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# ŠIRINA PRIPOJNE GINGIVE I NJENA VARIJABILNOST KOD OSOBA SA ZDRAVIM PARODONTALNIM STATUSOM

## THE WIDTH OF THE ATTACHED GINGIVA AND ITS VARIABILTY IN PEOPLE WITH HEALTHY PERIODONTAL STATUS

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### Sažetak

**Uvod:** Gingiva je deo sluzokože koja pokriva avleolarne grebene vilica i okružuje vratove zuba. Anatomske karakteristike gingive su veoma važne u planiranju lečenja oboljenja parodontata. Pripojna gingiva je važna za održavanje parodontata u zdravom stanju. Ovom studijom merene su normalne vrednosti širine pripojne gingive kod parodontalno zdravih osoba.

**Cilj** rada bio je procena širine pripojne gingive različitim metodama.

**Materijal i metode:** Širina pripojne gingive merena je korišćenjem parodontalne sonde kod parodontalno zdravih osoba. U zavisnosti od starosti pacijenata, formirane su četiri grupe (I - ≤ 14 god; II - 15-30 god; III - 31-45 god i IV - 46-60 god.). Deskriptivna statistička analiza urađena je za određivanje srednjih vrednosti pripojne gingive, koje će predstavljati normalne vrednosti širine pripojne gingive za osobe sa zdravim parodontom.

**Rezultati:** Kod ispitanika starosti od 15-30 godina, nađena je najveća širina pripojne gingive, kao i kod osoba ženskog pola u odnosu na mušku grupu ispitanika. Srednje vrednosti širine pripojne gingive varirale su u zavisnosti od područja usne duplje: najveća širina pripojne gingive zabeležena je u predelu gornjih centralnih sekutića, dok je najmanja širina zabeležena u predelu prvih molara gornje i donje vilice.

**Zaključak:** Širina pripojne gingive varira u odnosu na starost i pol osobe, kao i od mesta u usnoj duplji.

**Ključne riječi:** parodont, pripojna gingiva, zdravlje

### Abstract

**Background:** Gingiva is part of the mucous membrane that covers the alveolar ridges of the jaw and surrounds the necks of the teeth. Anatomical features of the gingiva are very important in planning the treatment of periodontal disease. The attached gingiva is important for maintaining a healthy periodontal condition. This study measured the normal value width of the attached gingiva in periodontal healthy subjects.

**The aim** was estimating the width of the attached gingiva by various methods.

**Material and Methods:** The width of the attached gingiva was measured using a periodontal probe in periodontally healthy subjects. The measurement was performed in the Department of Periodontology and Oral Medicine Clinic of Dentistry, Faculty of Medicine University of Nis. Descriptive statistical analysis was performed to determine the mean values of the attached gingiva, which will represent the normal value width of the attached gingiva for people with healthy periodontium.

**Results:** The greatest width of the attached gingiva was found in subjects aged 15-30 years, primarily in the female population. The mean value of the width of the attached gingiva varied depending on the area in the mouth: the maximum width of the attached gingiva was noted in the area of the upper central incisors, while the lowest recorded value was in the area of the first molars, both in the upper and lower jaw.

**Conclusion:** The width of the attached gingiva varies according to the age and sex of the person, and according to the site in the oral cavity.

**Key words:** periodontium, attached gingiva, health

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## Uvod

Pripojna gingiva je jedan od najvažnijih anatomskih i funkcionalnih delova potpornog aparata zuba. Iako u literaturi nema dovoljno podataka o ulozi pripojne gingive u održavanju parodontalnog zdravlja, odsustvo ili mala širina pripojne gingive može dovesti do bržeg širenja zapaljenja kod osoba koje ne održavaju dobru oralnu higijenu<sup>1</sup>.

Zdrava pripojna gingiva je svetloružičaste boje sa površinom koja je tačkasta. Pripojna gingiva, zajedno sa palatinalnom sluzokožom, spada u mastikatorni tip sluzokože. Iz tih razloga, prekrivena je epitelom koji keratinizira. Deo pripojne gingive pripojen je za cement zuba, dok je veći deo pripojen za alveolarnu kost.

Širina pripojne gingive predstavlja rastojanje od donje ivice slobodne gingive u nivou dna gingivalnog sulkusa do mukogingivalne linije u vestibulumu<sup>1</sup>. Uprkos raznim mišljenjima u vezi sa adekvatnom količinom keratinizovanog tkiva za održavanje zdravlja parodonta, mukogingivalna linija služi kao važno kliničko obeležje u proceni parodonta<sup>2</sup>. Mukogingivalna linija je diskretna linija koja predstavlja granicu između pokretne i nepokretne sluzokože prilikom pasivnog kretanja usana i obraza<sup>3</sup>. Metode za lociranje mukogingivalne linije su vizuelna metoda (VM), funkcionalna metoda (FM) i Šilerova metoda (ŠM)<sup>4</sup>.

Vizuelna metoda se zasniva na razlici u boji između gingive i alveolarne sluzokože<sup>5</sup>. U funkcionalnoj metodi se mukogingivalna linija ocenjuje kao granica između pokretnog i nepokretnog tkiva gde se mobilnost tkiva, utvrđuje korišćenjem parodontalne sonde, koja je pozicionirana laganim pritiskom horizontalno u predvorju usana prema ivici gingive<sup>3</sup>. Mukogingivalna linija može se proceniti i vizuelno posle bojenja mukogingivalnog kompleksa Lugolovim rastvorom (jodna proba). Alveolarna sluzokoža razlikuje se od keratinizovane gingive u sadržaju glikogena, kisele fosfataze i nespecifične esteraze i povećanoj količini elastičnih vlakana, što rezultira u pozitivnoj jodnoj reakciji<sup>6-9</sup>.

Pripojna gingiva koja je keratinizovana ne sadrži glikogen, tako da površinski sloj daje negativnu jodnu reakciju. Tako, Lugolov rastvor prebojava samo alveolarnu sluzokožu i jasno razgraničava mukogingivalnu liniju.

## Introduction

The attached gingiva is one of the most important anatomical and functional parts of the tooth supporting apparatus. Although there is insufficient literary data on the role of the attached gingiva in maintaining periodontal health, the absence or small width of the attached gingiva may lead to faster spread of inflammation in people who do not maintain good oral hygiene<sup>1</sup>.

Healthy attached gingiva is of light pink color with an area that is dotted. Attached gingiva, together with the palatal mucosa is one of the masticatory tips of mucous membranes. For these reasons, it is covered by keratinized epithelium. Part of the attached gingiva was annexed to the cement teeth, while the larger part was annexed to the alveolar bone.

The width of the attached gingiva is the distance from the bottom edge of the free gingiva in the bottom of the gingival sulcus to the gingival line in the vestibulum<sup>1</sup>. Despite various opinions regarding the appropriate amount of keratinized tissue to maintain periodontal health, mucogingival line serves as an important landmark in the clinical assessment of periodontium<sup>2</sup>. Mucogingival line is a discrete line representing the boundary between mobile and immobile mucous membranes in the passive movement of the lips and cheeks<sup>3</sup>. Methods for locating gingival lines are visual method (VM), functional (FM) and Shiler's method (ŠM)<sup>4</sup>.

Visual method is based on the difference in color between the gingival and alveolarmucous membrane<sup>5</sup>. In the functional method, the mucogingival line is estimated as a border between the movable and immovable tissue where the mobility of tissue is determined using a periodontal probe that is positioned horizontally by pressing gently in the lobby of the lips to the edge of the gingiva<sup>3</sup>. Mucogingival line can be assessed visually after staining the mucogingival complex with Lugol solution (iodine test). Alveolar mucosa differs from the gingival curettage in glycogen, acid phosphatase, and the non-specific esterase, and an increased amount of elastic fibers, resulting in a positive reaction on iodine<sup>6-9</sup>. The attached gingiva, which is keratinized, does not contain glycogen so that the surface layer provides a negative iodine reaction. Thus, the Lugol's solution stains only the alveolar mucosa and clearly demarcates the gingival line.

Širina pripojne gingive se znatno razlikuje i kreće se od jedan do devet milimetara. Širina se razlikuje u predelu pojedinih zuba, šira je u gornjoj vilici nego u donjoj i uža je kod mlečnih zuba<sup>10</sup>.

Povećanje širine pripojne gingive ima veliku ulogu u parodontalnoj plastičnoj hirurgiji. Malo je studija koje su ispitivale širinu pripojne gingive kod parodontalno zdravog stanovništva. Merenje širine pripojne gingive će pomoći u proceni rizika za pojavu i pogoršanje parodontalnih oboljenja kod parodontalno zdrave populacije.

Ciljevi ove studije bili su da se proceni širina pripojne gingive u punom zubnom nizu u ustima i razlike između vizuelne metode, određivane uz pomoć parodontalne sonde i vizuelne metode, određivane nakon Šilerove probe.

### ***Materijal i metode***

U ovom istraživanju učestvovalo je ukupno 120 osoba odabranih iz Službe za parodontologiju i oralnu medicinu Klinike za stomatologiju Medicinskog fakulteta u Nišu. Za odabir učesnika korišćena je neproporcionalna slojevita nasumična metoda. Uz ovu metodu, primenjivali su se i kriterijumi uključivanja i isključivanja u istraživanje. Pacijenti starosti do 60 godina, sa dobrim opštim zdravljem, zdravim gingivalnim tkivom (nema gubitka pripoja) i oni koji nisu imali neku vrstu parodontalnog tretmana u poslednjih 6 meseci, bili su uključeni u studiju. Iz studije su isključene trudnice i dojilje, zatim pacijenti sa sistemskim bolestima i oni koji su uzimali lekove koji mogu imati uticaj na stanje gingive.

Pacijenti su obavešteni o protokolu istraživanja i oni koji su pristali na ispitivanje, potpisali su pristanak. U zavisnosti od starosti pacijenata, formirane su sledeće grupe

- |                 |                  |
|-----------------|------------------|
| I ≤ 14 godina   | III 31-45 godina |
| II 15-30 godina | IV 46-60 godina. |

Širina pripojne gingive vizuelnom metodom merena je uz primenu parodontalne sonde Michigan 0 i stomatološkog ogledalceta pri veštačkoj svetlosti stomatološke stolice.

Drugi način izvođenja vizuelne metode merenja širine pripojne gingive bila je primena rastvora joda (Lugol rastvor) koji je pripremljen razblaživanjem 2 g kalijum jodida i 1 g kristala joda u 60 ml destilovane vode<sup>11</sup>.

The width of the attached gingiva varies considerably, ranging from one to nine millimeters. The width varies in the area of individual tooth; it is wider in the upper jaw than in the lower one and is narrower near the milk teeth<sup>10</sup>.

Increasing the width of the attached gingiva has a great role in periodontal plastic surgery. There are very few studies that have examined the width of the attached gingiva in periodontal healthy population. Measuring the width of the attached gingiva will assist in assessing the risk of the emergence and worsening of periodontal disease in a periodontally healthy population.

The objectives of this study were to estimate the width of the attached gingiva in full dental arch in the mouth and to assess the differences between visual methods determined with the help of periodontal probes and visual methods determined after Schiller's probe.

### ***Material and Methods***

This study involved a total of 120 people selected from the Department of Periodontology and Oral Medicine, Dental Clinic School of Medicine in Nis. For the selection of participants, a disproportionate stratified random method was used. Along with this method, the criteria for inclusion and exclusion were also applied. Patients up to the age of 60 years with good general health, healthy gingival tissue (no loss of attachment) and those who did not have some kind of periodontal treatment in the last six months were included in the study. Pregnant and lactating women, patients with systemic diseases, and those taking drugs that may affect the condition of the gingiva were excluded from the study.

Patients were informed about the study protocol, and those who agreed with the examination terms submitted the written informed consent. Depending on the age of the patient, the following groups were formed:

- |                |                 |
|----------------|-----------------|
| I ≤ 14 years   | III 31-45 years |
| II 15-30 years | IV 46-60 years. |

The width of the attached gingiva was measured with the use of periodontal probes Michigan 0 and dental mirror artificial light in the dental chair.

Another way of measuring the width of the attached gingiva was the application of iodine solution (Lugol's Solution), which was prepared by diluting 2 g of potassium iodide

Merenje širine pripojne gingive vršilo se na centralnoj poziciji bukalne površine svih centralnih sekutića, očnjaka, prvih premolara i prvih molara, na ukupno 16 zuba. Ceo postupak je sproveden od strane jednog ispitivača.

Da bi se procenila širina pripojne gingive, mukogingivalna linija je označena na sledeći način:

- vizuelnom metodom – 1. način (Slika 1)
- vizuelnom metodom nakon Šilerove probe – vrši se premazivanje pamučnom paletom blagim pritiskom tkiva gingive i alveolarne sluzokože do naglog razgraničenja između keratinizovane gingive i alveolarne mukoze (Slika 2).

Širina keratinizovane gingive je merena kao udaljenost od gingivalne ivice do mukogingivalne linije. Dubina sulkusa je merena kao udaljenost od gingivalne ivice do donje ivice slobodne gingive (dna gingivalnog sulkusa). Sa ovim vrednostima, širina pripojne gingive bila je izračunavana kao razlika dubine sulkusa i širine keratinizovanog tkiva.

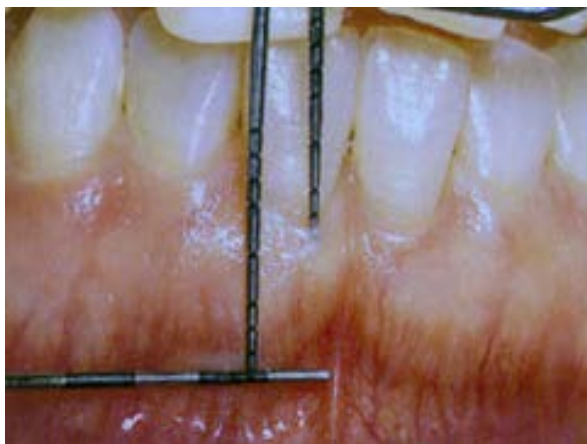
and 1 g of a crystal of iodine in 60 ml of distilled water <sup>11</sup>.

Measuring the width of the attached gingiva was performed in the central position of the buccal surface of the central incisors, canines, first premolars and first molars, i.e. a total of 16 teeth. The entire procedure was carried out by one examiner.

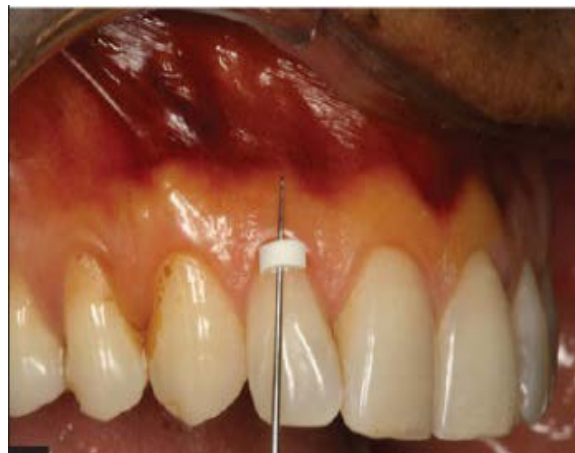
To assess the width of the attached gingiva, mucogingival line is indicated as follows:

- visual method - Method 1 (Figure 1)
- visual method after a Schiller's probe – staining is performed using a coating cotton palette, applying a slight pressure over the gingival and alveolar mucous membrane to a sharp demarcation between the subgingival curettage and alveolar mucosa (Figure 2).

The width of subgingival curettage is measured as the distance from the gingival edge to the mucogingival line. Sulcus depth was measured as the distance from the gingival edge to the bottom edge of the free gingiva (bottom of the gingival sulcus). With these values, the width of attached gingiva was calculated as the difference sulcus depth and width keratinized tissue.



**Slika 1.** Vizuelna metoda  
**Figure 1.** Visual method



**Slika 2** Vizuelna metoda nakon Šilerove probe  
**Figure 2.** Visual method after a Shiler's method

## Statistička obrada

Svi prikupljeni podaci su obrađeni u programskom paketu SPSS 15.0. Rađena je srednja vrednost i standardna devijacija dobijenih rezultata. Podaci pokazuju homogenost i razlike između analiziranih grupa korišćenjem ANOVA testa. Razlika između grupa je analizirana korišćenjem post-hoc testa. Kriterijum za statističku značajnost je prihvaćen na nivou verovatnoće  $p < 0,05$ .

## Rezultati

Ukupno 120 ispitanika je učestvovalo u ovom istraživanju, od kojih je 74 (61,67 %) bilo ženskog pola.

Ženske ispitanice su imale veću prosečnu širinu pripojne gingive (3,65 mm) od muških, koji su imali prosek od 2,42 mm (Tabela 1).

Maksimalni centralni sekutići imali su najveću širinu pripojne gingive sa prosekom od 3,57 mm, dok su mandibularni prvi molari imali najmanju širinu pripojne gingive (2,35 mm). Centralni sekutići u mandibuli imali su širinu 2,48 mm, maksimalni premolari 2,99 mm, mandibularni premolari 2,67 mm, dok su maksimalni prvi molari bili sa širinom od 2,58 mm (Tabela 2).

Procena širina pripojne gingive u različitim starosnim grupama vizuelnom metodom na 1. način otkrila je da se širina gingive povećava sa starenjem gde je prosečna širina na maksimalnim zubima u prvoj starosnoj grupi ( $\leq 14$  godina) bila 1,73 mm, sa povećanjem od 2,25 do 2,89 u drugoj grupi (15-30 godina) i trećoj starosnoj grupi (31-45 godina), dok je u starosnoj grupi od 46-60 godina bila 3,25 mm.

Slično tome, kod donjih zuba u prvoj starosnoj grupi ( $\leq 14$  godina), prosečna širina bila je 1,35 mm, sa povećanjem na 2,13 mm u drugoj i 2,10 mm u trećoj starosnoj grupi (15-45 godina) i 2,45 mm u starosnoj grupi od 45-60 godina (Tabela 3). Procena širine pripojne gingive u različitim starosnim grupama vizuelnom metodom nakon Šilerove probe pokazala je u proseku širinu pripojne gingive od 2,11 mm u prvoj starosnoj grupi ( $\leq 14$  godina) do 3,25 mm u starosnoj grupi od 45-60 godina starosti za gornju vilicu. Kod donjih zuba, srednja vrednost širine pripojne gingive kod prve starosne grupe ( $\leq 14$  godina) bila je 1,64 mm, dok je u najstarijoj starosnoj grupi od 45-60 godina bila 2,48 mm (Tabela 2).

## Statistical analysis

All collected data was analyzed by SPSS 15.0. The mean value and standard deviation of the results were determined. The data show homogeneity and differences between the groups analyzed using ANOVA test. The difference between groups was analyzed using post-hoc test. The criteria for statistical significance was accepted at the probability level of  $p < 0.05$ .

## Results

A total of 120 respondents participated in the survey, of which 74 (61.67%) were female.

Female respondents had a greater average width of the attached gingiva (3.65 mm) than men in whom the average width of width of the attached gingiva was 2.42 mm (Table 1).

The maxillary central incisors had a maximum width of the attached gingiva with an average of 3.57 mm, while the mandibular first molars had a minimal width of the attached gingiva (2.35 mm). The width of the central incisors in the mandible was 2.48 mm, 2.99 mm of the maxillary premolars, 2.67 mm of the mandibular premolars, while the width of the maxillary first molars was 2.58 mm (Table 2).

Visual assessment of the attached gingiva width in different age groups using the method 1 revealed that the width of the gingiva increases with age, where the average width of the maxillary teeth in the first age group ( $\leq 14$  years of age) was 1.73 mm, with an increase of 2.25 to 2.89 in the second group (15-30 years) and the third age group (31-45 years), while in the age group of 46-60 years it was 3.25 mm.

Similarly, in the lower teeth in the first age group ( $\leq 14$  years) the average width was 1.35 mm, increasing to 2.13 mm in the second and 2.10 mm in the third age group (15-45 years) and 2.45 mm in the age group of 45-60 years (Table 3).

Assessment of the width of the attached gingiva in different age groups by visual method after Schiller's probe showed that the average width of the attached gingiva was 2.11 mm in the first age group ( $\leq 14$  years) i.e. 3.25 mm in the age group of 45-60 years of age for the upper jaw. In the lower teeth, the mean width of the attached gingiva in the first age group ( $\leq 14$  years of age) was 1.64 mm, while in the oldest age group of 45-60 years it was 2.48 mm (Table 2).

Ne postoji statistički značajna razlika u širini pripojne gingive obe vilice u starosnoj grupi ( $\leq 14$  godina) bez obzira na metod koji se koristi za procenu (Tabela 5).

Poređenje dva različita metoda različitih zuba u starosnoj grupi od 15-30 godina nije otkrilo nikakve značajne razlike, iako je najšira zona pripojne gingive pronađena kod sekutića primenom obe metode (metoda 1 - 4,07, metoda 2 - 3,85) i najmanja zona širine u premolarnom regionu (metoda 1 - 1,92, metoda 2 - 2,07). Ovakve varijacije su slične i kod donjih zuba (Tabela 6).

Slične vrednosti maksimalne širine kod gornjih sekutića i kod donjih premolara uočeni su i u drugim starosnim grupama, odnosno u grupi od 31 - 45 godina i grupi od 46 - 60 godina, tako da nije uočena statistički značajna razlika između dve metode (Tabele 7 i 8).

There was no statistically significant difference in the width of the attached gingiva in both jaws in the age group ( $\leq 14$  years), regardless of the method used for the assessment (Table 5).

Comparison of two different methods of different teeth in the age group of 15-30 years did not show any significant differences, though the widest zone of the attached gingiva was found for incisors by the application of both methods (method 1 - 4.07, method 2 - 3.85), whereas the minimum zone width was seen in the premolar region (method 1 - 1.92, method 2 - 2.07). Such variations are similar in the lower teeth as well (Table 6).

Similar values for the maximum width of the upper incisors and the lower premolars were observed in other age groups, i.e. in groups of 31 - 45 years and the group of 46-60 years, so there was not a significant difference between the two methods (Table 7 and 8).

**Tabela 1.** Širina pripojne gingive kod muškaraca i žena  
**Table 1.** The width of the attached gingiva in men and women

pol sex	broj (procenat) number (percentage)	SV $\pm$ SD (mm)
ženski female	74 (61.67%)	3.654 $\pm$ 1.269
muški male	46 (38.33%)	2.426 $\pm$ 1.536

SV – srednja vrednost; SD – standardna devijacija  
SV – mean; SD – standard deviation

**Tabela 2.** Širina pripojne gingive kod različitih zuba u vilicama  
**Table 2.** The width of the attached gingiva in different teeth in the jaw

vrsta zuba type of teeth	SV ± SD (mm)
gornji centralni sekutići upper central incisors	3.57 ± 1.761
gornji očajnici upper canines	3.28 ± 1.527
gornji prvi premolari upper first premolars	2.99 ± 1.929
gornji prvi molari upper first molars	2.58 ± 1.581
donji centralni sekutići lower central incisors	2.48 ± 1.370
donji očajnici lower canines	2.18 ± 1.211
donji prvi premolari lower first premolars	2.67 ± 1.730
donji prvi molari lower first molars	2.35 ± 1.273

SV – srednja vrednost; SD – standardna devijacija  
 SV – mean; SD – standard deviation

**Tabela 3.** Procena širine pripojne gingive u različitim starosnim grupama vizuelnom metodom (način 1)

**Table 3.** Evaluation of the width of the attached gingiva in different age groups, using a visual method (method 1)

godine age	SV ± SD (mm)	F; p-vredn. F; p-value	Post-hoc test
gornji zubi upper teeth			
≤ 14	1.73 ± 0.77	F - 10.629 p < 0.001	II > I
15-30	2.25 ± 0.42		IV > I
31-45	2.89 ± 0.40		IV > II
46-60	3.25 ± 0.25		
donji zubi lower teeth			
≤ 14	1,35 ± 0.30	F - 6.398 p < 0.001	II > I
15-30	2.13 ± 0.42		III > I
31-45	2.10 ± 0.36		IV > I
46-60	2.45 ± 0.50		

SV– srednja vrednost; SD – standardna devijacija; F – vrednost signifikantnosti;  
 p – statistički značajna razlika

SV– mean; SD – standard deviation; F – the value of significance; p – statistically significant difference

**Tabela 4.** Procena širine pripojne gingive u različitim starosnim grupama vizuelnom metodom nakon Šilerove probe (način 2)**Table 4.** Visual assessment of the width of the attached gingiva in different age groups after a Schiller's probe (method 2)

godine age	SV ± SD (mm)	F; p-vredn. F; p-value	Post-hoc test
gornji zubi upper teeth			
≤ 14	2.11 ± 0.42	F - 8.558 p < 0.001	III > I
15-30	2.21 ± 0.52		IV > I
31-45	2.74 ± 0.49		IV > II
46-60	3.25 ± 0.63		
donji zubi lower teeth			
≤ 14	1.64 ± 0.38	F - 9.082 p < 0.001	II > I
15-30	2.08 ± 0.29		III > I
31-45	2.34 ± 0.38		IV > I
46-60	2.48 ± 0.41		

SV – srednja vrednost; SD – standardna devijacija; F – vrednost značajnosti; p – statistički značajna razlika

SV – mean; SD – standard deviation; F – the value of significance; p – statistically significant difference

**Tabela 5.** Poređenje dva različita metoda u starosnoj grupi ≤ 14 godina  
**Table 5.** Comparison of two different methods in the age group ≤ 14 years

zubi teeth	vizuelna metoda visual method	SV ± SD (mm)	F; p-vredn. F; p-value
gornji upper	način 1 method 1	1.89 (0.42)	F – 0.78
	način 2 method 2	2.05 (0.43)	n.s.
donji lower	način 1 method 1	1.50 (0.43)	F – 0.84
	način 2 method 2	1.57 (0.35)	n.s.

SV – srednja vrednost; SD – standardna devijacija; F – vrednost značajnosti; p – statistički značajna razlika; n.s. – nije statistički značajna razlika

SV – mean; SD – standard deviation; F – the value of significance; p – statistically significant difference; n.s. – it is not statistically significant



**Tabela 6.** Poređenje dve različite metode u starosnoj grupi od 15 do 30 godina starosti  
**Table 6.** Comparison of two different methods in the age group of 15-30 years

zubi teeth	vilica jaw	Vizuelna metoda Visual method	SV ± SD (mm)	F; p-vredn. F; p-value
sekutići incisors	gornja upper	način 1 method 1	4.07 ± 0,58	F – 0.82
		način 2 method 2	3.85 ± 0.84	n.s.
	donja lower	način 1 method 1	3.22 ± 0.73	F – 0.62
		način 2 method 2	3.12 ± 0.76	n.s.
očnjaci canines	gornja upper	način 1 method 1	3.80 ± 0,71	F – 0.72
		način 2 method 2	3.75 ± 0.98	n.s.
	donja lower	način 1 method 1	2.45 ± 0,48	F – 0.90
		način 2 method 2	2.65 ± 0.42	n.s.
premolari premolars	gornja upper	način 1 method 1	1.92 ± 0.65	F – 0.90
		način 2 method 2	2.07 ± 0.75	n.s.
	donja lower	način 1 method 1	1.50 ± 0.59	F – 0.84
		način 2 method 2	1.67 ± 0.38	n.s.
molari molars	gornja upper	način 1 method 1	2.67 ± 0.47	F - 0,97
		način 2 method 2	2.80 ± 0.57	n.s.
	donja lower	način 1 method 1	1.65 ± 0.65	F – 0.84
		način 2 method 2	1.92 ± 0.71	n.s.

SV– srednja vrednost; SD – standardna devijacija; F – vrednost značajnosti; p – statistički značajna razlika; n.s. – nije statistički značajna razlika

SV – mean; SD – standard deviation; F – the value of significance; p – statistically significant difference; n.s. – it is not statistically significant

**Tabela 7.** Poređenje dve različite metode u starosnoj grupi od 31 do 45 godina starosti  
**Table 7.** Comparison of two different methods in the age group of 31-45 years

zubi teeth	vilica jaw	vizuelna metoda visual method	SV $\pm$ SD (mm)	F; p-vredn. F; p-value
sekutići incisors	gornja upper	način 1 method 1	3.30 $\pm$ 1.08	F – 0.23
		način 2 method 2	3.62 $\pm$ 0.71	n.s.
	donja lower	način 1 method 1	3.22 $\pm$ 0.98	F – 0.87
		način 2 method 2	3.05 $\pm$ 0.72	n.s.
očnjaci canines	gornja upper	način 1 method 1	2.80 $\pm$ 1.25	F – 0.15
		način 2 method 2	2.95 $\pm$ 0.95	n.s.
	donja lower	način 1 method 1	1.80 $\pm$ 1.06	F – 0.86
		način 2 method 2	1.70 $\pm$ 0.94	n.s.
premolari premolars	gornja upper	način 1 method 1	2.07 $\pm$ 0.65	F – 0.54
		način 2 method 2	2.32 $\pm$ 0.73	n.s.
	donja lower	način 1 method 1	1.52 $\pm$ 0.47	F – 0.24
		način 2 method 2	1.47 $\pm$ 0.31	n.s.
molari molars	gornja upper	način 1 method 1	2.22 $\pm$ 0.74	F – 0.75
		način 2 method 2	2.42 $\pm$ 0.88	n.s.
	donja lower	način 1 method 1	1.97 $\pm$ 0.31	F – 0.68
		način 2 method 2	2.10 $\pm$ 0.48	n.s.

SV – srednja vrednost; SD – standardna devijacija; F – vrednost značajnosti; p – statistički značajna razlika; n.s. – nije statistički značajna razlika

SV – mean; SD – standard deviation; F – the value of significance; p – statistically significant difference; n.s. – it is not statistically significant

**Tabela 8.** Poređenje dve različite metode u starosnoj grupi od 46 do 60 godina starosti  
**Table 8.** Comparison of two different methods in the age group of 46-60 years

zubi teeth	vilica jaw	vizuelna metoda visual method	SV ± SD (mm)	F; p-vredn. F; p-vrednost
sekutići incisors	gornja upper	način 1 method 1	3.65 ± 1.08	F – 0.14
		način 2 method 2	3.30 ± 0.71	n.s.
	donja lower	način 1 method 1	3.05 ± 0.98	F – 0.23
		način 2 method 2	3.22 ± 0.72	n.s.
očnjaci canines	gornja upper	način 1 method 1	2.95 ± 1.25	F – 0.21
		način 2 method 2	2.80 ± 0.95	n.s.
	donja lower	način 1 method 1	1.70 ± 1.06	F – 0.84
		način 2 method 2	1.80 ± 0.94	n.s.
premolari premolars	gornja upper	način 1 method 1	2.32 ± 0.65	F – 0.52
		način 2 method 2	2.07 ± 0.73	n.s.
	donja lower	način 1 method 1	1.47 ± 0.47	F – 0.33
		način 2 method 2	1.52 ± 0.31	n.s.
molari molars	gornja upper	način 1 method 1	2.42 ± 0.74	F – 0.80
		način 2 method 2	2.22 ± 0.88	n.s.
	donja lower	način 1 method 1	2.10 ± 0.31	F – 0.06
		način 2 method 2	1.97 ± 0.48	n.s.

SV – srednja vrednost; SD – standardna devijacija; F – vrednost značajnosti; p – statistički značajna razlika; n.s. – nije statistički značajna razlika

SV – mean; SD – standard deviation; F – the value of significance; p – statistically significant difference; n.s. – it is not statistically significant

## Diskusija

Procena širine pripojne gingive je od vitalnog značaja za procenu rizika parodonticijuma za pojavu oboljenja. U proceni širine pripojne gingive mukogingivalna linija služi kao važan anatomski orijentir, koja se može razgraničiti različitim metodama. Kako sugerise Fasske i Morgenroth, tačna lokacija ove linije može se videti posle bojenja sluzokože različitim rastvorima (kao što je Lugolov jodni rastvor), koji omogućavaju određivanje tačne linije na kojoj se keratinizacija završava<sup>12</sup>. U cilju eliminacije razlika u sondiranju, sva merenja su vršena od strane jednog ispitivača.

Postoji veliki broj studija koje su ispitivale širinu pripojne gingive. Najčitanije studije koje su ispitivale širinu pripojne gingive su studije Boversa iz 1963.<sup>13</sup> i 1976. godine i Ainamo iz 1976. godine<sup>14</sup>. U ovom ispitivanju merenje pripojne gingive vršilo se pomoću periodontalne sonde slično kao Tenenbaum<sup>15</sup>, kao i korišćenjem rastvora joda (Šilerova jodna proba) kao Talari<sup>16</sup>, Ainamo<sup>17</sup> i Saario<sup>18,19</sup>. Bovers<sup>13</sup> je pronašao da širina pripojne gingive varira na različitim mestima usne duplje, kao što je nađeno i u ovom ispitivanju. Ainamo<sup>14</sup> je pronašao najveću širinu pripojne gingive u predelu maksilarnih inciziva slično rezultatima u našoj studiji. Najmanja širina u našoj studiji je bila u predelu prvog molara u mandibuli, dok je Ainamo<sup>14</sup> pronašao da je najmanja širina u predelu premolara u mandibuli. Ainamo<sup>14</sup> i Vincent<sup>20</sup> su utvrdili da se širina pripojne gingive povećava sa uzrastom, što je u saglasnosti sa rezultatima iz ovog istraživanja, koji pokazuju da je najveća širina pripojne gingive bila u drugoj starosnoj grupi (15-30 god.), dok je u srednjoj starosnoj grupi od 31-45 godina širina pripojne gingive bila najmanja (tabela 3).

Procena širine pripojne gingive u različitim starosnim grupama vizuelnom metodom otkrila je da se širina pripojne gingive povećava sa godinama, što je u saglasnosti sa autorima poput Ainamo i Talarija<sup>16</sup> i Vinsent sa sar.<sup>20</sup>. Širina pripojne gingive varira u različitim oblastima u usnoj duplji i iznosi od 1-9 mm,<sup>21</sup> 1-4 mm,<sup>22</sup> 0-5 mm<sup>23</sup>.

U ovoj studiji, opseg srednje širine pripojne gingive varira od 1 mm do 4 mm. Slične varijacije se vide u Boverovoj studiji, gde je najšira zona pripojne gingive pronađena

## Discussion

The assessment of the width of the attached gingiva is vital to assess the risk for the occurrence of periodontal disease. For the assessment of the width of the attached gingiva, mucogingival line serves as an important anatomical landmark, which can be delineated by various methods. As suggested by Fasske and Morgenroth, the exact location of this line can be seen after staining the mucosa with different solutions (such as Lugol iodine solution) which allow accurate determination of the line on which the keratinization ends<sup>12</sup>. For the purpose of elimination of the difference in probing, all measurements were performed by a single examiner.

There is a large number of studies that have examined the width of the attached gingiva. The most read studies related to the examination of the width of the attached gingiva are those authored by Bowers in 1963<sup>13</sup> and 1976 and Ainamo in 1976<sup>14</sup>. In this study, the measurement of the attached gingiva was performed using a periodontal probe similar to Tenenbaum<sup>15</sup>, and using a solution of iodine (Schiller's test) as Talari<sup>16</sup>, Ainamo<sup>17</sup> and Saario<sup>18,19</sup> did. Bowers<sup>13</sup> found that the width of the attached gingiva varies in different areas of the oral cavity, as it was found in this study. Ainamo<sup>14</sup> found the maximum width of the attached gingiva in the area of the maxillary incisors. Similar results were found in this study. Minimum width in this study was in the part of the first molar in the mandible, while Ainamo<sup>14</sup> found that the minimum width was in the region of the premolars in the mandible. Ainamo<sup>14</sup> and Vincent<sup>20</sup> found that the width of the attached gingiva increases with age, which is consistent with the results of this research. These results show that the maximum width of the attached gingiva was in the second age group (15-30 yrs.), while in the middle age group of 31-45 years the width of the attached gingiva was the smallest (Table 3).

The assessment of the width of the attached gingiva in different age groups using a visual method revealed that the width of the attached gingiva increases with age which is in accordance with the results obtained by Ainamo and Talari<sup>16</sup> and Vincent et al.<sup>20</sup> The width of the attached gingiva varies in different areas of the oral cavity, ranging from 1-9 mm,<sup>21</sup> 1-4 mm,<sup>22</sup> 0-5 mm<sup>23</sup>.

In this study, the extent of medium width of the attached gingiva can vary from 1 mm to 4 mm. Similar variations are seen in

u predelu sekutića, a najmanja u predelu premolara, bez obzira na metod koji se koristi u proceni<sup>21</sup>.

Kategorizacija različitih tipova zuba urađena je samo u poslednje tri starosne grupe, dok učesnici prve starosne grupe  $\leq 14$  godina, imaju različitu konfiguraciju prisutnih zuba zbog prisustva mešovite denticije. U slučaju mešovite denticije ne može se komentarisati zbog različite prirode prisutnih zuba.

Rezultati ove studije su pokazali da nije bilo značajne razlike u širini pripojne gingive dobijene merenjem vizuelnom metodom ili korišćenjem vizuelne metode nakon izvedene Šilerove probe. Ovi rezultati su u skladu sa istraživanjem Guglielmoni et al.<sup>24</sup>, dok Bernimoulin et al.<sup>25</sup> prijavljuje da izvođenje funkcionalne metode daje najveću širinu keratinizirane gingive. Osim toga, vizuelna metoda, nakon bojenja gingivalnog tkiva, dovodi do najmanjeg neslaganja vrednosti širine pripojne gingive u poređenju sa drugim metodama određivanja širine pripojne gingive.

Najšira je u predelu sekutića, zatim se sužava u predelu premolara, da bi se opet nešto širila u predelu molara. U pogledu širine pripojne gingive postoji simetrija sa leve i desne strane lica, dok razlika između polova ne postoji. Širina pripojne gingive je važna i za lekara i za pacijenta, jer utiče na prognozu oboljenja. Ako je pripojna gingiva uzana, prognoza oboljenja parodonta će biti nepovoljnija. Kod osoba koje imaju uzanu pripojnu gingivu, proces destrukcije koji nastaje u toku bolesti, brže dospeva do mukogingivalne linije. Tada dolazi do izražaja vuča preko pokretne sluzokože i daljeg napredovanja patološkog procesa. Vuča koja deluje odvaja ivicu gingive od zuba i omogućava lakše stvaranje i zadržavanje dentalnog plaka, sa svim neželjenim posledicama. Ovaj problem postaje izrazitiji ako se na to nadovežu i anomalije u mekom tkivu.

the Bover's study, where the widest zone of the attached gingiva was found in the area of incisors, and the lowest one in the region of the premolars, regardless of the method used in the assessment<sup>21</sup>.

The categorization of different types of teeth was done only in the last three age groups, while the participants of the first age group  $\leq 14$  years had a different configuration of the present teeth due to the presence of mixed dentition. The width of the attached gingiva cannot be compared in cases of mixed dentition because of the different nature of the present teeth.

The results of this study showed that there was no significant difference in the width of the attached gingiva obtained by measuring using the visual method or using visual methods implemented after Schiller probe. These results are consistent with the research of Guglielmoni et al.,<sup>24</sup> while Bernimoulin et al.<sup>25</sup> reported that performing the functional method gives a maximum width of keratinized gingiva. In addition, the visual method after staining the gingival tissue leads to the smallest disagreements in the values of the attached gingiva width compared to other methods of determining the width of the attached gingiva.

It is the widest in the area of incisors, and then it narrows in the premolar area to expand again slightly in the area of the molars. In terms of the width of the attached gingiva, there is a symmetry with the left and right sides of the face, while the difference between the sexes does not exist. The width of the attached gingiva is important for physicians and patients because it affects the prognosis of the disease. If the attached gingiva is narrow, the periodontal disease prognosis will be worse. Considering people with narrow attached gingiva, the process of destruction that occurs in the course of the disease reaches faster a mucogingival line. Then, there is a marked traction over the movable mucous membrane and further progression of the pathological process. Traction separates the edge of the gingiva from the teeth and facilitates the creation and retention of dental plaque, with all the adverse consequences. This problem becomes more noticeable if this is combined with the anomalies in the soft tissue.

## **Zaključak**

Procena širine pripojne gingive u punom zubnom nizu otkriva različite širine u različitim predelima usne duplje u predelu maksilarnih inciziva je zabeležena najveća širina, dok je najmanja širina u predelu donjih prvih molara. Starost pacijenata utiče na širinu pripojne gingive, dok je kod ženskih osoba zabeležena veća širina pripojne gingive.

Potrebna su dalja istraživanja kod parodontalno zdravih osoba sa različitim teritorija Srbije kako bi se utvrdilo da li i geografski položaj možda utiče na različite vrednosti širine pripojne gingive. Takođe je potrebno da se ova istraživanja izvrše na većem broju uzoraka, kako bi se dobio definitivn opseg koji bi se mogao definisati kao adekvatan ili ne, što olakšava lečenje oboljenja parodonta.

## **Conclusion**

Assessment of the width of the attached gingiva in full dental arch reveals different widths in different areas of the oral cavity. The maximum width is in the area of the maxillary incisors, while the smallest width is in the area of the lower first molar. Patients' age affects the width of the attached gingiva, while the females had greater width of the attached gingiva.

Further research is needed regarding the periodontally healthy people from different parts of Serbia in order to determine whether the geographical position may affect the different values of width of the attached gingiva. It is also necessary to perform this research on a larger number of participants to obtain a definite scope that could be defined as adequate or not, making it easier to treat periodontal disease.

## LITERATURA / REFERENCES

1. Newman MG, Takei HH, Klokkevold PR, Carranza FA Eds Carranza's Clinical Periodontology, 10th (eds.), 2006.
2. Wennström JL, Zucchelli G, Pini GP. Mucogingival therapy- periodontal plastic surgery. In: Lindhe J, Lang NP, Karring T, editors. Clinical Periodontology and Implant Dentistry. 5th ed. Oxford: Blackwell Munksgaard Publishers; 2008. p. 956- 7.
3. Hilming F, Jervoe P. Surgical extension of vestibular depth. On the results in various regions of the mouth in periodontal patients. Tandlaegebladet 1970; 74: 329- 343.
4. Guglielmoni P, Promsudthi A, Tatakis DN, Trombelli L. Intra- and inter- examiner reproducibility in keratinized tissue width assessment with 3 methods for mucogingival junction determination. J Periodontol 2001; 72: 134- 139.
5. Orban B. Clinical and histologic study of the surface characteristics of the gingiva. Oral Surg Oral Med Oral Pathol 1948; 1: 827- 841.
6. Weinmann JP, Meyer J, Mardfin D, Weiss M. Occurrence and role of glycogen in the epithelium of the alveolar mucosa and of the attached gingiva. Am J Anat 1959; 104: 381- 402.
7. Lozdan J, Squier CA. The histology of the muco- gingival junction. J Periodontal Res 1969; 4: 83- 93.
8. Kapur KK, Chauncey HH, Shapiro S, Shklar G. A comparative study of the enzyme histochemistry of human edentulous alveolar mucosa and gingival mucosa. Periodontics 1963; 1: 137- 147.
9. Tencate AR. The distribution of acid phosphatase, non- specific esterase and lipid in oral epithelia in man and the macaque monkey. Arch Oral Biol 1963; 8: 747- 753.
10. Kojović D, Pejčić A, Obradović R, Marjanović D. Parodontologija, Galaksija Niš, 2015.
11. Sheehan DC, Hrapchak BB. Staining and labelling- laboratory manuals. In: Sheehan DC, Hrapchak BB, editors. Theory and Practice of Histotechnology. 2nd ed. St. Louis: CV Mosby Publishers; 1980. p. 219.
12. Fasske E, Morgenroth K. Comparitive stomatoscopic and histochemical studies of the marginal gingiva in man. Parodontologie 1958; 12: 151- 160.
13. Bowers GM. A study of the width of the attached gingiva. J Periodontology, 1963; 34: 210-213.
14. Ainamo J, Talari A. The increase with age of the width of attached gingiva. J Periodontal Res 1976; 11: 182- 188.
15. Tenenbaum H, Tenenbaum M. A clinical study of the width of the attached gingiva in the deciduous, transitional and permanent dentitions. J Clin Periodontol 1986; 13(4):270-275.
16. Talari A, Ainamo J. Orthopantomographic assessment of the width of attached gingiva. J Periodontal Res 1976; 11(4): 177-181.
17. Ainamo A, Ainamo J. The width of attached gingiva on supraerupted teeth. J Periodontal Res 1978; 13(3): 194- 198.
18. Saario M, Ainamo A, Mattila K, Suomalainen K, Ainamo J. The width of radiologically-defined attached gingiva over deciduous teeth. J Clin Periodontology 1995; 22(12): 895-898.
19. Saario M, Ainamo A, Mattila K, Ainamo J. The width of radiologicallydefined attached gingiva over permanent teeth in children. J Clin Periodontology 1994; 21(10): 666-669.
20. Vincent JW, Machen JB, Levin MP. Assessment of attached gingiva using the tension test and clinical measurements J Periodontology 1976; 47(7): 412-414.
21. Bowers GM. A study of the width of attached gingiva. J Periodontol 1963; 34: 201- 209.
22. Jacob P, Zade RM. Width of attached gingiva in an Indian population: A descriptive study. Bangladesh J Med Sci 2009; 8: 1- 4.
23. Subbaiah R, Manohar B. Assessment of the width of attached gingiva in different regions of the mouth in an Indian subpopulation. J Indian Dent Assoc 2012; 6: 96- 98.
24. Guglielmoni P, Promsudthi A, Tatakis DN, Trombelli L. Intra- and inter- examiner reproducibility in keratinized tissue width assessment with 3 methods for mucogingival junction determination. J Periodontol 2001; 72: 134- 139.
25. Bernimoulin JP, Son S, Regolati B. Biometric comparison of three methods for determining the mucogingival junction. Helv Odontol Acta 1971; 15: 118- 120.