based on the analysis of restorative available space, biomechanical factors, manufacturing costs, laboratory procedure, patient wishes, etc. [10].

### BARS

A bar is a rail that connects two or more implants. The advantage of the bar as a supra-structure is reflected in the ability to provide three degrees of freedom of movement. They can be made as individual or factory manufactured. A prerequisite for a long-term successful treatment plan is the need for precise placement of the bar on all implants. This check is performed, in addition to visual detection, using the Sheffield test [10].

The procedure involves intraoral placement of the bar and indirect palpation with a probe in order to detect the transition between the implant and the bar. Another advantage of this retention system in relation to other connecting elements is that it provides the possibility of

compensating for the significant divergence of the implant axis. Also, due to the splinting effect, a rigid fit of the denture to the implants is provided and the possibility of reducing the base of the denture is given. By connecting the implants, even distribution of forces is created and the individual load is reduced by connecting the implants into the block. Although it has been proven that the bar offers better stabilization and greater freedom of movement of the future denture compared to other retention systems, when setting the indication, it is important to measure the value of the vertical dimension of the restorative available space. This space must have a height of at least 14 mm for the bar, while for the locator abutment the vertical dimension from the implant neck to the future level of the occlusal plane must be 9 mm, and for systems of individually made attachments 12 mm [11]. There are different techniques for assessing all three dimensions of the restorative space in edentulous patients, but the safest method is to develop study models and bite registrations. Based on that, diagnostic placement of artificial teeth (so-called “set up”) is performed. Only after such a preliminary analysis, clinicians make decision on the choice of retention system.

In relation to load, an important aspect of the even distribution of forces is the length of the anteroposterior distance (A-P spread) [10]. The possibility of distal extension of denture seats depends on the value of this distance. The anteroposterior distance is the distance between the most prominent part of the most anteriorly placed implant and the most distal part of the posterior implant. The length of cantilevers is the value of the anteroposterior spread multiplied by 1.5 [8]. If the cantilevers were higher than this value, it would endanger the load of distal implants and result in the consequent resorption of the bone. In the recent years, Nobel Biocare has been actively perfecting the Trefoil system as a therapeutic concept for the edentulous jaw. The concept is based on making a fixed prosthetic construction on only three implants, Ø 5 mm in diameter. The inspiration came from Brenemark's Novum System [12]. After installation, the implants are connected with a titanium bar made by a computer aided manufacturing process, individually planned according to the arch of the edentulous alveolar ridge. The delivery of the denture is done during the first week after the implant placement. The main advantages of Trefoil compared to the “All on four” concept are lower therapeutic costs and faster implementation of treatments. However, more clinical studies are needed for safe long-term therapeutic outcomes.

### LOCATORS

The advantage of the abutment locator in relation to the bar is reflected in the small height of the male part, which gives the possibility of making these systems at a small vertical inter alveolar distance. With more implants, it is possible to compensate for the difference in slope up to a maximum of 40 degrees. The greater the divergence of the implant axis, the more pronounced the wear of the female part [10].

## BALL-TYPE ATTACHMENTS

There is a large selection of ball-type attachment systems on the market, and retention is achieved by activating the male and female part. The strength of the retention force can be adjusted to different female part, and the values range from 6 N to 22 N depending on the manufacturer. Deviation from the parallelism of the axis of the implant leads to a more pronounced friction between the components [10].

Unlike implant-retained, the biomechanics of implant-supported restorations imply that occlusal forces are transmitted to the bone via the implant. These restorations can be removable or fixed. In order for the occlusal load to be fully accepted by the implants and for the load to be evenly distributed on the axial foundation, it is necessary that the basic biomechanical requirements are met. The load of implant-supported restorations depends on the number and spatial ratio of implants, so the conditions that must be met for this concept are: minimum number of implants to be 4, length at least 10 mm, and antero-posterior distance between implants to be at least 10 mm.

## LOADING PROTOCOLS

The loading protocol of the implants depending on the time elapsed since placement is divided into the three protocols: conventional (dental restoration is made after the end of bone healing, i.e. at least two months after placement), early (production of prosthetic component is realized between one week and two months) and immediately (implants are placed in function within the first week of placement) [2]. The model of immediate loading usually implies the creation of a temporary prosthetic restoration, which is replaced by a definitive one after six months for multi-member prosthetic restorations [13]. For individual crowns, replacement with a definitive restoration can be made after 4 months. In the literature, the entities of immediate restoration, i.e. the production of restoration that does not achieve occlusal contact with antagonists, and immediate loading are often described separately. For reconstructions performed in edentulous patients, immediate denture or bridge is always immediately loaded because the prosthodontic rehabilitation is realized in such a way as to achieve complete occlusal contact with antagonists, according to the type of bilaterally balanced occlusion. In the recent years, the scientific community has been actively perfecting the concept of immediate loading. The main advantage of the concept is reflected in immediate establishment of function, reduction of postoperative discomfort caused by poor retention and stabilization of the temporary restoration. Patients are psychologically better in accepting this idea. The concept requires adequate selection of implants. The length of the implants planned for this type of therapy must be from 8 to 11 mm. Implants shorter than 8 mm carry the risk of micro-movements during the phase of osseointegration, especially the critical third week of post-surgical treatment. On the other hand, implants longer than 11 mm are also

not recommended due to the increased risk of bone overheating during implantation. The macro and micro design of the implant, i.e. the active treated surface, is important for the concept of immediate loading [14, 15]. Immediate loading of implant-retained dentures with the attachment system is not recommended.

Good primary stability is a pre-requisite for the immediate loading to be realized. This means an insertion torque of 30 to 45 Ncm. Values less than 30 Ncm create an increased risk of micro-movements, and over 45 Ncm micro-bone fractures and early implant loss can occur. For the purpose of accurate determination of primary stability, digital measurement tests, perio test value (PVT) or implant stability quotient (ISQ) are used. In edentulous jaws, the primary stability of each implant must be confirmed if the concept of immediate loading is planned [14, 15].

## TYPE OF RETENTION SYSTEMS FOR IMPLANT RESTORATIONS

The mechanism of attachment of fixed implants restorations can be threefold. The crown can be retained with a screw, cement or based on the elasticity characteristics of the material. Statistical data show that the occurrence of technical and biological complications is higher in cement-retained restorations compared to screw retention [16]. Among biological complications, the most common are those in the form of peri-implantitis caused by extrusion of excess of cement material. Numerous authors [17, 18, 19] have given recommendations for various cement application techniques that aim to ensure an optimal amount of fixing material. The risk of complications in the form of peri-implantitis caused by extruded cement

is higher in crowns on implants than in crowns on natural teeth due to the histology of soft tissues and the lack of an intertwined orientation of hemidesmosomes. The circular orientation of the connective fibres surrounding the implant neck does not provide a strong enough barrier for the penetration of various environmental agents and represents the *locus minoris resistentiae* [20]. The innovative retention system based on the superelasticity of the material from which the abutment is made (so-called *Rodo abutment*) seems to combine the advantages of both widespread types of retention, eliminating their disadvantages. Rodo abutment consists of three components and is compatible with the Straumann, Nobel Biocare and Neodent implant systems. The abutment is made of nitinol alloy, unique in its functional properties, shape memory effect and superelasticity effect [21]. Given the increased incidence of biological complications, cement retention should be planned only in the case of fixed restorations with a smaller number of units and in situations where vertical dimension of the biological width of the implant retainer allows control of the removal of excess material. Prosthodontic components planned for the rehabilitation of edentulous jaws should achieve screw retention or retention with a "smart" abutment. The decision on the type of connection between the implant and the prosthodontic component is made by measuring the depth of the implant

neck in relation to the marginal edge of the soft tissue. When the shoulder of the supra-structure is placed deeper than 2 mm in relation to the level of marginal edge of soft tissues, preference should be given to screw-retention, because then the conditions for control of the suppressed material and removal of excess cement are difficult. It is recommended to use individualized instead of factory-designed abutments [22].

## AESTHETIC REQUIREMENTS

According to the modern definition of the International Team for Implantology, the aesthetic zone is the segment that is of aesthetic importance for the patient. It is desirable to evaluate the relation between the lip and artificial teeth within the static and dynamic analysis of the relation between prosthetic restoration and mimic muscles. The transitions between the natural mucosa of the residual alveolar ridge and the acrylic part of the denture (i.e. artificial gingiva) should be processed so that it is not visible when smiling. The crossing line is called the transit line. In patients with incompetent lips and a wide smile line, it is difficult to provide a good aesthetic result without prior pre-surgical preparation in the form of osteotomy. In these situations, clinician needs to place the implants in the same places where the roots of natural teeth used to be [23]. From the aspect of aesthetics and phonetics, the position of the upper front teeth is especially important, where the horizontal position and angulation affect the phonetics, and the vertical position of the teeth affects the aesthetics. Bearing in mind that the definitive prosthodontic replacement must be placed within the neutral zone, i.e. the space in which there is a balance between the muscles of the tongue, lips and cheeks, the implantation must be performed according to these requirements. When planning rehabilitation within the aesthetic zone, special attention is paid to dimensions of the epithelial component. The width of the keratinized gingiva is an individual independent factor. However, apical migration of the gingiva can be caused by frequent manipulations with the abutment and the lack of a stable connection between the implant and the abutment, which favours faster bacterial colonization. Quantitative verification of the dimensions of gingival hyperplasia and mobile alveolar ridge can be conducted by a simple clinical procedure using a thin endodontic instrument prior to local anaesthesia of the region of interest. Values greater than 4 mm require surgical removal of excess soft tissue [22].

## CONCLUSION

The advantages of implant-prosthodontic therapy in relation to conventional prosthodontic therapy are numerous. Greater patient satisfaction results from better masticatory efficiency due to the stabilizing and retentive effect of prosthetic restorations on implants, but also their better aesthetics. However, successfully performed implant and prosthetic work does not guarantee a long-term successful

outcome. The evaluation of the achieved therapeutic results is performed through control examinations that are scheduled in the interval between three to twelve months. That is why it is important to adequately motivate and inform the patient.

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# Implantatno-protetski plan terapije – protetski aspekt

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## KRATAK SADRŽAJ

Pravilno realizovan plan terapije podrazumeva prilagođavanje individualnom slučaju. Anatomo-morfološka ograničenja krezubih i bezubih vilica predstavljaju izazov za kliničara u kontekstu uspostavljanja adekvatne pozicije implantata, a kasnije retencije i stabilizacije zubne nadoknade. Sa druge strane, visokoestetski zahtevi pacijenta igraju značajnu ulogu u postizanju celokupnog zadovoljstva implantatno-protetskim tretmanom. Iz perspektive složenosti implantološke terapije, prva klinička faza planiranja zahteva detaljnu sublimaciju kriterijuma koji definišu terapijski plan, a među kojima su najznačajniji: stepen regresivne koštane remodelacije, vrsta protetskog rada, vreme opterećenja, tip fiksiranja nadoknada na implantatima, planirani materijali za izradu, kao i estetski kriterijumi. Idealna pozicija implantata je važan preduslov uspešne tkivne integracije.

Cilj rada je da se razmatranjem prikupljene literature prikaže kompleksnost terapijskog plana kroz analizu faktora u vezi sa protetskim aspektom.

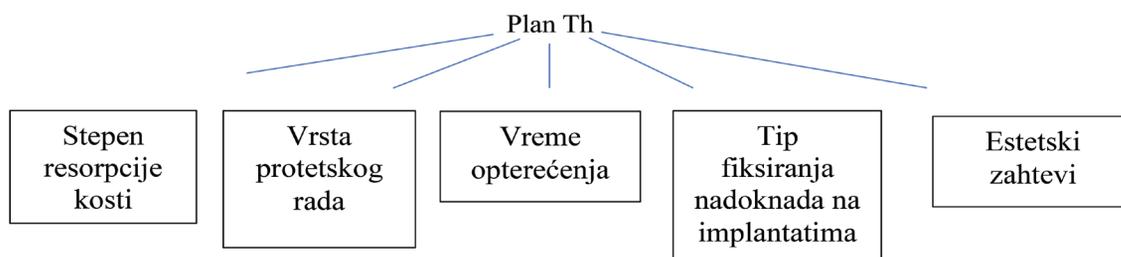
**Ključne reči:** implantatno-protetska rehabilitacija; plan terapije; protetskom nadoknadom vođena implantologija

## UVOD

Savremena implantologija zahteva multidisciplinarni pristup planiranja u cilju smanjenja učestalosti komplikacija. Imajući u vidu da je protetska komponenta integralni deo implantatno-protetske terapije, učestalost komplikacija mobilnih i fiksnih zubnih nadoknada, sa tehničkog aspekta, značajnija je u odnosu na komplikacije u vezi sa samim implantatom [1]. Evidentno je da neuspeh terapije nije uvek jatrogene prirode. Ipak, kompleksnost etiologije i patogeneze implicira da plan terapije podrazumeva analizu svakog pojedinačnog slučaja. U eri savremene implantologije nove metode digitalizacije postale su nerazdvojni deo planiranja jer garantuju izuzetnu preciznost i predvidivost terapijskog ishoda. Poslednje dve decenije karak-

teriše rapidan tehnološki razvoj, što se neposredno odrazilo na aspekt planiranja. Prešlo se sa „hirurški vođenog“ na „protetski vođen pristup“. Konstataciju da metode digitalizacije garantuju terapijski uspeh ne bi trebalo shvatiti kao apsolutnu imajući u vidu da i najbolje isplanirani radovi mogu rezultirati neupehom koji je u vezi sa faktorima zavisnim od pacijenta i specifičnim uslovima koji vladaju u usnoj šupljini. Posebno značajna su konstantna ciklična opterećenja kojima su protetske komponente ali i implantati izloženi u toku funkcionalnih, ili još nepovoljnije, parafunkcionalnih kretnji donje vilice. Pred kliničara se postavlja zadatak da preoperativnim planom obuhvati analizu mogućih biomehaničkih problema. Autori će kroz dostupne podatke iz literature apostrofirati značaj preciznog protetskog protokola na krajnji terapijski uspeh.

## Kriterijumi koji definišu implantatno-protetski plan terapije



## STEPEN KOŠTANE RESORPCIJE

Dinamika regresivne remodelacije kosti posle gubitka prirodnih zuba predstavlja individualni parametar. Najintenzivnije promene, 70% od ukupne koštane resorpcije, odvijaju se u prvih šest meseci od ekstrakcije zuba. Mehanizam koštane resorpcije danas je dobro poznat i nastaje usled izostanka stimulacije aktivnosti osteoblasta, što je u vezi sa nedostatkom stimulacije proprioceptivnih receptora periodoncijuma. Kod nosilaca konvencionalnih totalnih proteza jedan od glavnih razloga ubrzane resorpcije rezidualnog alveolarnog grebena jeste neadekvatan prenos pritiska na osealni fundament. Kako kompaktna i spongiozna građa kosti imaju različite smerove resorpcije koji

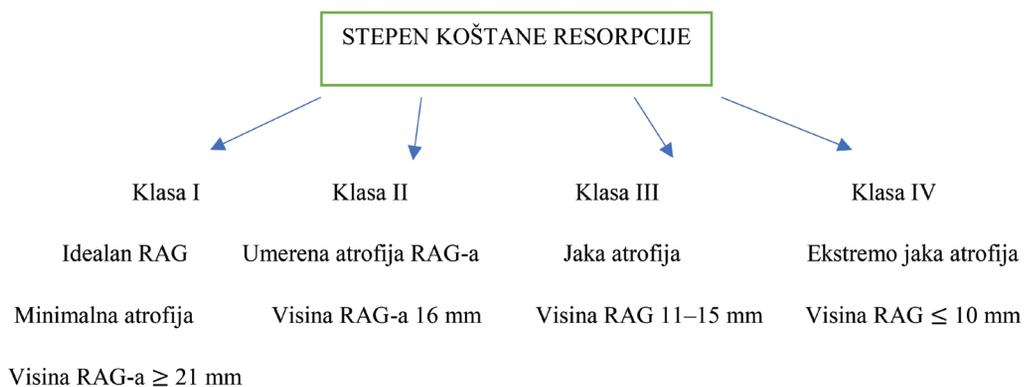
rezultiraju konačnim različitim oblicima rezidualnih alveolarnih grebenova, spomenuti su i različiti terapijski koncepti. Kliničari, često suočeni sa izazovom slabe retencije kod nosilaca totalnih proteza, ovaj nedostatak kompenzuju primenom jačeg pritiska na noseća tkiva. Međutim, ovakva odluka dugoročno pogoduje još većoj resorpciji, s obzirom na to da sile zatezanja prenesene na ćelije osealnog fundamenta dovode do aktivacije prostaglandina, koji je poznati indikator koštane resorpcije. Ipak, uznapredovala resorpcija nije uvek najbolji pokazatelj potrebe za ugradnjom implantata zarad stabilizacije proteze. Bjumer i saradnici [2] ustanovili su da pacijenti kod kojih je odlična neuro-mišićna kontrola imaju mogućnost da funkcionišu uspešno i sa konvencionalnim totalnim protezama.

Poslednih godina mnogobrojni autori dali su preporuke za klasifikacione sisteme bezubih vilica [3–6]. Jedna od novijih, objavljena u januaru 2020. godine [7], objedinjuje četiri parametra na osnovu kojih daje preporuke za plan protetske terapije. Koncept ove takozvane klasifikacije „ABCD“ temelji se na sledećim parametrima:

A (*eng. age*) – Protetsku rehabilitaciju bi trebalo prilagoditi starosnom dobu pacijenta, sa posebnim akcentom na to da se opsežne hirurške intervencije i dugotrajne protetske terapije izbegavaju kod starijih pacijenata. B (*eng. bone*) – Ukoliko izrazita resorpcija koštanog tkiva zahteva augmentaciju, preporuka je prednost dati mobilnoj nad fiksnom zubnom nadoknadom kod pacijenata starije životne dobi. C (*eng. cosmetic display*) – Pod ovim pojmom analiziraju se estetski parametri PES (*eng. Pink esthetic score*) i WES (*eng. White esthetic score*). Ovi estetski pokazatelji posebno su značajni kod srednje i visoke linije osmeha. Važan segment estetskog momenta jeste potreba da se prelaz akrilatnog ruba proteze ka alveolarnom grebenu ne nalazi u zoni koja je prilikom smeha i govora vidljiva. Vidljivost tranzicione linije pri maksimalnoj pokretljivosti usne je pokazatelj neophodnosti hirurške pripreme alveolarnog grebena. D (*eng. degree of resorption*) – stepen resorpcije je u vezi sa interalveolarnim rastojanjem i prostorom neophodnim za smeštaj zubne nadoknade. Autori rada [7] izvršili su kategorizaciju intermaksilarnog prostora na osnovu stepena resorpcije na četiri klase: D1 – minimalni intermaksilarni prostor 10–12 mm; D2 – umereni 12–15 mm; D3 – umereni 15–18 mm; D4 – izraženi (< 18 mm).

Procena preostale raspoložive kosti utiče na dva terapijska faktora. Prvi je u vezi sa osobinama implantata, a drugi sa tipom

protetske nadoknade. Greben se procenjuje na osnovu raspoloživih dimenzija u sve tri prostorne ravni, pri čemu bukolingvalna dimenzija kosti mora biti takva da postoji minimum milimetar više kosti od promera implantata sa vestibularne i oralne strane alveolarnog nastavka. Neretko, zubna nadoknada kod ekstenzivnih resorpcija trebalo bi da nadoknadi ne samo izgubljene prirodne zube nego i resorbovani deo zubnog grebena i vezivno tkivo. Praksa je u jednom saglasna – apsolutno je neprihvatljivo gubitak potpornih tkiva kompenzovati povećanjem zuba. Time bi prvi postulat estetike bio narušen, što bi kompromitovalo konačan terapijski rezultat. Restaurativni raspoloživi prostor se definiše kao prostor potreban za smeštaj zubne nadoknade koji se nalazi između grebena i buduće orijentacione okluzione ravni [8]. U slučaju manje vertikalne dimenzije restaurativnog raspoloživog prostora, greška je istanjiti materijal buduće nadokande jer će to rezultirati frakturom baze proteze, odnosno konstrukcije mosta ako je u planu fiksni rad. Strukturalna trajnost svake protetske nadoknade definisana je potrebnom debljinom gradivnog materijala od kog će nadoknada biti izrađena. Tako, na primer, debljina akrilata ne bi trebalo da bude manja od 2,5 mm. Na osnovu intenziteta resorpcije kosti, gornji i donji bezubi alveolarni greben podeljeni su u četiri klase, a dijagnostički kriterijumi klasifikacionog sistema su: visina tela mandibule, morfologija rezidualnog alveolarnog grebena mandibule i maksile, mišićni pripoji i međuvilični odnos [9]. Kod povećane interalveolarne udaljenosti načelno je moguće izraditi i protezu i most retiniran zavrtnjem. Najbolji estetski rezultati postižu se protezom, s obzirom na to da bi kod fiksne konstrukcije u ovakvim situacijama bilo otežano obezbediti profilaktičke zahteve čišćenja.



## VRSTA PROTETSKOG RADA

Broj implantata, dimenzije i njihov raspored moraju biti prilagođeni implantatno-protetskom planu terapije, obliku bezube vilice i volumenu kosti. Na osnovu pomenutih parametara protetski rad može biti implantatno nošen ili retiniran [2].

Kada govorimo o tretmanu bezube vilice, tendencije idu u smeru rehabilitacije fiksnim radom koji će biti nošen sa što manjim brojem implantata. Ako situacija ipak zahteva mobilni rad, da li bi važilo identično pravilo? Odgovor leži u različitom prenosu opterećenja kod mostova i proteza. Manji broj implantata u slučaju mobilnog rada govori u prilog intenzivnijoj koštanoj resorpciji, i to dva do tri puta intenzivnijoj kod implantatno retiniranih proteza u odnosu na implantatno nošene, pa su neophodna česta podlaganja i reokludacije. Implantatno podržane,

odnosno retinirane (*eng. implant-assisted*) proteze su protetske nadoknade kod kojih se okluzalno opterećenje raspoređuje na implantat/e i mukoperiost. To podrazumeva kombinovanu tkivnu i implantatnu potporu zubne nadoknade. Ovakve nadoknade su uvek mobilne. Ovaj koncept zahteva ugradnju minimum dva implantata u donjoj, odnosno četiri u gornjoj vilici. U literaturnim izvorima mogu se naći slučajevi proteza retiniranih na samo jednom implantatu u donjoj vilici [2]. Iako se ovaj koncept navodi kao minimalno invazivan sa dobrim petogodišnjim preživljavanjem implantata, podaci o korisnom retentivnom efektu proteze i zadovoljstvu pacijenta ovakvim nadoknadama su oskudni. Odgovor za slabu retentivnu moć leži u nemogućnosti sistema atečmena na nosaču implantata da se odupre silama koje deluju iz različitih pravaca. U toku dejstva mastikatornih sila, retencioni element se ponaša kao tačka

oslonca oko koje proteza teži da rotira. Krak aktivne sile postaje prevelik, dok krak sile retencije izostaje. Iako sistemi retiniranja proteze za implantate mogu biti različiti, najčešće primenjavani su prečke, individualno izrađeni atečmeni, lokatori i dvostruke krune. Odluku o vrsti preciznog veznog elementa koji će biti upotrebljen donosi kliničar na osnovu analize restaurativnog raspoloživog prostora, biomehaničkih faktora, troškova izrade, laboratorijskog postupka, želje pacijenta itd. [10].

## PREČKE

Prečka predstavlja šinu koja povezuje dva ili više implantata. Prednost prečke kao suprastrukture ogleda se u mogućnosti da u funkciji obezbedi tri stepena slobode kretanja. Mogu se izraditi kao individualne ili fabričke. Preduslov za dugoročno uspešan plan terapije jeste neophodnost preciznog naleganja prečke na sve implantate. Ova provera izvodi se, pored vizuelne detekcije, i primenom Šefildovog testa [10]. Procedura podrazumeva intraoralno postavljanje prečke i indirektnu palpaciju sondom u cilju detekcije prelaza između implantata i prečke. Još jedna prednost ovog sistema retencije u odnosu na ostale vezne elemente ogleda se u tome što daje mogućnost kompenzacije izrazite divergencije osi implantata. Takođe, zahvaljujući efektu splintiranja, obezbeđeno je kruto naleganje proteze na implantate i data je mogućnost redukovanja baze proteze. Povezivanjem implantata u blok stvara se ravnomerna distribucija sila i smanjuje se pojedinačno opterećenje. Iako je dokazano da prečka nudi bolju stabilizaciju i veću slobodu pokreta buduće nadoknade u odnosu na druge retencione sisteme, prilikom postavljanja indikacije važno je izmeriti vrednost vertikalne dimenzije restaurativnog raspoloživog prostora. Ovaj prostor mora imati visinu od minimum 14 mm za prečku, dok za lokator abatmente vertikalna dimenzija od vrata implantata do budućeg nivoa okuzalne ravni mora biti 9 mm, a za sisteme individualno izrađenih atečmena 12 mm [11]. Postoje različite tehnike za procenu sve tri dimenzije restaurativnog prostora kod bezubih pacijenata, ali je najsigurniji metod izrada studijskih modela i zagrižajnih šablona. Na osnovu toga vrši se dijagnostičko postavljanje vestaških zuba (tzv. *set up*). Tek posle tako izvršene, preliminarne, analize donosi se odluka o izboru sistema retencije.

U vezi sa opterećenjem, važan aspekt ravnomerne raspodele sila predstavlja dužina anteroposteriornog rastojanja (*eng. A-P spread*) [10]. Mogućnost distalne ekstenzije proteznih sedala zavisi od vrednosti ovog rastojanja. Anteroposteriorno rastojanje je distanca između najprominentnijeg dela najanteriornije postavljenog implantata i najdistalnijeg dela posteriornog implantata. Dužina slobodnih sedala je vrednost anteroposteriornog rastojanja pomnožena sa 1,5 [12]. Ukoliko bi distalne ekstenzije proteze bile veće od ove vrednosti, to bi dovelo u opasnost opterećenje distalnih implantata i rezultiralo sledstvenom resorpcijom kosti. Poslednjih godina kompanija *Nobel Biocare* aktivno usavršava sistem *Trefoil* kao terapijski koncept bezube vilice. Koncept se bazira na izradi fiksnog protetskog rada na samo tri implantata, prečnika  $\varnothing$  5 mm. Inspiracija je proizašla iz *Brenemarkovog* sistema *Novum* [13]. Implantati se po ugradnji povezuju titanijumskom prečkom izrađenom kompjuterskim proizvodnim procesom, individualno isplaniranim prema luku bezubog alveolarnog grebena. Predaja akrilatne proteze vrši se u toku prve nedelje od ugradnje implanata. Kao glavne pred-

nosti *Trefoil* u odnosu na koncept *All on four* navode se manji terapijski troškovi i brža realizacija tretmana. Ipak, potrebno je više kliničkih studija za sigurne dugoročne terapijske rezultate. Pri izboru sistema retencije buduće mobilne nadoknade na implantatima, kliničar bi trebalo da uzme u obzir nivo oralne higijene pacijenta budući da sistemi prečke zahtevaju složene konstrukcije, čije je održavanje zahtevnije.

## LOKATORI

Prednost lokator abatmenta u odnosu na prečku ogleda se u maloj visini patrice, što daje mogućnost izrade ovih sistema kod malog vertikalnog interalveolarnog rastojanja. Kod više implantata moguće je kompenzovati razliku u nagibu maksimum do 40 stepeni. Što je veća divergencija osi implantata, to će trošenje matrice biti izraženije [10].

## DUGMIČASTA SIDRA

Na tržištu postoji veliki izbor sistema dugmičastih sidara, a retencija se ostvaruje aktivacijom patrice i matrice. Jačina retencione sile može se prilagoditi različitim matricama, a vrednosti se kreću od 6 N do 22 N, zavisno od proizvođača. Odstupanje od paralelnosti osi implantata vodi izraženijem trenju između komponenata [10]. Dugmičasta sidra omogućuju šest slobodi kretanja gingivalno nošene nadoknade.

Za razliku od implantatno retiniranih, biomehanika implantatno nošenih (*eng. implant-supported*) nadoknada podrazumeva da se okluzalne sile preko implantata prenose na kost. Ove nadoknade mogu biti mobilne ili fiksne. Da bi implantati mogli u potpunosti da prihvate okluzalno opterećenje i izvrše ravnomernu distribuciju opterećenja na osealni fundament, neophodno je da budu ispunjeni osnovni biomehanički zahtevi. Opterećenje implantatno nošenih nadoknada zavisi od broja i prostornog odnosa implantata, pa su stoga uslovi koji moraju biti zadovoljeni za ovaj koncept: da je minimalan broj implantata 4, dužina minimum 10 mm i da anteroposteriorno rastojanje između ugrađenih implantata bude najmanje 10 mm.

## VREME OPTEREĆENJA

Opterećenje implantata zavisno od vremena proteklog od implantacije deli se na tri protokola: konvencionalno (zubna nadoknada se izrađuje po završetku koštanog zarastanja, tj. minimum dva meseca od implantacije), rano (izrada protetske komponente realizuje se između jedne nedelje i dva meseca od implantacije) i imedijatno (implantati se stavljaju u funkciju unutar prve nedelje od implantacije) [2]. Model imedijatnog opterećenja najčešće podrazumeva izradu privremene protetske nadoknade, koja se zamenjuje definitivnom posle šest meseci za višečlane protetske konstrukcije [14]. Zamena pojedinačnih kruna definitivnom nadoknadom može se izvršiti posle četiri meseca. U literaturi se često odvojeno opisuju entiteti imedijatne restauracije, odnosno izrade nadoknade koja ne ostvaruje okluzalni kontakt sa antagonistima, i imedijatnog opterećenja. Za rekonstrukcije koje se izrađuju kod bezubih pacijenata, imedijatna proteza ili most je uvek imedijatno opterećena jer je protetska rehabilitacija

realizovana tako da se ostvaruje potpun okluzalni kontakt sa antagonistima, i to po tipu bilateralno uravnotežene okluzije. Naučna zajednica poslednjih godina aktivno usavršava koncept imedijatnog opterećenja. Osnovna prednost koncepta ogleda se u imedijatnom uspostavljanju funkcije, redukciji postoperativnog diskomforta uzrokovanog slabom retencijom i stabilizacijom privremene proteze. Pacijenti psihološki bolje prihvataju ovu ideju. Koncept zahteva adekvatan odabir implantata, o čemu je bilo više reči u prvom delu rada, koji se bavio hirurškim aspektom. Dužina implantata planiranih za ovakav vid terapije mora biti od 8 do 11 mm. Implantati kraći od 8 mm nose rizik od mikropokreta u toku faze oseointegracije, posebno kritične treće nedelje posthirurškog tretmana. Sa druge strane, implantati čija je dužina veća od 11 mm takođe nisu preporučljivi, zbog povećanog rizika od pregrevanja kosti u toku ugradnje. Za koncept imedijatnog opterećenja važan je makro i mikrodizajn implantata, odnosno aktivna tretirana površina [15, 16].

Imedijatno opterećenje implantatno podržanih proteza sistemom atečmena se ne preporučuje.

Dobra primarna stabilnost je preduslov da bi se imedijatno opterećenje moglo realizovati. Ovo podrazumeva insercioni tork od 30 do 45 Ncm. Vrednosti manje od 30 Ncm stvaraju povećan rizik od mikropokreta, a preko 45 Ncm mogu dovesti do mikrofrakture kosti i ranog gubitka implantata. U svrhu preciznog određivanja primarne stabilnosti koriste se testovi digitalnog merenja, periotest vrednosti ili koeficijent stabilnosti implantata. Kod bezubih vilica primarna stabilnost svakog implantata mora biti potvrđena ako se planira koncept imedijatnog opterećenja [15, 16].

## TIP FIKSIRANJA NADOKNADA NA IMPLANTATIMA

Mehanizam vezivanja fiksnih nadoknada za implantate može biti trojak. Kruna može biti retinirana zavrtnjem, cementom ili na osnovu elastičnih svojstava materijala. Statistički podaci govore da je pojava tehničkih i bioloških komplikacija veća kod cementom retiniranih nadoknada u odnosu na retenciju šrafom [17]. Među biološkim komplikacijama najzastupljenije su one u vidu periimplantitisa nastalog kao posledica ekstruzije viška cementnog materijala. Mnogobrojni autori [18, 19, 20] dali su preporuke za različite tehnike aplikacije cementa koje imaju za cilj da osiguraju optimalnu količinu materijala za fiksiranje. Rizik za nastanak komplikacija u vidu periimplantitisa uzrokovanog potisnutim cementom je veći kod kruna na implantatima u odnosu na kruna na prirodnim zubima zbog histologije mekih tkiva i nedostatka isprepletane mreže hemidezmozoma. Cirkularna orijentacija vezivnih vlakana koja okružuje vrat implantata ne daje dovoljno jaku barijeru za prodor različitih agenasa spoljašnje sredine i predstavlja *locus minoris resistentiae* [21]. Čini se da inovativni sistem retencije zasnovan na superelastičnom svojstvu materijala od kog se izrađuje suprastruktura (tzv. *Rodo abutment*) objedinjuje prednosti oba dosadašnja široko rasprostranjena tipa retencije, eliminišući njihove nedostatke. Rodo abutment se sastoji iz tri komponente i kompatibilan je sa implantološkim sistemima Straumann, Nobel Biocare i Neodent. Suprastruktura je izrađena od legure nitinol, unikatne po svojim funkcionalnim osobinama, efektu memorije oblika i superelastičnom efektu [22]. S obzirom na povećanu incidencu bioloških komplikacija, cementnu retenciju bi trebalo planirati samo u slučaju fiksnih

konstrukcija sa manjim brojem članova i u situacijama gde vertikalna dimenzija biološke širine nosača dozvoljava kontrolu uklanjanja viška materijala. Protetske komponente planirane za rehabilitaciju bezubih vilica trebalo bi da ostvaruju retenciju zavrtnjem ili „pametnim“ abatmentom. Odluka o vrsti veze između implantata i protetske komponente donosi se i posle evaluacije dubine vrata implantata u odnosu na slobodnu ivicu gingive. Kada je rame suprastrukture postavljeno dublje od 2 mm u odnosu na nivo mekih tkiva, prednost treba dati retenciji zavrtnjem, jer su tada uslovi za kontrolu potisnutog materijala i uklanjanje viška otežani. Preporuka je koristiti individualizovani umesto fabrički dizajniranog abatmenta [23].

## ESTETSKI ZAHTEVI

Prema savremenoj definiciji Internacionalnog tima za implanto-logiju, estetska zona je onaj segment koji je od estetske važnosti za pacijenta. Procenu odnosa između usne i veštačkih zuba poželjno je izvoditi u okviru statičke i dinamičke analize odnosa između protetske nadoknade i mimične muskulature. Prelaz između prirodne sluzokože rezidualnog alveolarnog grebena i akrilatnog dela proteze (tj. veštačke gingive) treba obraditi tako da pri osmehu ne bude vidljiv. Linija prelaza naziva se tranzitna linija. Kod pacijenata sa inkompetentnim usnama i širokom linijom smeha teško je obezbediti dobar estetski rezultat bez prethodne predhirurške pripreme u vidu osteotomije. U ovim situacijama treba težiti da se implantati ugrade na ista mesta gde su nekad bili korenovi prirodnih zuba [24]. Sa aspekta estetike i fonetike posebno je važan položaj gornjih prednjih zuba, pri čemu horizontalna pozicija i angulacija utiču na fonetiku, a vertikalna pozicija zuba na estetiku.

Imajući u vidu da definitivna protetska nadoknada mora biti postavljena unutar neutralne zone, odnosno prostora u kom vlada ravnoteža između mišića jezika, usana i obraza, implantacija mora biti sprovedena prema tim zahtevima. Prilikom planiranja rehabilitacije u okviru estetske zone posebna pažnja posvećena je dimenzijama epitelne komponente. Širina keratinizovane gingive jeste individualni nezavisan faktor. Ali, apikalnu migraciju gingive mogu da izazovu česte manipulacije sa abatmentom i nedostatak stabilne veze između implantata i abatmenta, što pogoduje brzom bakterijskoj kolonizaciji. Kvantitativna verifikacija dimenzija gingivalnih hiperplazija i pokretnog alveolarnog grebena može se izvesti jednostavnim kliničkom procedurom mapiranja tankim endodontskim instrumentom uz prethodnu lokalnu anesteziju regije od interesa. Vrednosti veće od 4 mm zahtevaju hirurško uklanjanje viška mekih tkiva [23].

## ZAKLJUČAK

Pogodnosti implantatno-protetske terapije u odnosu na konvencionalnu protetsku terapiju su mnogobrojne. Veće zadovoljstvo pacijenta proizilazi iz bolje efikasnosti žvakanja s obzirom na stabilizacioni i retentivni efekat protetskih nadoknada na implantatima ali i njihovu bolju estetiku. Ipak, upešno predat rad ne garantuje dugoročno uspešan ishod. Evaluacija postignutih terapijskih rezultata vrši se kroz kontrolne preglede koji se zakazuju u intervalu između tri do dvanaest meseci. Upravo zato je vazno adekvatno motivisati i informisati pacijenta.

# Primary intraosseous leiomyosarcoma of the nasal and paranasal cavities – a case report

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## SUMMARY

Leiomyosarcomas belong to one of the histological subtypes of soft tissue sarcomas. They most often occur in genital, gastrointestinal tract and extremities, and the appearance of these tumors in the bones (especially head and neck) is very rare. Clinically, leiomyosarcomas are aggressive tumors. Treatment is multidisciplinary and includes surgery, radiotherapy, and chemotherapy.

This case report presents a 61-year-old patient who was referred to a maxillofacial surgeon due to congestion of the right side of the nose, pain in the right eye, and occasional epistaxis. After complete examination, including biopsy with histopathology and immunohistochemistry, primary intraosseous leiomyosarcoma of the nose and paranasal cavities was diagnosed. Since the tumor lesion was assessed as inoperable, the treatment started with radiotherapy. Two and half years after the radiotherapy was completed, there was good local control of the disease and no dissemination. The case report illustrates the rarity of localization, challenges and difficulties in multimodal treatment, and contribution of radiotherapy to good treatment results.

**Keywords:** primary intraosseous leiomyosarcoma; nasal and paranasal cavities; radiotherapy

## INTRODUCTION

Sarcomas are rare diseases that arise from malignantly transformed connective tissue cells. They are divided into the two major groups: soft tissue sarcomas and bone sarcomas.

Soft tissue sarcomas form a heterogeneous group of rare tumors that differ in anatomical location, histology, and biological behavior [1]. In adults, incidence of soft tissue sarcomas is less than 1% of all solid tumors, of which about 45% are localized in the extremities (mostly in the lower extremities in the femoral region), 38% are intra-abdominal and pelvic (mostly retroperitoneal), 10% are in the trunk (skin and subcutaneous tissue) and 5% in head and neck (mostly skin and subcutaneous tissue) [2]. There are over 50 histological subtypes of soft tissue sarcomas, and leiomyosarcomas make up about 10% [3]. Leiomyosarcomas are tumors of smooth muscle cells, and most often occur in genital and gastrointestinal tract and extremities, less often in head and neck, and rarely in the nasal and paranasal cavities [4].

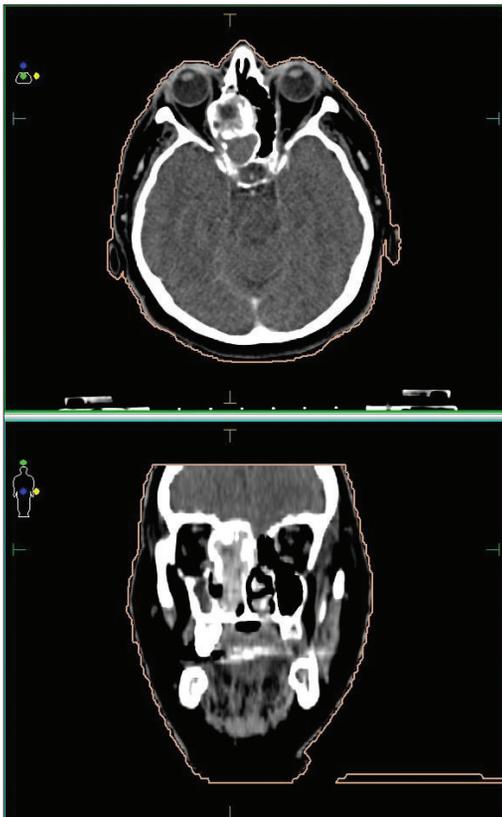
Literature data show that it is a disease of the elderly population, usually after the age of 50 [5]. There is no clearly defined cause of these tumors, but there are certain risk factors: genetic (hereditary leiomyomatosis, hereditary retinoblastoma and Li-Fraumeni syndrome), lymphedema, trauma, previous exposure to radiotherapy and carcinogens (vinyl chloride, arsenic) [6]. The symptoms of these tumors are different, such as epistaxis, nasal congestion, sinus pain and pressure. At the time of diagnosis, more than 95% of patients have localized disease, and 5% have distant

metastases. Patients with local and close regional disease (stages I-III) have a 5-year survival rate of about 55-65 %, while 5-year survival rate in patients with metastases is less than 1% [7]. Treatment is multimodal, individualized, and includes surgery, radiotherapy, and chemotherapy.

## CASE REPORT

A 61-year-old female patient underwent a CT scan of the head and neck in March 2017 due to nasal congestion, right eye pain, and occasional epistaxis. Examination showed a 3x3x4cm tumor lesion in the right nasal space (in the projection of the middle and lower nasal concha with extension to ethmoidal sinuses), with an impression on the medial wall of the right orbit (without clear signs of orbit infiltration), with retention changes in the right maxillary sinus and hemorrhagic content in the right sphenoidal sinus without intracranial penetration (Figure 1). Chest and abdomen CT showed no dissemination of the disease. The patient had type II diabetes and high blood pressure as the comorbidities.

She was referred to a competent maxillofacial surgeon who performed an endoscopic examination and biopsy of the tumor in April 2017. A definite pathohistological finding with additional immunohistochemical analysis showed spindle cell tumor, with the expression of a smooth muscle phenotype that infiltrates the bone. Necrosis was not present and the number of mitoses was large (10/10 HPF, high power fields). The tumor was positive for SMA (smooth muscle actin), PanActin, Vimentin, negative for



**Figure 1.** Tumor – Initial CT findings of the head and facial region  
**Slika 1.** Tumor – Inicijalna KT endo- i splahnokranijuma

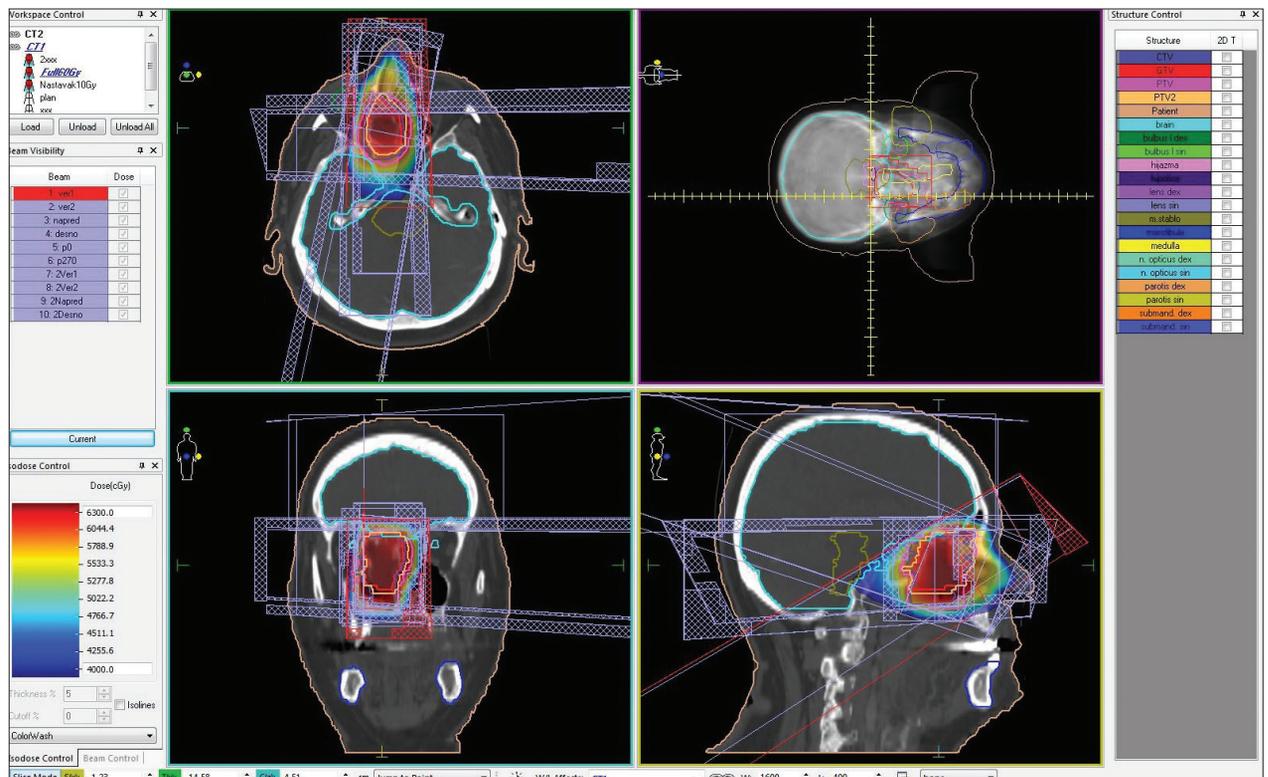
EMA (epithelial membrane antigen), and S 100, with poor expression of estrogen and negative progesterone receptors, which corresponded most to the low-grade primary malignant mesenchymal tumor, intraosseous leiomyosarcoma type.

In May 2017, the patient was referred to the sarcoma board at the Institute for Oncology and Radiology of Serbia, and because the tumor was assessed as inoperable, radiation therapy was indicated. Radiation treatment was planned using 3D conformal technique, with standard fractionation schedule (2 Gy/day) with 60 Gy in 30 fractions of tumor (Figure 2). Radiotherapy was applied in August 2017, with good tolerance and local radiation mucositis grade I-II. Mucositis healed with enhanced local care.

Control CT examinations of the head and paranasal cavities and CT thorax (lungs) in January 2018 showed local partial response without dissemination of the disease, so the tumor board indicated regular follow-ups. At the checkup in January 2020, the patient was without symptoms, with stable local disease, without signs of dissemination, and without manifested toxicity two and a half years after the radiotherapy treatment was completed and three years after the diagnosis.

**DISCUSSION**

Leiomyosarcomas are rare diseases that are most common in the urogenital system (usually in uterus), gastrointestinal system (retroperitoneal) and extremities (mostly in



**Figure 2.** Treated volume, dose distribution and radiation fields arrangement  
**Slika 2.** Tretirani volumen, dozna distribucija i raspored zračnih polja

the femoral region), while occurrence in head and neck is very rare (mainly in the skin and subcutaneous tissue) making about 3% of all leiomyosarcomas.

Leiomyosarcomas of the nose and paranasal cavities are very rare tumors that appear in population over 53 years [8], and more often occur in men [7].

These tumors are manifested by epistaxis, nasal congestion, pressure and sinus pain, which can lead to a clinical diagnostic dilemma because these symptoms can also be attributed to benign diseases such as chronic sinusitis, sinonasal polyposis, and allergic rhinitis. Appropriate time referral to a maxillofacial surgeon contributes to quick diagnosis and the beginning of treatment.

Pathohistological examination is necessary for the definitive diagnosis of leiomyosarcoma, but its differentiation from rhabdomyosarcoma, fibrosarcoma, malignant schwannoma, or spindle cell tumors is difficult using only standard pathohistological staining. Therefore additional immunohistochemical staining is used. Immunohistochemical markers that are useful in making a definitive diagnosis are smooth muscle actin (SMA) that is positive in 95%, muscle-specific actin (MSA) positive in 88%, desmin in 73% and myosin in 64% of cases. There is also expression of estrogen (ER) and progesterone (PR) receptors in almost all leiomyosarcomas except bone [9].

Treatment is multimodal, individualized, and includes surgery, radiotherapy, and chemotherapy, but the ideal treatment modality for these tumors can be a therapeutic challenge. The primary choice of treatment is usually radical surgical resection, and the maximum possible resection is also desirable. Often, due to the localization of the tumor, surgical resection is not feasible, and when surgical resection is without an appropriate safety margin, then recurrence occurs in about half of patients within the first year [10]. Leiomyosarcomas are not radiosensitive, but radiation treatment applies as an adjuvant, rarely as radical, and very rare as neoadjuvant treatment.

Radiotherapy contributes to reduction of local recurrence and better local control of the disease. Chemotherapy is used for metastatic disease, effective chemotherapy is not standardized, and various agents such as doxorubicin and ifosfamide are used. Among head and neck sarcomas, leiomyosarcomas do not have poor prognosis, probably due to the possibility of an earlier diagnosis, as nasal obstruction quickly leads to the appearance of symptoms. The five-year survival of patients with local and regional disease (stage I-III) is about 55-65% [7]. They rarely me-

tastasize to the lymph nodes of the neck. The prognosis is affected by a number of factors such as tumor localization and extension (as the most important), tumor size, grade, and resection edges [9].

Primary intraosseous leiomyosarcoma in the region of the head and neck rarely occurs, and this case report indicates that maxillofacial surgeons play an important role in the early diagnosis of this disease, and thus can contribute to better treatment results. Although not considered radio-sensitive, this case report suggests that radiotherapy may play a significant role in the local control of the disease.

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# Primarni intraosealni lejomiosarkom nosnih i paranazalnih šupljina – prikaz bolesnika

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## KRATAK SADRŽAJ

Lejomiosarkomi spadaju u jedan od histoloških podtipova sarkoma mekih tkiva. Najčešće se javljaju u genitalnom, gastrointestinalnom traktu i ekstremitetima, a pojava ovih tumora u kostima (posebno glave i vrata) vrlo je retka. Klinički lejomiosarkomi su agresivni tumori. Lečenje je multidisciplinarno i uključuje primenu hirurgije, radioterapije i hemoterapije. Prikaz bolesnika se odnosi na pacijentkinju staru 61 godinu koja je upućena maksilofacijalnom hirurgu zbog zapušnosti desne strane nosa, bola u predelu desnog oka i povremene epistakse. Posle kompletne dijagnostičke obrade, biopsije sa patohistologijom i imunohistohemijom dijagnostikovana je primarni intraosealni lejomiosarkom nosa i paranazalnih šupljina. Pošto je tumorska promena procenjena kao inoperabilna, lečenje je započeto radioterapijom. Posle dve i po godine od završene radioterapije postoji dobra lokalna kontrola bolesti i nema diseminacije. Prikaz bolesnika ukazuje na retkost lokalizacije, izazove i poteškoće u multimodalnom lečenju i doprinos radioterapije dobrim rezultatima lečenja.

**Cljučne reči:** primarni intraosealni lejomiosarkom, nosne i paranazalne šupljine; radioterapija

## UVOD

Sarkomi su retki tumori koji nastaju iz maligno transformisanih ćelija vezivnog tkiva. Dele se u dve velike grupe: sarkome mekih tkiva i sarkome kostiju.

Sarkomi mekih tkiva sačinjavaju heterogenu grupu retkih tumora, koji se dosta razlikuju po anatomskoj lokaciji, histologiji i biološkom ponašanju [1]. Kod odraslih sarkomi mekih tkiva čine manje od 1% svih solidnih tumora, a od toga je oko 45% lokalizovano u ekstremitetima (najviše u donjem ekstremitetu i to najčešće u butini), 38% intraabdominalno i pelvično (najviše retroperitonealno), 10% u trupu (najviše u koži i potkožnom tkivu) i 5% u glavi i vratu (najviše u koži i potkoži) [2]. Postoji preko 50 histoloških podtipova sarkoma mekih tkiva, a lejomiosarkomi čine oko 10% njih [3]. Lejomiosarkomi su tumori glatkih mišića, a najčešće se javljaju u genitalnom i gastrointestinalnom traktu i ekstremitetima, ređe u glavi i vratu, a vrlo retko u nosnim i paranazalnim šupljinama [4].

Literaturni podaci govore da se radi o bolesti starije populacije, obično posle 50. godine života [5]. Ne postoji jasno definisan uzrok nastanka ovih tumora, ali postoje određeni faktori rizika: genetski (nasledna lejomiomatoza, nasledni retinoblastom i Li-Fraumenijev sindrom), limfedem, trauma, prethodna izloženost radioterapiji i karcinogeni (vinil-hlorid, arsen) [6].

Simptomi ovih tumora su različiti – epistaksa, zapušnost nosa, pritisak i bol u sinusima.

U trenutku dijagnostikovanja više od 95% pacijenata ima lokalizovanu bolest, a 5% ima udaljene metastaze. Pacijentati sa lokalnom i lokoregionalnom bolešću (stadijum I–III) imaju petogodišnje preživljavanje oko 55–65%, dok je kod bolesnika sa metastazama manje od 1% [7].

Lečenje je multimodalno i individualizovano, uključuje hirurgiju, radioterapiju i hemioterapiju.

## PRIKAZ BOLESNIKA

Pacijentkinji staroj 61 godinu je u martu 2017. godine zbog zapušnosti desne strane nosa, bola u predelu desnog oka i povremene epistakse učinjena inicijalna KT endo- i splanhokranijuma, koja

je pokazala tumorsku promenu nazalnog prostora desno (u projekciji srednje i donje nazalne konhe sa ekstenzijom prema etmoidalnim sinusima), sa impresijom na medijalni zid orbite desno (bez jasnih znakova njene infiltracije) dimenzija 3×3×4 cm, sa retencionim promenama u desnom maksilarnom sinusu i hemoragičnim sadržajem u desnom sfenoidalnom sinusu bez prodora intrakranijalno (Slika 1), dok inicijalna KT toraksa i abdomena nije pokazala diseminaciju bolesti. Od komorbiditeta pacijentkinja je imala dijabetes tip II i povišen krvni pritisak.

Potom je upućena nadležnom maksilofacijalnom hirurgu, koji je načinio endoskopski pregled i biopsiju tumorske promene aprila 2017. godine. Definitivni patohistološki nalaz sa dopunskom imunohistohemijskom analizom je pokazao da se radi o vretenastom ćelijskom tumoru sa ekspresijom glatko-mišićnog fenotipa koji infiltrira kost. Nekroza nije bila prisutna, a broj mitozna je bio veliki (10/10 HPF (*high power fields*, polja velikog uveličanja)). Tumor je bio pozitivan na SMA (*smooth muscle actin*, aktin glatkih mišića), PanAktin, Vimentin, negativan na EMA (*epithelial membrane antigen*, antigen epitelne membrane) i S 100, sa slabom ekspresijom estrogenskih i negativnim progesteronskim receptorima, što je najviše odgovaralo niskogradusnom primarnom malignom mezenhimalnom tumoru tipa intraosealnog lejomiosarkoma.

Pacijentkinja je maja 2017. godine od strane nadležnog maksilofacijalnog hirurga upućena konzilijumu za sarkome Instituta za onkologiju i radiologiju Srbije, a s obzirom na to da je promena bila procenjena kao inoperabilna, indikovana je zračna terapija.

Zračna terapija je planirana 3D konformalnom tehnikom (3DCRT) standardnim režimom frakcionisanja 2 Gy/dnevno sa TD 60 Gy u 30 frakcija na tumorsku promenu (Slika 2). Radioterapija je sprovedena avgusta 2017. godine uz dobru subjektivnu toleranciju i razvoj radiomukozitisa gr I/II, koji su sanirani uz pojačanu lokalnu negu.

Kontrolna KT endo- i splanhokranijuma i KT toraksa januara 2018. ukazale su na lokalni parcijalni odgovor bez diseminacije bolesti, te je konzilijum indikovao redovne kontrole.

Na kontroli januara 2020. pacijentkinja je bila bez tegoba, sa stabilnom bolešću lokalno i bez znakova diseminacije bolesti, bez ispoljene toksičnosti dve i po godine posle sprovedenog radioterapijskog lečenja i tri godine od postavljanja dijagnoze.

## DISKUSIJA

Lejomiosarkomi su retki tumori koji se obično javljaju u genitalnom traktu (najčešće u uterusu), gastrointestinalnom traktu (najčešće u retroperitoneumu) i estemitima (najčešće u femoralnoj regiji), dok je pojava u glavi i vratu vrlo retka (najčešće u koži i potkožnom tkivu; oko 3% svih lejomiosarkoma).

Lejomiosarkomi nosa i paranasalnih šupljina su vrlo retki tumori koji se najčešće javljaju u populaciji preko 53 godine [8], a oboljevaju češće muškarci [7].

Ovi tumori se manifestuju epistaksom, zapušenošću nosa, pritiskom i bolom u sinusima, što može dovesti do kliničko dijagnostičke dileme, jer se ovi simptomi mogu pripisati i benignim oboljenjima kao što su hronični sinuzitis, sinonazalna polipoza i alergijski rinitis. Pravovremeno upućivanje maksilofacijalnom hirurgu doprinosi brzom postavljanju dijagnoze i otpočinjanju lečenja.

Patohistološki pregled je neophodan za definitivnu dijagnozu lejomiosarkoma, ali njegovo razlikovanje od rbdomiosarkoma, fibrosarkoma, malignog švanoma ili tumora vretenastih ćelija je teško upotrebom samo standardnog patohistološkog bojenja, već se koristi dopunsko imunohistohemijsko bojenje. Imunohistohemijski markeri koji su vrlo korisni u postavljanju definitivne dijagnoze su aktin glatkih mišića, koji je pozitivan u 95% slučajeva, mišićno specifičan aktin, koji je pozitivan u 88% slučajeva, dezmin u 73% slučajeva i miozin u 64% slučajeva. Postoji ekspresija estrogenskih i progesteronskih receptora u skoro svim lejomiosarkomima osim u koštanim [9].

Lečenje je multimodalno i uključuje hirurgiju, radioterapiju i hemioterapiju, a idealni način lečenja ovih tumora može predstavljati terapijski izazov. Primarni izbor lečenja je obično radikalna hirurška resekcija, a poželjna je i maksimalno moguća resekcija. Često zbog same lokalizacije tumora hirurška resekcija nije izvodljiva, a kada je hirurška resekcija bez odgovarajuće sigurnosne margine, onda se recidiv javlja kod oko polovine pacijenata unutar prve godine [10]. Lejomiosarkomi nisu radiosenzitivni, ali se radioterapija primenjuje kao postoperativna, ređe kao radikalna, a najređe kao preoperativna. Radioterapija doprinosi smanjenju pojave lokalnog recidiva i boljoj lokalnoj kontroli bolesti. Hemioterapija se koristi kod metastatske bolesti, efikasna hemioterapija nije standardizovana, a koriste se razni agensi, kao što su doksorubicin i ifosfamid.

Među sarkomima glave i vrata lejomiosarkomi imaju ne tako lošu prognozu, verovatno zbog mogućnosti ranijeg postavljanja dijagnoze, zato što nosna opstrukcija brzo dovodi do pojave simptoma. Petogodišnje preživljavanje pacijenata sa lokalnom i lokoregionalnom bolešću (stadijum I–III) jeste oko 55–65% [7]. Oni retko metastaziraju u limfne čvorove vrata. Na prognozu utiču brojni faktori, kao što su lokalizacija i ekstenzija tumora (kao najznačajniji), veličina tumora, gradus i ivice resekcije [9].

Primarni intraosealni lejomiosarkom u regiji glave i vrata se retko javlja, a ovaj prikaz bolesnika ukazuje da maksilofacijalni hirurzi imaju izuzetno važnu ulogu u što ranijoj dijagnozi ove bolesti, a samim tim mogu doprineti boljim rezultatima lečenja. Iako se smatra da nisu radiosenzitivni, ovaj prikaz bolesnika ukazuje da radioterapija može da ima značajnu ulogu u lokalnoj kontroli bolesti.

# Class II Division 1 malocclusion treatment using TADs – case report

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## SUMMARY

**Introduction** Orthodontic treatment of Class II Division 1 (II/1) malocclusions in adults can be challenging since skeletal effects are limited. Possible treatment options are orthodontic camouflage or orthognatic surgery, in severe cases. The aim of this paper was to present a successful management of Class II malocclusion in an adult patient using temporary anchorage devices (TADs).

**Case report** After detailed clinical examination, study models and cephalometric analysis, a 26 years old patient was diagnosed with Class II malocclusion, an overjet of 12 mm, congenitally missing tooth 41 and midline shifted to the right in upper dental arch. In prior orthodontic treatment, patient had upper premolars extracted. Posterior teeth in upper left quadrant were shifted mesially. The camouflage treatment was considered, using temporary anchorage devices (TADs) to distalize posterior teeth on the left side, and gain space for incisor retraction and midline correction in upper dental arch.

**Results** Using TADs as additional anchorage in anterior region and coil spring for molar distalization, the space was made for tooth 23, midline correction and incisor retraction. After 40 months, a satisfactory result was achieved, overjet and midline correction, class I canines occlusion and class II molar occlusion.

**Conclusion** Class II/1 malocclusion in adults can be successfully treated using TADs. The success depends on the severity of malocclusion and patient cooperation.

**Keywords:** class II malocclusion division 1; adults; TAD

## INTRODUCTION

Class II malocclusion is the most frequent type of malocclusions in Caucasians globally [1, 2]. In Europe the prevalence of Class II malocclusions in permanent dentition is 33.5% [1]. Epidemiological investigations in Serbia show that prevalence varies 23.4% to 54.9% in different regions [3–7]. Treatment considerations depend on patient age and severity of malocclusion [2, 8]. In literature numerous treatment protocols are presented [9, 10, 11], but none of them is accepted as agreement on whether it should be one-phase or two-phase treatment in school children [12, 13, 14].

Orthodontic management of adults with Class II division 1 (II/1) malocclusion is challenging and controversial, since the patient's growth is over, and skeletal component of malocclusion is difficult to change [2]. The treatment plan of Class II/1 malocclusion in non-growing patients involves orthodontic camouflage or orthognatic surgery [15]. In adult patients fixed functional appliances are also used, although skeletal effects are limited and changes are mostly dental [16]. The treatment plan decision is made upon numerous criteria - subjective and objective. Objective criteria are the severity of skeletal, dental and soft tissue discrepancy, oral health condition, number of permanent teeth present, whereas subjective criteria rely on patient's personal experience of his appearance with the malocclusion, and cooperation during the treatment.

Orthodontic camouflage is frequently a method of choice in Class II/1 malocclusion treatment. It presents dentoalveolar compensation of skeletal discrepancy. The change of teeth position should mask the sagittal discrepancy between maxilla and mandible. Orthodontic camouflage involves fixed appliances combined with extractions in one or both dental arches, functional fixed appliances or a combination of these methods [17]. In order to avoid unwanted teeth movements, in modern orthodontics temporary anchorage devices (TADs) are used for the purpose of enhancing orthodontic anchorage [18, 19]. In this case report a successful orthodontic camouflage of a severe Class II/1 is presented, using fixed orthodontic appliances and TADs.

## CASE REPORT

A 26 years old female patient was diagnosed with Class II/1 malocclusion. She already had orthodontic treatment previously with active appliances in early adolescence combined with extractions of upper premolars. Extraoral examination showed lips incompetence, prominent upper incisors, slightly increased height of lower facial third and convex profile with no signs of face asymmetry. Intraoral examination revealed labial inclination of upper incisors, absence of upper premolars with spaces in upper arch, and



**Figure 1.** Patient before orthodontic treatment. Extraoral photos show lips incompetence, midline shifted to the right in upper dental arch, open bite, crowding in lower dental arch, hypodontia of tooth 41. Teeth 14 and 24 were extracted prior to orthodontic treatment.

**Slika 1.** Fotografije pacijentkinje pre terapije. Na fotografijama lica se uočava inkompetencija usana, pomeren sredina gornjeg zubnog niza udesno, otvoren zagrižaj, teskoba u donjem zubnom nizu i hipodoncija zuba 41. U okviru prethodne ortodontske terapije izvađeni su zubi 14 i 24.



**Figure 2.** Alignment of the arches. Diastemas were closed, overjet decreased and crowding in lower dental arch solved.

**Slika 2.** Faza nivelacije tokom koje su zatvorene dijasteme, smanjen incizalni razmak i rasterećena teskoba u donjem zubnom nizu.



**Figure 3.** TADs in anterior region of maxilla as additional anchorage for tooth 27 distalization.

**Slika 3.** Faza terapije tokom koje su kao dodatno uporište uključeni mini-implantati za distalizaciju zuba 27.

metal ceramic crown on tooth 22. In lower arch, right central incisor was congenitally missing, lower canine was in ectopic position and crowding was present. Overjet was 12 mm, overbite on the left side 2 mm, whereas on the right side there was no vertical overlap of the incisors. In the upper arch midline shift of 2 mm to the right side was noted. Intercuspidation of right molars was 1/2 Class II, on the left Class II, whereas on the right side canines were in 1/2 Class III, and on the left 1/2 Class II (Figure 1).

Functional analysis showed nasal respiration. Tongue thrust was noticed and sigmatism while talking. Analysis of symmetry of dental arches showed mesial shift of upper posterior teeth on the left side, and lower posterior teeth on the right side. Cephalometric analysis showed bimaxillary retrognathism with class II relation of maxilla and mandible, ANB angle 7, anterior inclination of maxilla and posterior inclination of mandible, with higher value of SpP/MP angle and lower incisors proclination.

After precise orthodontic diagnosis it was decided to start camouflage therapy with fixed appliances in the upper and lower arch. Since prior orthodontic treatment teeth 14 and 24 were already extracted, treatment plan involved gaining space for midline correction and correct intercuspitation by distalization of posterior teeth on the left side. Conventional fixed appliances were used, brackets with Roth prescription for slot 0.018<sup>°</sup>. In the first phase, overjet slowly decreased by upper teeth movements and diastema closure (Figure 2). After alignment and leveling of the arches and canines intercuspitation correction, two TADs were positioned in anterior region for additional anchorage (Figure 3).

Posterior teeth distalization started with helical bulbous loops for tooth 27, and after 27, teeth 26 and 25 were moved distally using coil springs and power chains. TADs were removed (first on the left side, then on the right), teeth were moved one by one to correct midline shift and save the right inclination of upper incisors, while avoiding losing anchorage. After TAD removal, the therapy continued using class II intermaxillary elastics, and elastics for midline correction. During the night the patient wore headgear with intermaxillary elastics, to avoid unwanted extrusion and additional retroinclination of upper incisors. The therapy was finished after 40 months. Class I occlusion on canines and Class II on molars was achieved, with symmetry of the upper arch, overbite and overjet within normal



**Figure 4.** Patient after completed orthodontic treatment. Competent lips, straight profile, Class I intercuspitation of canines. Dental arches aligned, fixed retainer in upper dental arch.

**Slika 4.** Fotografije pacijentkinje na kraju terapije. Usne kompetentne, prav profil, interkuspிடация I klase na očnjacima. Zubni nizovi izniveisani i prisutan fiksni ritejner u gornjem zubnom nizu.

values and crowding in the lower arch was solved (Figure 4). Retention plan involved lingual retainer in the upper arch and thermoplastic retainers in both dental arches.

## DISCUSSION

In this report a successful management of Class II/1 malocclusion is presented in a female adult patient. Although it is one of the most common malocclusions, it is still widely investigated, especially in adult patients. Challenges in adult patients are numerous: oral health condition, need for restorative or periodontal treatment, preparation for dental implants or prosthetic solutions and correction of relapse of prior treatments.

In our case report, the patient was young adult with good oral health and great cooperation during treatment, with appropriate oral hygiene. Good cooperation was important for successful outcome. She was motivated and that was important when deciding to use TADs during treatment. Since upper premolars were extracted prior to the treatment, treatment possibilities were limited. Using TADs in this case was in the space of bone apposition in upper jaw. Enlow and Hans considered this as physiologically optimal region to gain space in upper arch [20]. Tooth positioning in the region with bone apposition should ensure stability of the results and prevent relapse.

Anterior inclination of maxilla and posterior inclination of mandible present additional challenge in adult patients, since extrusion of upper posterior teeth worsens sagittal

discrepancy. Comparing the effects of orthodontic camouflage in hyperdivergent Class II/1 malocclusions, Ding et al. recommended additional use of intrusive forces to avoid extrusion of posterior teeth [21]. Extractions in camouflage treatment are not enough for correction of vertical dimension, control and avoiding additional extrusion should provide decrease in vertical dimension [22].

While planning a Class II/1 adult treatment, it is important to consider correction of upper incisors inclination and their influence on soft tissue profile changes. Although this patient already had premolars extracted, retroinclination of upper incisors did not worsen the soft tissue profile; on the contrary, it improved the upper lip position and its relation to the lower lip, since the lips were incompetent before the treatment. Considering the influence of extractions to aesthetic appearance of patients with Class II/1 it has also been noticed that adults faces of patients with extractions of 2 premolars were much more attractive than those without extractions, or with 4 premolars extractions [23]. Also, favorable influence of therapy on soft tissues in this case can be explained that in patients with vertical growth pattern, soft tissue fullness improves less developed skeletal tissues [24]. According to this, retroinclination of upper incisors in

this case did not worsen soft tissue profile.

The success in Class II/1 malocclusion treatment depends on numerous factors. Treatment involves individual planning according to oral health status, number of teeth present, severity of skeletal and dental discrepancies and considering patient's wishes and expectations in order to achieve satisfactory aesthetic and functional results.

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# Terapija malokluzije II klase 1. odeljenja kod odraslih pacijenata primenom mini-implantata – prikaz bolesnika

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## KRATAK SADRŽAJ

**Uvod** Malokluzije II klase 1. odeljenja mogu biti poseban izazov za zbrinjavanje kod odraslih osoba. Terapijske mogućnosti su ograničene u smislu delovanja na skeletne promene. Kao mogući modaliteti u terapiji primenjuju se ortodonska kamuflaža ili ortognata hirurgija.

Cilj ovog rada bio je da se predstavi uspešna ortodonska terapija malokluzije II/1 klase kod odrasle pacijentkinje uz primenu mini-implantata.

**Prikaz bolesnika** Pacijentkinji starosti 26 godina, nakon kliničkog pregleda, analize studijskih modela i profilnog telerendgena, postavljena je dijagnoza malokluzije II/1 klase, sa incizalnim razmakom od 12 mm, hipodoncijom zuba 41 i pomerenom sredinom gornjeg zubnog niza udesno. Pacijentkinji su u prethodnom ortodontskom tretmanu izvađeni zubi 14 i 24 u školskom uzrastu. Analizom simetričnosti u gonjem zubnom nizu uočena je mezijalna pomenost bočnih zuba u levom kvadrantu. Odlučeno je da se sprovede ortodonska terapija kamuflažom uz primenu mini-implantata kako bi se izvršila distalizacija gornjih bočnih zuba sa leve strane i dobio prostor za retrakciju sekutića i korekciju sredine zubnog niza.

Primenom mini-implantata kao dodatnog uporišta u regiji prednjih zuba i opruge za distalizaciju molara dobijen je prostor za distalizaciju zuba 23, korekciju sredine zubnog niza i retroklinaciju sekutića. Nakon 40 meseci uspostavljena je okluzija I klase na očajnicima, pune II klase na molarima, korigovani su incizalni razmak i preklap i uspostavljena je simetričnost gornjeg zubnog niza.

**Zaključak** Primenom ortodontske terapije uz pomoć mini-implantata moguće je uspešno korigovati izražene malokluzije II/1 klase kod odraslih osoba. Uspeh terapije zavisi od izraženosti nepravilnosti, stanja oralnog zdravlja, kao i saradnje pacijenta.

**Ključne reči:** malokluzija II klase 1. odeljenje; mini-implantati; terapija; odrasli

## UVOD

Malokluzije II klase predstavljaju najzastupljenije ortodonske nepravilnosti u populaciji bele rase na globalnom nivou [1, 2]. Na evropskom kontinentu učestalost malokluzija II klase u stalnoj denticiji iznosi 33,5% [1]. Epidemiološka istraživanja na području naše zemlje pokazuju da učestalost ove nepravilnosti iznosi od 23,4 do 54,9% za različite regione [3–7]. Terapijski pristup u lečenju ove vrste nepravilnosti zavisi od načina njenog ispoljavanja, odnosno izraženosti skeletne, dentoalveolarne ili neuomišične komponente, kao i uzrasta pacijenta [2, 8]. U literaturi su opisani brojni protokli lečenja malokluzija II klase 1. odeljenja [9, 10, 11]. Ali za sada nema jedinstvenog stava istraživača i kliničara o primeni jednofazne ili dvofazne terapije malokluzija II/1 klase kod dece školskog uzrasta [12, 13, 14].

Poseban izazov u zbrinjavanju predstavljaju malokluzije II/1 klase kod odraslih pacijenata. S obzirom na završen rast, terapijske mogućnosti su ograničene u smislu delovanja na skeletnu komponentu nepravilnosti [2]. Terapijski modaliteti u lečenju malokluzija II/1 klase kod odraslih su ortodonska kamuflaža nepravilnosti i ortognatska hirurgija [15]. Takođe, u terapiji odraslih koriste se i fiksni funkcionalni aparati, iako su skeletni efekti ograničeni i promene su u najvećoj meri dentoalveolarne [16]. Izbor metode lečenja zavisi od brojnih subjektivnih i objektivnih faktora. Objektivni parametri se odnose na stepen izraženosti skeletne, dentoalveolarne i mekotivne nepravilnosti malokluzije II/1 klase, stanje oralnog zdravlja, broj prisutnih stalnih zuba i opšte zdravstveno stanje pacijenta, dok se subjektivni odnose se na način ličnog doživljaja nepravilnosti samog pacijenta, njegov odnos prema tome i unutrašnju motivisanost.

Ortodonska kamuflaža je često metod izbora u terapiji malokluzije II/1 klase kod odraslih, kako od strane ortodonata tako i od strane pacijenata. Sam pristup podrazumeva dentoal-

veolarnu kompenzaciju, odnosno promena položaja zuba treba da doprinese ublažavanju postojećeg sagitalnog nesklada između vilica. Terapija kamuflažom sprovodi se primenom fiksnih ortodontskih aparata u kombinaciji sa ekstrakcionom terapijom u jednom ili oba zuba niza, pri čemu se mogu primeniti fiksni funkcionalni aparati, ili kombinacija ovih metoda lečenja [17]. Kako bi se postiglo željeno pomeranje zuba, bez neželjene sile reakcije na zube u uporištu, u ortodontskoj terapiji adolescenata i odraslih se sve više primenjuju mini-implantati [18, 19]. U ovom prikazu bolesnika predstavljena je uspešna ortodonska terapija kamuflažom izražene malokluzije II/1 klase, primenom fiksnih ortodontskih aparata uz pomoć ortodontskih mini-implantata.

## PRIKAZ BOLESNIKA

Pacijentkinje starosti 26 godina na osnovu kliničkog pregleda postavljena je dijagnoza malokluzije II/1 klase. Na osnovu uzete anamneze ustanovljeno je da je u pubertetu već sprovedena ortodonska terapija, primenom aktivnih aparata uz ekstrakciju prvih gornjih premolara. Na ekstraoralnom pregledu uočena je inkompetentnost usana sa prominentnim gornjim sekutićima, blago povećan donji sprat lica i konveksan profil, bez vidljivih znakova asimetrije lica. Intraoralni nalaz u gornjoj vilici pokazao je izraženu labijalnu inklinaciju gornjih sekutića, odsustvo prvih premolara sa rastresitošću u gornjem zubnom nizu, prisutnu krunicu na zubu 22. U donjoj vilici uočena je hipodoncija centralnog sekutića sa desne strane, ektopičan položaj očajnika sa desne strane i umerena teskoba u zubnom nizu. Incizalni razmak iznosio je 12 mm, a preklap sekutića sa leve strane 2 mm, dok je u regiji gornjih i donjih sekutića sa desne strane prisutan otvoren zagrižaj. Sredina gornjeg zubnog niza je bila pomerena udesno za 2 mm. Interkuspidacija prvih molara sa

desne strane je bila ½ II klase, sa leve strane u hiper II klasi, dok je interkuspidacijom očnjaka sa desne strane bila ½ III klase, a sa leve strane u ½ II klase (Slika 1).

Funkcionalnim ispitivanjima ustanovljena je nazalna respiracija. Uočeno je tiskanje jezika prilikom gutanja, dok je tokom govora bio prisutan sigmatizam. Analizom simetričnosti zubnih nizova ustanovljena je mezijalna pomenost gonjih bočnih zuba u levom kvadrantu i donjih bočnih zuba u desnom kvadrantu. Na profilnom telerendgenskom snimku glave postavljena je dijagnoza bimaksilarnog retrognatizma sa međuviličnim odnosom II klase i vrednošću ugla ANB 7°, anteinklinacija maksile, retoinklinacija mandibule, sa povećanom vrednošću ugla SpP/MP i sa proklinacijom donjih sekutića.

Nakon donošenja precizne ortodontske dijagnoze, u dogovoru sa pacijentom odlučeno je da se primeni terapija kamuflažom gornjim i donjim fiksnim aparatom. Kako su u prethodnoj terapiji već izvađeni zubi 14 i 24, plan terapije je podrazumevao da se prostor za korekciju sredine zubnog niza i klase okluzije obezbedi distalizacijom bočnih zuba sa leve strane, u regiji tubera. Postavljen je gornji i donji fiksni aparat sa konvencionalnim metalnim bravicama Roth preskripcije za slot 0,018 inča širine. U toku faze nivelacije postepeno se smanjivao incizalni razmak, pomeranjem gornjih zuba i popunjavanjem dijastema (Slika 2). Nakon nivelisanja zubnih nizova, za korekciju interkuspidacije očnjaka i prvih molara, u terapiju su uključena dva mini-implantata, kao dodatno uporište u regiji prednjih zuba (Slika 3). Pomeranje bočnih zuba je započeto primenom opruge *helical bulbous* za distalizaciju zuba 27, zatim su uz pomoć federa i čejnova pojedinačno distalizirani zubi 26 i 25. Postepenim uklanjanjem mini-implantata, prvo levog pa desnog, pojedinačno su pomerani prednji zubi kako bi se korigovala sredina zubnog niza i očuvao pravilan nagib gornjih sekutića i sprečio gubitak uporišta u regiji prednjih zuba. Posle uklanjanja mini-implantata nastavljena je terapija primenom bočnih intermaksilarnih gumica II klase, kao i primenom gumica za korekciju sredine zubnog niza. Tokom noći pacijentkinja je nosila hedger uz intermaksilarne gumice, kako bi se sprečila neželjena ekstruzija i dodatna retroklinacija gornjih sekutića. Terapija je završena posle 40 meseci. Uspostavljena je okluzija I klase na očnjacima, a pune II klase na prvim molarima, dobijena je simetričnost gornjeg niza, korigovani su incizalni razmak i dubina preklopa i teskoba u donjem zubnom nizu (Slika 4). Retencionna faza je započeta primenom retencionih folija u obe vilice.

## DISKUSIJA

U ovom prikazu predstavljena je uspešna ortodontska terapija izražene malokluzije II/1 klase kod mlade odrasle osobe. I pored toga što terapija malokluzija II/1 klase predstavlja jednu od najzastupljenijih procedura u ortodontskoj kliničkoj praksi, i dalje je predmet brojnih istraživanja, posebno kada je u pitanju pristup kod odraslih osoba. Izazovi sa kojima se ortodonti susreću u terapiji odraslih su brojni, od stanja oralnog zdravlja, potrebe za sanacijom zuba ili parodontijuma, pripreme za protetsko-implantološke radove, do korekcije recidiva prethodne ortodontske

terapije. Unutrašnja motivisanost pacijenta i njegova spremnost za saradnju i aktivno učestovanje tokom terapije u velikoj meri doprinose uspehu ortodontske terapije.

U ovom slučaju pacijentkinja je mlada odrasla osoba koja je imala dobro stanje oralnog zdravlja i pokazivala je odličnu saradnju tokom terapije, od održavanja oralne higijene do pridržavanja uputstava o nošenju intermaksilarnih gumica. Dobra saradnja je uticala i na ukupno vreme terapije i doprinela uspešnom ishodu. Motivisanost pacijentkinje je pomogla u donošenju odluke o primeni mini-implantata u toku terapije. Kako su u prethodnoj terapiji već izvađeni zubi 14 i 24, terapijske mogućnosti u smislu dobijanja prostora za asimetrična pomeranja zuba uz smanjenje ukupne dužine gornjeg zubnog luka bile su dodatno sužene. Primena mini-implantata je pomogla da se iskoristi prostor koji predstavlja polje apozicije kosti u gornjoj vilici. Enlow i Hans [20] smatraju da je ovo ujedno i fiziološki najoptimalnija regija za dobijanje prostora u gornjem nizu. Postavljanjem zuba u zoni vilice u kojoj se kost stvara treba da se obezbedi stabilnost postignutih rezultata i smanji pojava recidiva.

Izrazita prednja rotacija maksile i zadnja mandibule predstavljaju dodatni izazov u terapiji odraslih, pošto dodatna ekstruzija gornjih bočnih zuba otežava korekciju sagitalne nepravilnosti i doprinosi pogoršanju kliničke slike. U poređenju efekata ortodontske kamuflaže kod hiperdivergentnih malokluzija II/1 klase kod adolescenata i odraslih, Ding i sar. [21] dodatno preporučuju upotrebu intruzivnih sila, kao bi se sprečile neželjene ekstruzije bočnih zuba. Primena ekstrakcione terapije u cilju kamuflaže nepravilnosti nije dovoljna za korekciju vertikalne dimenzije, već kontrola i sprečavanje dodatne ekstruzije molara i kod ekstrakcione terapije treba da obezbede smanjenje vertikalne dimenzije okluzije [22].

Prilikom planiranja ortodontske terapije II/1 klase kod odraslih veoma je važno uzeti u obzir i obim korekcije nagiba gornjih sekutića i njihov uticaj na mekotkivni profil pacijenta. Iako je kod pacijentkinje prethodno izvršena ekstrakciona terapija u gornjoj vilici, retroklinacija gornjih sekutića do korekcije incizalnog razmaka nije narušila mekotkivni profil, već je doprinela poboljšanju položaja gornje usne u odnosu na estetsku liniju i uspostavljanju kompetentnosti usana. U razmatranju dugoročnog uticaja ekstrakcione terapije na privlačnost lica pacijenata nakon terapije malokluzije II/1 klase uočeno je da su u adultnom periodu lica pacijenata kod kojih su ekstrahovana dva premolara bila znatno privlačnija u odnosu na lica pacijenata bez ekstrakcija ili ekstrakcija sva četiri premolara [23]. Takođe povoljan uticaj terapije na meka tkiva u ovom prikazu može se objasniti i punoćom mekih tkiva. Kod pacijenata sa vertikalnim tipom rasta prisutna je veća debljina mekotkivnog pokrivača, koja treba da ublaži slabije razvijen skelet lica [24]. Na osnovu toga, u ovom slučaju, retroklinacija gornjih sekutića nije pogoršala položaj mekih tkiva.

Uspeh u terapiji malokluzija II/1 klase kod odraslih zavisi od brojnih faktora. Terapija podrazumeva individualno planiranje u skladu sa stanjem oralnog zdravlja, brojem prisutnih zuba, stepenom izraženosti skeletnih i dentoalveolarnih nepravilnosti, i uključivanje želja i očekivanja pacijenta kako bi se postigli zadovoljavajući estetski i funkcionalni rezultati terapije.

# Maxillary bone necrosis following the use of formaldehyde containing paste – case report

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## SUMMARY

Many of medicaments used historically in root canal treatment have been shown to be cytotoxic. Paraformaldehyde agents (such as Toxavit and Depulpin) are used to devitalize inflamed pulp when local anesthesia is ineffective. The misuse of pulp devitalizing agents may cause damage to gingiva and alveolar bone. This case report demonstrates complications arising after application of paraformaldehyde containing paste, necrosis of the gingiva and alveolar cortical bone, which resulted in great loss of supporting bone. Surgical intervention was required wherein necrotic bone was removed and bone defect was filled with xenograft of bovine origin. After three months endodontic treatment was performed. After the treatment, the patient's complaints were resolved. The use of paraformaldehyde-based agents during endodontic therapy requires special caution.

**Keywords:** root canal treatment; paraformaldehyde; bone necrosis

## INTRODUCTION

Successful local anesthesia and performing pain-free root canal treatment may be a challenge for dentists. Cohen et al. reported that 39% of patients who had irreversible pulpitis of the mandibular molar remained sensitive to a cold test after administration of an inferior alveolar nerve block with 2% lidocaine [1]. In cases of acute symptomatic pulpitis, particularly in the mandibular molar, where profound anesthesia was previously difficult to achieve because of technical or anatomical problems, dental clinicians used arsenic or paraformaldehyde paste to devitalize inflamed painful pulp. Pulp necrotizing agents are toxic and exhibit non-selective action. Effect of paraformaldehyde paste is not confined to the pulp but it also affects surrounding tissues if it comes into contact, directly or by diffusion through dentin. If not placed correctly, it may lead to local complications such as damage to interdental papilla, destruction of periodontal ligament, or the formation of periapical, interradical and lateral damage of periodontal bone tissue [2, 3].

The purpose of this article is to present the complications caused by inadequate application of paraformaldehyde-based pulp devitalizer on periodontal and bone tissues and its treatment.

## CASE REPORT

A 23 year old male patient visited our clinic asking for advice and complained about pain in upper first right molar region. He reported that root canal treatment has been started by his dentist 3 month earlier. Due to extreme pain during access preparation caused by ineffective anesthesia, the patient was told that the pulp devitalizing paste was applied. It was later confirmed (by phone) that it was a paraformaldehyde paste (Depulpin, Voco, GmbH, Cuxhaven, Germany). Shortly after the placement of the paraformaldehyde paste, the patient experienced pain and this feeling persisted even after endodontic treatment was completed. The patient called his dentist and he was told to take some antibiotics and analgesics. However, the patient's complaints did not resolve and he came to our clinic for further evaluation and management.

Clinical examination revealed a crater-like lesion located on the interdental gingiva between upper right second premolar and first molar (tooth #15 and 16), as well as periodontal pocket in the same region (Figure 1). Second class composite fillings (mesio-occlusal) were observed on both teeth. A radiograph revealed incomplete root canal treatment of tooth 16 (only the palatal canal was obturated) and severe intraosseous defect between teeth 15 and 16 (Figure 2). Sensitivity of the tooth 15 to the electric pulp test was absent.



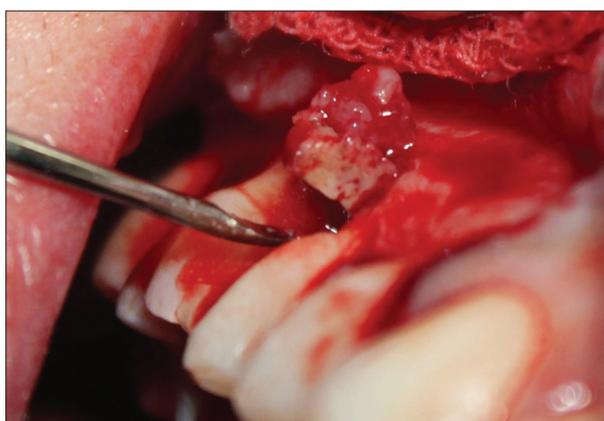
**Figure 1.** Lesion localized in the area of interdenal papilla between teeth 15 and 16.

**Slika 1.** Lezija lokalizovana u području interdentalne papile između zuba 15 i 16.



**Figure 2.** Diagnostic radiograph

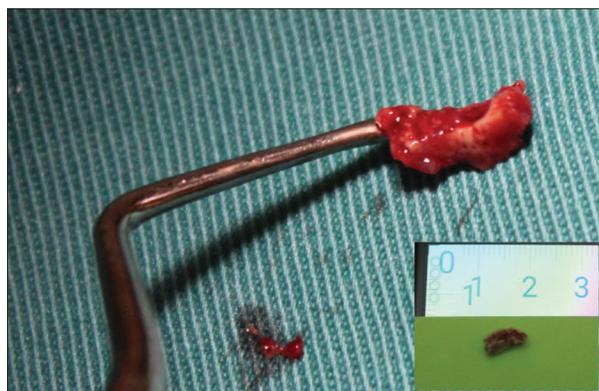
**Slika 2.** Dijagnostički RTG snimak



**Figure 3.** Removal of necrotic bone

**Slika 3.** Uklanjanje nekrotične kosti

Disinfection of the mouth was performed with chlorhexidine 0,2%, and under local anaesthesia, the full thickness periodontal flap was raised both buccally and palatally, necrotic bone was removed and curettage of the cavity was carried out (Figure 3, 4, 5). The surgical site was irrigated with sterile physiological saline. After curettage and irrigation of the area, the defect was filled with xenograft of bovine origin (Figure 6). The flap was sutured in place and periodontal dressing was given (Figure 7). The



**Figure 4.** Necrotic bone sequestrum

**Slika 4.** Sekvestri kosti



**Figure 5.** Defect seen after necrotic bone removal

**Slika 5.** Defekt posle uklanjanja nekrotične kosti

patient was prescribed antibiotics for seven days (amoxicillin 500 mg 3×1 and metronidazole 400 mg 3×1).

After three months, endodontic treatment was performed on tooth 15, as well as retreatment on tooth 16 (Figure 8). After surgical procedure and endodontic treatment completion all symptoms disappeared.

## DISCUSSION

Dentists often face difficulties during endodontic treatment, when there is failure of anesthesia in teeth diagnosed with irreversible pulpitis. Various agents are used to devitalize extremely painful pulps prior to extirpation. Paraformaldehyde-containing products are commonly used for this purpose. Paraformaldehyde leads to coagulation and denaturation of cell wall proteins, which results in the arrest of all vital cell functions. The tissue becomes “fixed,” and this state of fixation is irreversible [3, 4]. Despite of its clinical benefit, the use of paraformaldehyde containing paste in such circumstances may lead to many noxious effects on the host tissue. In addition to damage of interdental papilla, these agents can diffuse deeper into the bone and with their effect, lead to circulatory disorders and consequent necrosis. These changes may create a precondition for bone infection or localized osteomyelitis [5–8]. Caution should be exercised during



**Figure 6.** Xenograft placed in the defect  
**Slika 6.** Defekt popunjen ksenotransplantatom



**Figure 7.** Periodontal dressing placed  
**Slika 7.** Postavljen hirurški zavoj

its use, by properly isolating surrounding tissues from the tooth. Proper application implies complete removal of all carious masses and application of the agent directly to the previously made dental pulp microperforation at a distance of at least 2 mm from the edge of the cavity, for a period not longer than two weeks. In order to prevent microleakage and eliminate the possibility of diffusion of the devitalizing agent towards the gingiva, the application of temporary filling needs to be carried out in layers.

In the case described here, depulpin was probably in direct contact with alveolar bone or soft tissue because of an inadequate temporary restoration. This resulted in severe complications, such as pain, loss of sensitivity of tooth 15, gingival necrosis and bone necrosis. This case required surgical treatment to remove necrotic alveolar bone and sequestrum in order to maintain circulation of the supporting tooth structure.

A study by Ozgöz et al. reported cases of complications occurred after the application of paraformaldehyde-based paste during endodontic treatment. Clinical and radiological findings indicated pain, gingival necrosis, and enlargement of the periodontal ligament and loss of lamina dura. Inadequate molar anesthesia was reported as the most common cause of devitalization agents application [9]. Similar changes after devitalization of the upper molar were reported in case report by Srivastava et al.



**Figure 8.** Post-op radiograph after three month  
**Slika 8.** RTG snimak posle tri meseca

where, in addition to the changes described, the resulting periodontal pocket, 11 mm in depth, was diagnosed [3]. A study by Stabholz and Blush and another study by Di Felice and Lombardi reported necrotic bone and gingiva that resulted from paraformaldehyde containing paste used during root canal treatment [10, 11]. Similar cases of paraformaldehyde – related tissue necrosis are occasionally reported, with severe consequences [12, 13].

A study by Hülsmann et al. reported that marginal leakage of temporary filling material may result in diffusion of paraformaldehyde containing paste into the periodontal tissues [14]. Tortorici et al. reported three cases of maxillary bone necrosis following the use of formaldehyde containing paste. Each of these three cases resulted in significant damage to periodontal and bone tissues and tooth loss in the affected region [4]. Lee et al. described two cases of osteomyelitis after the use of paraformaldehyde containing paste. In the first case, the clinician applied Depulpin on the perforation site inside the pulp chamber, and in the second case Depulpin was in direct contact with soft tissue [8].

Although effective, the use of paraformaldehyde is not without risk as there may be unfavorable adverse effects on soft tissues and bone. Unfortunately, sometimes unintentional leakage may occur. This may not only lead to superficial mucosal injuries but may also penetrate deeper into the bone and cause its necrosis. Such toxic chemical agents should be used very cautiously in the oral cavity,

so that they do not come in contact with gingiva or other parts of oral mucosa during placement.

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# Nekroza maksilarne kosti posle primene devitalizacione paste na bazi formaldehida – prikaz bolesnika

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## KRATAK SADRŽAJ

Veliki broj medikamenata koji su se kroz istoriju koristili za tretman kanala korena ispoljavali su citotoksičnost. Sredstva na bazi paraformaldehida (kao što su toksavit i depulpin) koriste se za devitalizaciju zubne pulpe u slučajevima kada je primena lokalnih anestetika neefikasna. Nepravilna primena sredstava za devitalizaciju pulpe može prouzrokovati oštećenja desni i alveolarne kosti. Ovaj prikaz iz prakse ukazuje na ozbiljne komplikacije nastale posle primene paste na bazi paraformaldehida, nekrozu desni i alveolarne kosti, što je rezultiralo velikim gubitkom koštanog tkiva. Bila je potrebna hirurška intervencija da se ukloni nekrotična kost i defekt popuni ksenotransplantatom bovinog porekla. Tri meseca posle operacije izvedena je endodontska terapija. Nakon tretmana pacijentove tegobe su prestale. Primena sredstava na bazi paraformaldehida tokom endodontske terapije zahteva poseban oprez.

**Ključne reči:** tretman kanala korena; paraformaldehyd; nekroza kosti

## UVOD

Uspešna primena lokalne anestezije i izvođenje bezbolnog endodontskog tretmana u pojedinim situacijama može predstavljati izazov za stomatologa. Cohen i saradnici su u svojoj studiji pokazali da 39% pacijenata sa ireverzibilnim pulpitisom mandibularnih molara pokazuje osetljivost na hladne nadražaje polse blok-anestezije donjeg alveolarnog nerva 2% rastvorom lidokaina [1]. U slučajevima akutnog simptomatskog pulpitisa, posebno mandibularnih molara, kada je postizanje adekvatne anestezije bilo otežano zbog tehničkih ili anatomskih faktora, stomatolozi su koristili paste na bazi arsena ili paraformaldehida za devitalizaciju inflamirane, bolne zubne pulpe. Sredstva za nekrotizaciju pulpe su toksična i ispoljavaju neselektivno delovanje. Paraformaldehyd ne deluje isključivo na pulpu već i na okolna tkiva sa kojima dođe u kontakt – direktno ili difuzijom kroz dentinske tubule. Ukoliko se ne postavi pravilno, može dovesti do lokalnih komplikacija kao što su oštećenje interdentalne papile, destrukcija parodonta, odnosno nastanak periapikalnih, intraradikalnih i lateralnih oštećenja u koštanom tkivu parodonticijuma [2, 3].

Cilj ovog članka je da prikaže komplikacije nastale nakon neadekvatne primene sredstva za devitalizaciju pulpe na bazi paraformaldehida i terapiju komplikacija.

## PRIKAZ BOLESNIKA

Pacijent star 23 godine, muškog pola, primljen je na našu kliniku sa molbom za konsultaciju i mišljenje u vezi sa tegobama u vidu bola u regiji prvog gornjeg desnog molara. Pacijent u anamnezi navodi da je tri meseca pre dolaska zub 16 bio podvrgnut endodontskoj terapiji. Zbog izraženih bolova tokom preparacije pristupnog kaviteta pacijentu je tada ukazano na neefikasnost lokalne anestezije i aplikovana je devitalizaciona pasta. Kasnije je potvrđeno da je u pitanju pasta na bazi paraformaldehida (Depulpin, Voco, GmbH, Cuxhaven, Germany). U periodu posle aplikacije paste pacijent je osećao bolove, koji su perzistirali i posle završene endodontske terapije na zubu 16. Prilikom

ponovnog javljanja svom stomatologu pacijentu su propisani antibiotici i analgetici. Ipak, pacijentove tegobe nisu prestale i on se upravo zbog toga javio na našu kliniku.

Kliničkim pregledom je utvrđeno postojanje lezije u obliku kratera, lokalizovane u području interdentalne papile između zuba 15 i 16, kao i postojanje parodontalnog džepa u pomenutoj regiji (Slika 1). Na oba zuba su uočeni kompozitni ispuni druge klase, mezio-okluzalno. Radiografijom je ustanovljena nepotpuna endodontska terapija na zubu 16 (opturisan je jedino palatinalni kanal) i izražen intrakoštani defekt između zuba 15 i 16 (Slika 2). Zub 15 je bio negativan na elektro test.

Potom se pristupilo parodontološkoj intervenciji. Za dezinfekciju usta korišten je 0,2% hlorheksidin. Pod dejstvom lokalne anestezije podignut je mukoperiostalni režanj pune debljine i nekrotična kost je pažljivo uklonjena uz kiretažu šupljine (slike 3, 4, 5). Operaciono polje je irigirano sterilnim fiziološkim rastvorom. Posle kiretaže i irigacije područja defekt je popunjen ksenotransplantatom bovinog porekla (Slika 6). Režanj je ušiven i postavljen je hirurški zavoj (Slika 7). Pacijentu su propisani antibiotici u trajanju od sedam dana (amoksicilin 500 mg 3×1 i metronidazol 400 mg 3×1).

Posle tri meseca izvršeni su endodontska terapija na zubu 15 i retreatman na zubu 16 (Slika 8). Na kontrolnom pregledu posle hirurške terapije i endodontskog tretmana pacijent nije imao nikakve simptome.

## DISKUSIJA

Stomatolozi često imaju poteškoće tokom endodontske intervencije u slučajevima kada je lokalna anestezija neuspešna kod zuba sa dijagnostikovanim ireverzibilnim pulpitisom. Za devitalizaciju bolnih zuba tokom ekstirpacije zubne pulpe primenjuju se različita sredstva. U ovu svrhu se najčešće koriste preparati na bazi paraformaldehida. Paraformaldehyd dovodi do koagulacije i denaturacije proteina ćelijskog zida, što uzrokuje prestanak svih vitalnih ćelijskih funkcija. Na ovaj način tkivo postaje „fiksirano“ i ovo stanje je ireverzibilno [3, 4]. I pored kliničkih prednosti, primena pasti na bazi paraformaldehida

može dovesti do toksičnog delovanja na okolna tkiva sa kojima dođu u kontakt. Pored oštećenja interdentalne papile, ova sredstva mogu difundovati dublje u kost te svojim efektom dovesti do poremećaja cirkulacije i posledične nekroze. Ove promene mogu stvoriti preduslov za nastanak infekcije kosti ili lokalizovani osteomijelitis [5–8]. Prilikom njegove aplikacije treba biti veoma oprezan, u smislu izolacije i zaštite okolnog tkiva. Pravilna aplikacija podrazumeva potpuno uklanjanje svih karijesnih masa i aplikaciju primenjenog sredstva direktno na prethodno napravljenu mikroperforaciju zubne pulpe, udaljenju najmanje 2 mm od ivice kaviteta, na period ne duži od dve sedmice. Kako bi se sprečilo mikrocurenje i otklonila mogućnost difundovanja sredstva za devitalizaciju prema gingivi, aplikaciju privremenog ispuna potrebno je sprovesti u slojevima.

U prikazu bolesnika koji je opisan u ovom radu, depulpin je verovatno bio u direktnom kontaktu sa koštanim tkivom ili gingivom zbog neadekvatnog privremenog ispuna. Ovo je rezultiralo pojavom teških komplikacija, kao što su bol, nekroza gingive i koštanog tkiva te formiranje paradontalnog džepa. U ovom slučaju je bila neophodna hirurška intervencija uklanjanja nekrotične kosti sa ciljem održavanja cirkulacije potpornog aparata zuba.

Ozgöz i saradnici u svom radu navode slučajeve komplikacija nastalih posle primene paste na bazi paraformaldehida prilikom endodontskog tretmana zuba. Klinički i radiološki nalazi ukazali su na bol, nekrozu gingive te proširenje paradontalnog ligamenta i gubitak lamine dure. Neadekvatna anestezija molara se navodi kao najčešći uzrok primene sredstava za devitalizaciju

zuba [9]. Slične promene posle devitalizacije gornjeg molara navode u svom prikazu slučaja Srivastava i saradnika, gde je pored gore opisanih promena dijagnostikovana i dubina nastalog paradontalnog džepa od 11 mm [3]. U svojim radovima Stabholz i Blush, kao i Di Felice i Lombardi opisuju nekrozu koštanog tkiva i gingive prouzrokovanu sredstvima za avitalizaciju na bazi paraformaldehida [10, 11]. Povremeno se objavljuju slični slučajevi tkivnih nekroza sa teškim posledicama izazvanim aplikacijom sredstava na bazi paraformaldehida [12, 13]. Hülsmann i saradnici su pokazali da marginalno curenje privremenog ispuna može dovesti do difuzije paraformaldehida u parodonticijum [14]. Tortorici i saradnici su opisali tri slučaja nekroze maksilarne kosti posle primene paste na bazi formaldehida. Svaki od ova tri slučaja je rezultirao značajnim oštećenjima paradontalnog tkiva i gubitkom zuba u zahvaćenoj regiji [4]. Lee i saradnici su opisali dva slučaja osteomijelitisa koji je nastao kao posledica primene paste na bazi formaldehida. U prvom slučaju stomatolog je aplikovao pastu u području perforacije pulpne komore, a u drugom slučaju depulpin je bio u direktnom kontaktu sa mekim tkivima [8].

Iako je efikasna, primena devitalizacionih sredstava na bazi formaldehida nije bez rizika jer može izazvati neželjena dejstva na meka tkiva i kost. Nažalost, nekada može doći do difuzije u okolna tkiva, što može prouzrokovati ne samo oštećenje sluznice već i nekrozu koštanog tkiva. Toksična hemijska sredstva, kao što su devitalizacione paste, treba primenjivati uz veliki oprez u usnoj duplji, da bi se izbegao njihov kontakt sa gingivom ili drugim delovima oralne sluznice.

## Da li ste pažljivo čitali radove?

1. Defekt oštećene kosti posle primene preparata na bazi paraformaldehida je popunjen:
  - a) transplantatom bovinog porekla
  - b) transplantatom veštačke kosti
  - c) transplantatom dentalnog porekla
2. Navike i stavovi o oralnom zdravlju su ispitivani:
  - a) kod savremenih doktora medicine
  - b) kod savremenih doktora stomatologije
  - c) kod savremenih doktora veterine
3. Implantatno-protetski plan terapije uključuje:
  - a) estetske zahteve
  - b) hirurške zahteve
  - c) konzervativni tretman
4. Terapija malokluzije II klase 1. odeljenja je najefikasnija:
  - a) kod odraslih
  - b) kod dece
  - c) podjednako kompleksna i kod odraslih i kod dece
5. Za uklanjanje nekrotične kosti posle primene formaldehida primenjena je:
  - a) kauterizacija
  - b) medikamentna terapija
  - c) hirurška intervencija
6. Anketni upitnik za ispitivanje studenata o oralnom zdravlju je sadržao:
  - a) 10 pitanja
  - b) 15 pitanja
  - c) 16 pitanja
7. Najintenzivnije promene na viličnim kostima posle gubitka prirodnih zuba se odvijaju:
  - a) u prvih šest meseci
  - b) u prva dva meseca
  - c) odmah posle gubitka zuba
8. Terapijske mogućnosti kod II klase 1. odeljenja kod odraslih pacijenata su:
  - a) ograničene
  - b) sa prilično dobrim ishodom
  - c) sa širokim dijapazonom izbora terapije
9. Da se uvede poseban predmet o oboljenjima usne duplje saglasno je:
  - a) 20% studenata
  - b) 40% studenata
  - c) 50% studenata
10. Osnovni razlog ubrzane resorpcije alveolarnog grebena kod nosilaca totalnih proteza je:
  - a) neadekvatan prenos pritiska na kost
  - b) materijal od koga je napravljena proteza
  - c) individualna osetljivost koštanog grebena
11. Ortodonska terapija malokluzije II klase 1. odeljenja u predstavljenom slučaju je realizovana:
  - a) primenom pokretnog aparata
  - b) primenom fiksno aparata
  - c) primenom mini-implantata
12. Prikaz bolesnika ukazuje na ozbiljne komplikacije nastale posle nepravilne primene
  - a) paraformaldehida
  - b) arsena
  - c) hlorfenol-kamfora
13. Navike i stavovi o oralnom zdravlju su proveravani:
  - a) kod studenata medicine
  - b) kod studenata stomatologije
  - c) kod studenata veterine
14. Ukoliko postoji izrazita resorpcija koštanog tkiva kod odraslih pacijenata, prednost treba dati:
  - a) mobilnoj nadoknadi
  - b) fiksnoj nadoknadi
  - c) oba rešenja su dobra
15. Ortodonska terapija mini-implantatima je realizovana kod pacijentkinje:
  - a) starosti 10 godina
  - b) starosti 15 godina
  - c) starosti 26 godina

16. Nepravilna primena sredstva za devitalizaciju pulpe može uzrokovati:
  - a) oštećenje desni
  - b) oštećenje zuba
  - c) oštećenje dentina
17. Ispitivanje studenata o oralnom zdravlju je realizovano:
  - a) u Beogradu
  - b) u Nišu
  - c) u Kragujevcu
18. Kategorizacija intermaksilarnog prostora na osnovu stepena resorpcije je urađena:
  - a) na tri klase
  - b) na četiri klase
  - c) na pet klasa
19. Incizalni razmak kod pacijentkinje kod koje je terapija realizovana mini-implantatima je iznosila:
  - a) 8 mm
  - b) 10 mm
  - c) 12 mm
20. Istraživanje o oralnom zdravlju je sprovedeno na uzorku:
  - a) od 100 ispitanika
  - b) od 80 ispitanika
  - c) od 50 ispitanika
21. Prečka je šina koja povezuje:
  - a) dva ili više implantata
  - b) samo dva implantata
  - c) više od 10 implantata
22. Kod pacijentkinje sa mini-implantatima analizom simetričnosti je uočena:
  - a) mezijalna pomeranost bočnih zuba u levom kvadrantu
  - b) desnom kvadrantu
  - c) gornjem desnom kvadrantu
23. Istraživanje o oralnom zdravlju je sprovedeno:
  - a) kliničkim pregledom
  - b) testom
  - c) anketom
24. Kruna može biti rep za implantat zavrtnjem?
  - a) Da
  - b) Ne
  - c) Zavisi od fiksne nadoknade
25. Ortodontska terapija kamuflažom je realizovana
  - a) uz primenu klasičnih implantata
  - b) uz primenu mini-implantata
  - c) primenom klasičnih i mini-implantata
26. Osim karijesa studenti medicine su poznavali:
  - a) jedno lokalno oboljenje usne duplje
  - b) pet lokalnih oboljenja usne duplje
  - c) nisu poznavali nijedno oboljenje usne duplje
27. Rano opterećenje implantata podrazumeva:
  - a) izradu nadoknade posle pet dana
  - b) izradu nadoknade posle 10 nedelja
  - c) izradu nadoknade između dve nedelje i dva meseca
28. Primenom opruge za distalizaciju dobijen je prostor za distalizaciju:
  - a) zuba 21
  - b) zuba 22
  - c) zuba 23
29. Karijes kao estetski problem klasifikuje:
  - a) 6% ispitanika
  - b) 16% ispitanika
  - c) 26% ispitanika
30. Imedijatno oštećenje implantanata podrazumeva:
  - a) izradu naknade prve nedelje
  - b) izradu naknade druge nedelje
  - c) izradu naknade treće nedelje
31. Primenom ortodontske terapije uz pomoć mini-implantanata:
  - a) moguće je korigovati malokluzije II/1 klase
  - b) nije moguće korigovati malokluzije II/1 klase
  - c) moguće je korigovati malokluzije II/1 klase samo kod dece
32. Kod studenata medicine:
  - a) postoji dobra informisanost o oboljenjima usne duplje
  - b) ne postoji dobra informisanost o oboljenjima usne duplje
  - c) informisanost nije neophodna
33. Konvenciono opterećenje implantanata podrazumeva:
  - a) minimum dve nedelje od implantacije
  - b) minimum dva meseca od implantacije
  - c) minimum pet meseci od implantacije
34. Prikaz bolesnika osobe sa lejomiosarkomom ukazuje na retku lokalizaciju tumora:
  - a) na nosu i paranazalnim šupljinama
  - b) na čelu
  - c) na bradi
35. Zbog oboljenja zuba i usne duplje pacijenti se češće obraćaju:
  - a) lekaru opšte prakse
  - b) stomatologu
  - c) podjednako i jednom i drugom
36. Veliki broj studenata medicine:
  - a) ne poznaje oboljenja koja predstavljaju rizik za stomatološke intervencije
  - b) poznaje oboljenja koja predstavljaju rizik za stomatološke intervencije
  - c) poznaje samo jedno rizično oboljenje

37. Lejomiosarkomi su:  
 a) benigni tumori  
 b) ograničeni tumori  
 c) agresivni tumori
38. Četkica za zube se najčešće bira na osnovu:  
 a) preporuke stomatologa  
 b) izgleda  
 c) usne
39. Lejomiosarkomi se najčešće javljaju u:  
 a) genitalnom prolazu  
 b) na glavi  
 c) na rebrima
40. Prikaz bolesnika osobe sa lejomiosarkomom odnosi se na:  
 a) odraslog pacijenta  
 b) odraslu pacijentkinju  
 c) dete
41. Osim četkice za čišćenje zuba najčešće se koristi još:  
 a) konac za zube  
 b) tečnost za ispiranje  
 c) interdentalna četkica
42. Terapija lejomiosarkoma je:  
 a) hirurška  
 b) radiološka  
 c) multidisciplinarna
43. Pojava lejomiosarkoma u kostima glave i vrata je:  
 a) vrlo česta  
 b) vrlo retka  
 c) izuzetno retka
44. Na pitanje koliko molara ima čovek pravilno je odgovorilo:  
 a) 10 osoba  
 b) 20 osoba  
 c) 38 osoba
45. Pogodnosti implantno-protetske terapije su:  
 a) mnogobrojne  
 b) malobrojne  
 c) minimalne
46. Kod stomatologa se najčešće dolazi:  
 a) preventivno  
 b) redovno  
 c) kad zaboli zub
47. Mehanizam vezivanja fiksnih nadoknada za implantat može biti:  
 a) dvojak  
 b) trojak  
 c) na četiri načina
48. Implantno-protetska terapija obezbeđuje:  
 a) bolju žvaćnu efikasnost  
 b) slabiju žvaćnu efikasnost  
 c) neznatno slabiju žvaćnu efikasnost
49. Evaluacija uspeha implantsko-protetske terapije se radi u intervalu:  
 a) 1–3 meseca  
 b) 3–6 meseci  
 c) 3–12 meseci
50. Lejomiosarkomi su podtipovi:  
 a) sarkoma tvrdih tkiva  
 b) sarkoma mekih tkiva  
 c) karcinoma tvrdih tkiva

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