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Ahmad Safa Alkateb[1], Hafize Ozturk Ozener[2], Leyla Kuru[2]

Assessment of Reliability of Three Indices Measuring Gingival Overgrowth

Procjena pouzdanosti triju indeksa za mjerenje hiperplazije gingive

[1] Department of Periodontology, Institute of Health Sciences, Marmara University, Istanbul, Turkey
Institut zdravstvenih znanosti – Zavod za parodontologiju Sveučilišta Marmara, Istanbul, Turska
[2] Department of Periodontology, Faculty of Dentistry, Marmara University, Istanbul, Turkey
Zavod za parodontologiju Stomatološkog fakulteta Sveučilišta Marmara, Istanbul, Turska

Abstract

Objectives: Numerous indices have been used to grade the severity of gingival overgrowth which led to suspicion regarding the results concerning its prevalence and pathogenicity. The aim of this study was to assess the concordance of three different gingival overgrowth indices, which were used widely in previous studies, and check their reliability and reproducibility. **Material and Methods:** A total of 30 full-mouth plaster casts and 90 intra-oral photographs collected from 30 patients diagnosed with gingival overgrowth were included in our study. Three trained examiners performed measurements twice on plaster casts using gingival hyperplasia index (A index) and hyperplastic index (B index). Intraoral photographs were assessed also twice using (C index). **Results:** Concordance of intra-examiner and inter-examiner reliability of the recorded measurements was carried out for each index using weighted kappa (*K*), with a confidence interval of 95%. The A index revealed intra-examiner total kappa values between 0.724-0.876 for horizontal measurement and 0.512-0.823 for vertical measurement, and inter-examiner total kappa values between 0.255-0.626 horizontally and 0.235-0.279 vertically. The B index presented intra-examiner total kappa values between 0.587-0.868 horizontally and 0.653-0.855 vertically; and inter-examiner total kappa values between 0.393-0.595 and 0.372-0.635 for horizontal and vertical measurements, respectively. The C index achieved the highest intra-examiner concordance with total kappa values between 0.758-0.855 and inter-examiner total kappa values between 0.716-0.804. **Conclusions:** The C index evaluated through intraoral photographs is considered the most reliable and applicable method to be utilized. The C index is suggested to be used in large scale populations with its definite detailed criteria.

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Address for correspondence
Ahmad Safa Alkateb
Marmara University
Institute of Health Sciences
Department of Periodontology
Istanbul, Turkey
GSM: +905465914486
safa.alkateb@outlook.com

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Ahmad Safa Alkateb https://orcid.org/0000-0002-0716-8637
Hafize Ozturk Ozener https://orcid.org/0000-0002-2156-584X
Leyla Kuru https://orcid.org/0000-0002-7599-2409

Introduction

The term gingival overgrowth (GO) refers to gingival intensification and proliferation which depict a prevailing character of the diseased gingival tissues. It is characterized by an alteration in gingival morphology that is accompanied with diverse etiologic factors and pathologic changes. Besides, it refers to the horizontal and vertical enlargements of the gingival tissues in both bucco-lingual and gingivo-incisal directions, respectively (1). The types of GO are classified as inflammatory, drug-induced, idiopathic, enlargements associated with systemic diseases or conditions and neoplastic enlargements (2). Drug-induced GO is a frequent side effect associated with three major drug groups: anticonvulsants, calcium channel blockers, and immunosuppressants (3). The prevalence of drug-induced GO shows variations among drugs ranging from 6% to 15% for nifedipine, about 50% for phenytoin, and between 25% and 39.4% in adult patients

Uvod

Pod pojmom hiperplazija gingive (HG) podrazumijeva se intenziviranje i proliferacija desni koja se manifestira predominacijom zahvaćenoga gingivnog tkiva. Karakterizira je promjena morfologije gingive koja je praćena različitim etiološkim čimbenicima i patološkim promjenama, a odnosi se na horizontalno i vertikalno povećanje gingivnoga tkiva u bukalno-lingvalnom i gingivo-incizalnom smjeru (1). Vrste hiperplazije gingive klasificiraju se kao upalna, izazvana lijekovima, idiopatska, povezana sa sistemskim bolestima ili stanjima i neoplastična hiperplazija (2). HG prouzročen lijekovima česta je nuspojava povezana s trima glavnim skupinama lijekova: antikonvulzivima, blokatorima kalcijevih kanala i imunosupresivima (3). Prevalencija HG-a izazvanog lijekovima pokazuje varijacije među lijekovima u rasponu od 6 % do 15 % za nifedipin, oko 50 % za fenitoin i između 25 % i 39,4 % kod odraslih bolesnika i >70 % kod djece kad je riječ

and >70% in children for cyclosporine A (4, 5). Interestingly, Gaspar et al. (6) showed a 5% prevalence of GO in patients who had undergone renal transplantation where one of the sample group was under cyclosporine A, valproic acid, and clonazepam treatment. The wide variation in the reported prevalence of this side effect was thought to be due to differences in the criteria used to assess it (7).

So far, several indices have been developed using a wide variety of methods to determine the severity of enlarged gingiva. The starting point of GO associated indices was to evaluate the severity and prevalence of drug-induced GO in the society, particularly. Nevertheless, these indices have also been used in some clinical studies evaluating patients with GO related to different etiologies other than drugs. For example, Miranda et al. (1) analyzed reliability of the vertical component of gingival hyperplasia index (8) in subjects who had worn orthodontic brackets and were diagnosed with chronic inflammatory GO due to the accumulation of microbial dental plaque while it was originally implemented with drug-induced GO patients due to side effects of phenytoin and sodium valproate. In order to illustrate this point more thoroughly, it is quite important to recognize that one of the clinical obstacles is to discriminate between alterations of soft tissues related to medicines, and those related to the inflammatory process changes in the connective tissue (9).

By doing a backward reference search, we found 24 GO indices. These indices depend on different means such as intra-oral examination, plaster casts, intra-oral photographs, and microscopes. Moreover, some of these GO indices were modified versions of previously described indices where further details were added to each specific grade of the original described criteria or the numerical order of the index was either increased or decreased.

In 1939, Kimball (10) was the first author to describe GO as an adverse effect to sodium diphenylhydantoin in epileptic patients. He created an index which is consisted of 4 grades initiating from "normal grade" as no signs of GO to "three plus grade" as severe GO. Since then, many indices have been proposed for intra-oral evaluation of GO using descriptive scales such as mild, moderate, and severe to describe various degrees of gingival tissues expansion. In 1942, Harris and Ewalt (11) classified the changes occurring in the gingiva into five grades as it was described by Leon J. Robinson in 1942 (12). Nery et al. (13) used similar index to the one described by Harris and Ewalt (11) for normal dentate patients with some additions regarding the distribution of the enlargement. In 2002, Prasad et al. (14) modified the index described by Harris and Ewalt (11) in such a manner that there were six grades instead of five by adding a final level of GO which depicts the situation of interference with function. Another objective scale was described by Aas (15) which divides the quadrants into sextants and graded GO according to the distortion of the papilla and the volume of enlargement on the anatomic crowns. Simultaneously, depending on the amount of encroachment, other methods that measure the vertical growth of the gingival tissues after dividing each crown into three thirds, were used by Angelopoulos and Goaz (16) and Conard et al. (17).

o ciklosporinu A (4, 5). Zanimljivo je da su Gašpar i suradnici (6) pokazali 5-postotnu prevalenciju hiperplazije gingive kod pacijenata koji su bili podvrgnuti transplantaciji bubrega gdje je jedan iz uzorkovane skupine bio pod terapijom ciklosporinom A, valproičnom kiselinom i klonazepamom. Smatralo se da je velika varijacija u prijavljenoj prevalenciji te da su nuspojave posljedica razlika u kriterijima koji se koriste za njezinu procjenu (7).

Dosad je razvijeno nekoliko indeksa korištenjem širokoga spektra metoda za određivanje stupnja hiperplazije gingive. Polazna točka bila je procjena stupnja i prevalencije HG-a prouzročenog lijekovima. Unatoč tomu, ti su indeksi također korišteni u nekim kliničkim istraživanjima u kojima su se procjenjivali pacijenti s HG-om povezanim s različitim etiologijama, osim lijekova. Na primjer, Miranda i suradnici (1) analizirali su pouzdanost vertikalne komponente indeksa gingivne hiperplazije (8) kod ispitanika koji su nosili ortodontske bravice i dijagnosticiran im je kronični upalni HG zbog nakupljanja mikrobnoga zubnog plaka, a izvorno je primijenjen kod pacijenata s HG-om izazvanim lijekovima zbog nuspojava fenitoina i natrijeva valproata. Za ilustraciju te točke vrlo je važno prepoznati da je jedna od kliničkih prepreka razlikovati promjene mekih tkiva uzrokovane lijekovima i one povezane s promjenama zbog upalnog procesa u vezivnom tkivu (9).

Pretraživanjem literature uspjeli smo pronaći 24 indeksa gingivne hiperplazije. Ti indeksi ovise o različitim sredstvima kao što su intraoralni pregled, sadreni modeli, intraoralne fotografije i mikroskopi. Štoviše, neki su bili modificirane verzije prethodno opisanih indeksa gdje su dodatne pojedinosti dodane svakoj specifičnoj ocjeni izvorno opisanog kriterija ili je brojčani poredak indeksa povećan ili smanjen.

Godine 1939. Kimball (10) je bio prvi autor koji je opisao HG kao nuspojavu natrijeva difenilhidantoina kod pacijenata s epilepsijom. Razvio je indeks koji se sastoji od četiriju stupnjeva – počinje s „normalnim stupnjem" bez znakova HG-a, sve do „razreda tri plus" kao teškog HG-a. Od tada su predloženi mnogi indeksi za intraoralnu procjenu HG-a korištenjem deskriptivnih ljestvica kao što su blaga, umjerena i teška za opisivanje različitih stupnjeva rasta gingivnoga tkiva. Godine 1942. Harris i Ewalt (11) klasificirali su promjene na gingivi u pet stupnjeva kako je to opisao Leon J. Robinson 1942. (12). Nery i suradnici (13) upotrijebili su indeks sličan onomu koji su opisali Harris i Ewalt (11) za normalne ozubljene pacijente s nekim dodatcima, ovisno o distribuciji hiperplazije. Godine 2002. Prasad i suradnici (14) modificirali su indeks koji su opisali Harris i Ewalt (11) na šest stupnjeva umjesto dotadašnjih pet, dodajući konačnu razinu HG-a koja opisuje situaciju kada je funkcija ometana. Još jednu objektivnu ljestvicu opisao je Aas (15) koji kvadrante dijeli na sekstante i HG procjenjuje prema distorziji papile i volumenu hiperplazije na anatomskim krunama. Paralelno su Angelopoulos i Goaz (16) te Conard i suradnici upotrijebili druge metode kojima se mjeri vertikalni rast gingivnoga tkiva nakon podjele svake krune na tri trećine (17).

U različitim istraživanjima upotrebljavali su se sadreni modeli kao alternativni način procjene HG-a. Godine 1985. Seymour i suradnici (8) predstavili su indeks koji je uključi-

Plaster casts have been employed in different studies as an alternative mean to assess GO. In 1985, Seymour et al. (8) presented an index that included a record of both horizontal and vertical dimensions of GO on plaster casts, focusing on the anterior teeth in particular. Two scores (gingival thickening and gingival encroachment) were measured separately, and then were combined to give a hyperplasia score for each gingival unit buccally and lingually. The advantage of combining both horizontal and vertical components of GO was extending the 2-dimensional assessment into a 3-dimensional one. In 1993, King et al. (18) developed a practical assessment of the vertical component of GO that was used in previous studies (15, 19, 20). King et al. (18) used a specific textual criteria to assess the vertical component of GO without the dependency on unclear figure describing the division criteria of the clinical crown concealed by enlarged gingival tissues as described by Seymour et al. (8).

Histological findings have also been used to evaluate GO. An index was defined by Kitamura et al. (21) who applied a stereoscopic dissecting microscope to study GO developed in experimental animals. Barak et al. (22) reported the histopathologic findings in gingival tissue biopsies taken from cardiac patients under the treatment of nifedipine. However, surgical intervention for the purpose of measuring GO solely is technically difficult and/or impractical, and even impossible.

Intra-oral photographs have been inserted into the field of methodologies to measure GO. In 1989, Heijl and Sundin (23) created an index to compare the size of gingival tissues between different time points in which gingival changes on the mesial, buccal, and distal surfaces for each tooth were evaluated. While O'Valle et al. (24) developed an approach to assess the degree of GO using a quantitative method with digital image analysis based on the criteria set by Angelopoulos and Goaz (16) , Ellis et al. (9) identified a photographic technique to quantify GO using a modified version of the vertical component described by Seymour et al. (8).

So far, a wide range of GO index systems using different methodologies have been defined. However, there is no gold standard index yet for measuring GO. As any clinical situation, the diagnosis, treatment and even prevention from recurrence are only achieved when the clinician is able to realize the degree of the lesion as well as the relation of its extent and severity with the etiopathogenesis. The perfect methodology to assess GO can be achieved using an appropriate and reproducible index (1). The appropriate index should be non-invasive, technically easy to perform, thus enabling the clinician to indicate the severity of this clinical phenomenon, as well as assisting the clinician in deciding whether surgical excision of GO is necessary or not. Therefore, the objective of this study was to investigate the concordance of three GO indices which were chosen after a comprehensive search that has been employed regarding the most commonly used indices through the history of this clinical manifestation. Also, their dependency on different techniques and means was considered, and their reliability and reproducibility were compared to select an appropriate GO index that can be dependable and easily used by clinicians, dental students and researchers in scanning wide/small populations without the

vao zapis horizontalnih i vertikalnih dimenzija HG-a na sadrenim modelima, s posebnim naglaskom na prednje zube. Dvije ocjene (zadebljanje gingive i prerastanje gingive) mjerene su odvojeno, a zatim su kombinirane da bi se dobila ocjena hiperplazije za svaku gingivnu jedinicu bukalno i lingvalno. Prednost kombiniranja horizontalne i vertikalne komponente HG-a bila je proširenje dvodimenzionalne procjene na trodimenzionalnu. Godine 1993. King i suradnici (18) predložili su praktičnu procjenu vertikalne komponente HG-a koja je korištena u prethodnim istraživanjima (15, 19, 20). King i njegovi kolege (18) upotrijebili su specifične tekstualne kriterije za procjenu vertikalne komponente HG-a, bez ovisnosti o nejasnoj slici koja opisuje kriterije podjele kliničke krune skrivene hiperplastičnim gingivnim tkivom kako su opisali Seymour i suradnici (8).

Histološki nalazi također su korišteni za procjenu HG-a. Indeks su definirali Kitamura i suradnici (21) koji su upotrijebili stereoskopski disekcijski mikroskop za proučavanje HG-a razvijenog na pokusnim životinjama. Barak i suradnici (22) izvijestili su o patohistološkim nalazima u biopsijama gingivnoga tkiva uzetih od srčanih bolesnika koji su bili liječeni nifedipinom. No kirurška intervencija isključivo u svrhu mjerenja HG-a tehnički je teška i/ili nepraktična, pa čak i nemoguća.

Intraoralne fotografije također su uvrštene među metodologije za mjerenje HG-a. Godine 1989. Heijl i Sundin (23) izradili su indeks za usporedbu veličine gingivnoga tkiva između različitih vremenskih točaka u kojima su procijenjene promjene gingive na mezijalnoj, bukalnoj i distalnoj površini za svaki zub. Dok su O'Valle i suradnici (24) razvili pristup za procjenu stupnja HG-a korištenjem kvantitativne metode s analizom digitalnih fotografija na temelju kriterija koje su postavili Angelopoulos i Goaz (16), Ellis i suradnici (9) identificirali su fotografsku tehniku za kvantificiranje HG-a koristeći se modificiranom verzijom vertikalne komponente koju su opisali Seymour i suradnici (8).

Dosad je definiran širok raspon sustava indeksa gingivne hiperplazije koji se primjenjuje u različitim metodologijama. Međutim, još ne postoji indeks zlatnog standarda za mjerenje HG-a. Kao i u svakoj kliničkoj situaciji, dijagnoza, liječenje, pa čak i prevencija recidiva, postižu se samo kada je kliničar u stanju shvatiti stupanj lezije te odnos njezina opsega i težine s etiopatogenezom. Savršena metodologija za procjenu HG-a moguća je uz pomoć ispravnoga i ponovljivog indeksa (1). Odgovarajući indeks trebao bi biti neinvazivan i tehnički jednostavan za primjenu, što kliničaru omogućuje da upozori na težinu toga kliničkog fenomena te mu pomaže u donošenju odluke je li kirurška ekscizija potrebna ili nije. Zato je cilj ovog istraživanja bio analizirati podudarnost triju indeksa HG-a koji su odabrani nakon opsežne pretrage najčešće korištenih indeksa kroz povijest te kliničke manifestacije, a također uzimajući u obzir njihovu ovisnost o različitim tehnikama i sredstvima, te usporediti njihovu pouzdanost i ponovljivost kako bi se odabrao pravilan indeks koji kliničari, studenti stomatologije i istraživači mogu pouzdano primjenjivati i u većim i u manjim populacijama bez potrebe za digitalnim tehnikama koje bi u određenim slučajevima mogle biti skupe.

need of interfering with digital techniques that might be expensive in certain situations.

Material and methods

The study protocol was approved by the Ethics Committee of Clinical Research, Faculty of Dentistry, Marmara University on 06/06/2017, and number 2017-113. Written informed consent forms were obtained from the participants and legal guardians/parents of the children. Plaster casts and intra-oral photographs of patients referred to the Periodontology Clinics, Faculty of Dentistry, Marmara University with GO due to inflammatory, drug-induced, pubertal or hereditary factors were analyzed.

A total of 30 patients agreed to participate in the study voluntarily. The mean age of the study population was a 44.47±17.14 year ranging from 13 to 70 years. According to gender, 50% of the participants were females (n=15; mean age 44.46±17.70 years) and remaining 50% were males (n=15; mean age 43.80±16.57 years). The majority of patients presented drug-induced GO (n=18, 60%), followed by 9 patients with inflammatory GO (30%), 2 patients with pubertal GO (6.7%), and one patient with hereditary gingival enlargement (3.3%).

Three GO indices depending on different diagnostic means and criteria were evaluated in this study. The A index and B index depend on plaster casts, and the C index counts on intra-oral photographs. Furthermore, the ability of the examiners to perform the evaluations through ready diagnostic data without being dependent neither on each other nor on the patient's intra-oral measurements was also taken into consideration in the selection of the indices. Since high levels of sensitivity and specificity are required to determine the diagnostic accuracy of any given index, an evaluation of reproducibility needs to be carried out on the same patients at the same time points (25). In the current study, we decided to perform repeated measurements on plaster casts and intra-oral photographs only, without any intra-oral readings to ensure that the intensity of overgrowth remains unchanged.

A total of 30 full-mouth plaster casts and 90 intra-oral photographs from 30 GO patients (each patient had a full-mouth plaster casts and 3 intra-oral photographs /right side – frontal – left side/) were utilized in the study. All diagnostic data met the following inclusion criteria: (a) presence of at least 12 anterior teeth (between 13 and 23 in the maxilla, and between 33 and 43 in the mandible), (b) plaster casts without any distortions, (c) high quality intra-oral photographs without any blurriness or indistinct vision, (d) consent to participate in the study. The full-mouth plaster casts were used to assess GO in both A and B indices, while intra-oral photographs were used in the C index.

Gingival overgrowth indices

Three indices have been applied exactly as they were described originally without modifying the scales or inserting any adjustments. Three trained examiners (ASA, LK, and HOO) measured the degree of GO on plaster casts using two different indices (A index and B index), and on intra-oral photographs using (C index), twice for each index. In

Materijal i metode

Protokol istraživanja odobrilo je 6. lipnja 2017. Etičko povjerenstvo za klinička istraživanja Stomatološkog fakulteta Sveučilišta Marmara pod brojem 2017-113. Obrasci pisanoga informiranog pristanka prikupljeni su od sudionika i zakonskih skrbnika/roditelja djece. Analizirani su sadreni modeli i intraoralne fotografije pacijenata upućenih u Kliniku za parodontologiju Stomatološkog fakulteta Sveučilišta Marmara s HG-om zbog upalnih, lijekovima izazvanih, pubertetskih ili genetskih čimbenika.

Ukupno 30 pacijenata dobrovoljno je pristalo sudjelovati u istraživanju. Prosječna dob ispitivane populacije bila je 44,47 ± 17,14 godina, u rasponu od 13 do 70 godina. Prema spolu 50 % sudionika bile su žene (n = 15; prosječna dob 44,46 ± 17,70 godina), a preostalih 50 % bili su muškarci (n = 15; prosječna dob 43,80 ± 16,57 godina). Većina pacijenata imala je HG prouzročen lijekovima (n = 18, 60 %), 9 pacijenata oboljelo je zbog upale (30 %), kod 2 pacijenta bio je pubertetski (6,7 %), a kod jednoga genetski (3,3 %).

U ovom istraživanju procijenjena su tri indeksa gingivne hiperplazije koja ovise o različitim dijagnostičkim sredstvima i kriterijima. Indeks A i indeks B temelje se na sadrenim modelima, a indeks C na intraoralnim fotografijama. Nadalje, sposobnost ispitivača da provedu evaluacije na temelju gotovih dijagnostičkih podataka, a da ne ovise jedni o drugima ili o pacijentovim intraoralnim mjerenjima, također je uzeta u obzir pri odabiru indeksa. Budući da je potrebna visoka razina osjetljivosti i specifičnosti za određivanje dijagnostičke vrijednosti bilo kojega navedenog indeksa, procjena ponovljivosti mora se provesti na istim pacijentima u istim vremenskim točkama (25). U ovom istraživanju odlučili smo obaviti ponovljena mjerenja samo na sadrenim modelima i intraoralnim fotografijama bez ikakvih intraoralnih očitanja kako bismo osigurali da intenzitet hiperplazije ostane nepromijenjen.

U istraživanju je upotrijebljeno ukupno 30 sadrenih modela cijelih čeljusti i 90 intraoralnih fotografija 30 pacijenata s HG-om (svaki pacijent imao je sadrene modele čeljusti i 3 intraoralne fotografije /desna strana – frontalno – lijeva strana/). Svi dijagnostički podatci zadovoljavali su sljedeće kriterije za uključivanje: (a) najmanje 12 prednjih zuba (između 13 i 23 u gornjoj čeljusti i između 33 i 43 u donjoj čeljusti), (b) sadreni modeli bez ikakvih distorzija, (c) visokokvalitetne intraoralne fotografije bez zamućenja ili nejasnog prikaza (d) pristanak za udjelovanje u istraživanju. Za procjenu HG-a na temelju indeksa A i indeksa B upotrijebljeni su sadreni modeli cijelih čeljusti, a intraoralne fotografije korištene su kod indeksa C.

Indeksi hiperplazije gingive

Tri su indeksa primijenjena točno onako kako su izvorno opisani bez modificiranja ljestvica ili bilo kakvih prilagodbi. Tri educirana ispitivača (A.S.A., L.K. i H.O.O.) mjerila su stupanj HG-a na sadrenim modelima s pomoću dvaju različitih indeksa (indeks A i indeks B) te na intraoralnim fotografijama (indeks C) dva puta za svaki indeks. Drugim riječi-

other words, each one of the examiners used each of the indices on each sample twice. It is belief that assessing the indices by three examiners will add up to the credibility of the results since inter-examiner reliability will be checked three times in this manner (Examiner 1-2 / Examiner 1-3 / Examiner 2-3). There was an interval of two weeks between the first and the second measurements.

A index: The first GO index used in this study was developed by Seymour et al. (8) and termed originally as "Gingival Hyperplasia index" where plaster casts are used to assess the readings. Maxillary and mandibular anterior segments were divided into five gingival units for each jaw at both buccal and oral sides. This index enables the clinician to evaluate both horizontal and vertical components of the overgrown gingiva (Figure 1). The horizontal component examines the degree of gingival thickness regarding both labial and lingual aspects as follows: 0 = normal thickness of the papilla; 1 = thickness of the papilla extends from normal up to 2 mm; 2 = thickness of the papilla extends from the normal up to more than 2 mm (Figure 2). The vertical component of this index examines the encroachment extent of the gingival tissues onto the adjacent clinical crowns, graded 0, 1, 2 and 3 on both labial and lingual surfaces (Figure 3). The higher score was given if there was any discrepancy between encroachments on two adjacent surfaces in one gingival unit. The maximum value of this index obtained by adding the scores of the horizontal and vertical components was 5.

B index: The second GO index was described by King et al. (18) and defined originally as "Hyperplastic Index" which also measures both the horizontal and vertical components of GO on plaster casts independently. The regions from 13 to 23 and from 33 to 43 on each plaster cast were divided also into five gingival units for each jaw at both buccal and oral sides. The horizontal component of B index measures the degree of gingival thickening in the same manner as the horizontal component of A index. The vertical component of B index focuses on measuring the degree of GO in an apico-coronal direction for each gingival unit and is graded by means of a 4-point interval scale as follows: 0 = normal gingiva; 1 = mild GO (blunting of the gingival margin); 2 = moderate GO (less than ½ of crown length is covered); 3 = severe GO (more than ½ of crown length is covered) (Figure 4).

C index: The third GO index was developed by Ellis et al. (9) using intra-oral photographs taken from each patient (right side – frontal – left side). The photographs of the anterior buccal aspect were taken using Canon EOS 60D camera at the appropriate speed and 11 F-stop (Tamron Sp 90mm 1:25 lens, Cobra Macro Ring Flash), with the cheeks retracted. The criteria for C index was: 0 = no encroachment of the papilla onto the clinical crown; 1 = mild encroachment (blunted appearance of the papilla's tip; 2 = moderate encroachment with lateral spread of interdental papilla on the buccal surface of the clinical crown (less than ¼ of tooth width); 3 = marked encroachment (more than ¼ of tooth width) with loss of normal papilla form (Figure 5). A total of 10 gingival units were scored from the midpoint of the tooth to the midpoint of the adjacent tooth between 13 to 23, and 33 to 43 on the buccal aspect.

ma, svaki od ispitivača primijenio je svaki indeks na svakom uzorku dva puta. Smatralo se da će, ako indeks procjenjuju tri ispitivača, to pridonijeti vjerodostojnosti rezultata jer se na taj način tri puta provjerava pouzdanost između ispitivača (ispitivač 1 – 2 / ispitivač 1 – 3 / ispitivač 2 – 3). Između prvoga i drugoga mjerenja bio je razmak od dva tjedna.

Indeks A: Prvi indeks gingivne hiperplazije upotrijebljen u ovom istraživanju razvili su Seymour i suradnici (8) i izvorno nazvan „indeks gingivalne hiperplazije", a za procjenu se koriste sadreni modeli. Maksilarni i mandibularni prednji segmenti podijeljeni su u pet gingivnih jedinica za svaku čeljust i na vestibularnoj i na oralnoj strani. Taj indeks kliničaru omogućuje procjenu horizontalne i vertikalne komponente hiperplastične gingive (slika 1.). Horizontalna komponenta opisuje debljinu gingive vestibularno i oralno kako slijedi: 0 = normalna debljina papile; 1 = debljina papile seže od normale do 2 mm; 2 = debljina papile seže od normale do više od 2 mm (slika 2.). Vertikalna komponenta ovog indeksa opisuje stupanj zadiranja gingivnoga tkiva u susjedne kliničke krune kao 0, 1, 2 i 3 na vestibularnoj i oralnoj površini (slika 3.). Viša se ocjena daje ako postoji razlika u zadiranju na dvije susjedne površine u jednoj gingivnoj jedinici. Najveća vrijednost ovog indeksa, dobivena zbrajanjem rezultata horizontalne i vertikalne komponente, jest 5.

Indeks B: Drugi indeks gingivne hiperplazije opisali su King i suradnici (18) i izvorno je definiran kao „hiperplastični indeks" kojim se također neovisno mjeri horizontalna i vertikalna komponenta HG-a na sadrenim modelima. Područja od 13 do 23 i od 33 do 43 na svakom modelu također su podijeljena u pet gingivnih jedinica za svaku čeljust na vestibularnoj i oralnoj strani. Horizontalnom komponentom indeksa B mjeri se stupanj zadebljanja gingive na isti način kao i horizontalna komponenta indeksa A. Vertikalna komponenta indeksa B fokusira se na mjerenje stupnja HG-a u apikalno-koronalnom smjeru za svaku gingivnu jedinicu i stupnjevana je s pomoću intervalne ljestvice od 4 točke kako slijedi: 0 = normalna gingiva; 1 = blagi HG (otupljenost ruba gingive); 2 = umjereni HG (prekriveno je manje od ½ duljine krune); 3 = teški HG (prekriveno je više od ½ duljine krune) (slika 4.).

Indeks C: Treći indeks gingvne hiperplazije razvili su Ellis i suradnici (9) koristeći se intraoralnim fotografijama svakog pacijenta (desna strana – frontalno – lijeva strana). Fotografije prednjega bukalnog segmenta snimljene su fotoaparatom Canon EOS 60D pri odgovarajućoj brzini i 11 F-stop (objektiv Tamron Sp 90 mm 1:25, Cobra Macro Ring Flash), s retrahiranim obrazima. Kriteriji za indeks C su sljedeći: 0 = nema zadiranja papile u kliničku krunu; 1 = blago zadiranje (zatupljeni izgled vrha papile; 2 = umjereno zadiranje s lateralnim širenjem interdentalne papile na bukalnoj površini kliničke krune (manje od ¼ širine zuba); 3 = izrazito zadiranje (više od ¼ širine zuba) s gubitkom normalnog oblika papile (slika 5.). Ukupno 10 gingivnih jedinica ocijenjeno je od sredine zuba do sredine susjednoga zuba između 13 i 23 i od 33 do 43 s vestibularne strane.

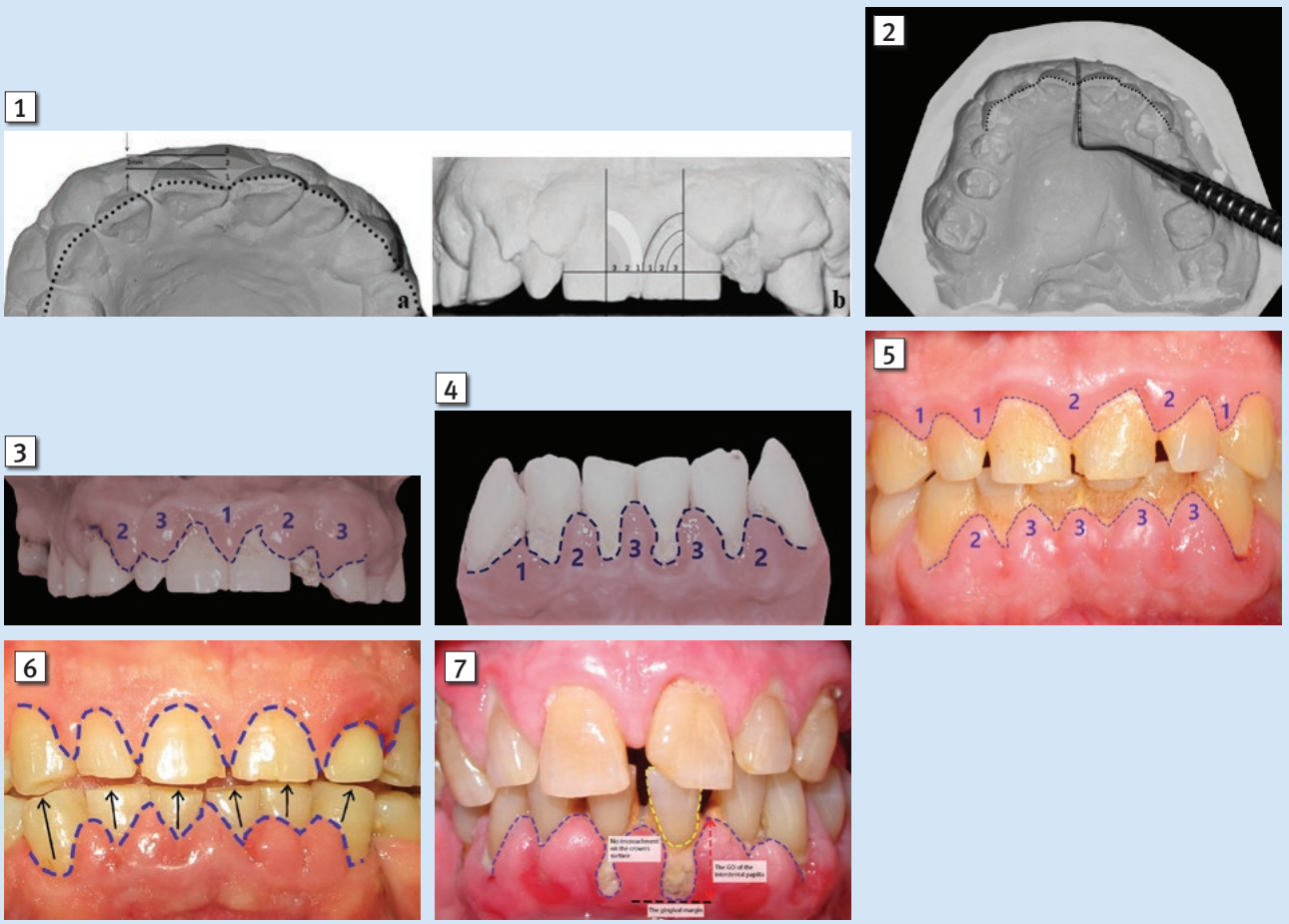

Figure 1 The horizontal (**a**) and vertical (**b**) components of A index.
Slika 1. Horizontalna (**a**) i vertikalna (**b**) komponenta indeksa A
Figure 2 Measuring the horizontal component of A index.
Slika 2. Mjerenje horizontalne komponente indeksa A
Figure 3 Measuring GO using the vertical component of A index.
Slika 3. Mjerenje hiperplazije gingive primjenom vertikalne komponente indeksa A
Figure 4 Measuring GO using the vertical component of B index.
Slika 4. Mjerenje hiperplazije gingive primjenom vertikalne komponente indeksa B
Figure 5 Measuring GO using C index.
Slika 5. Mjerenje hiperplazije gingive primjenom indeksa C
Figure 6 Limitations of B index in attrition cases.
Slika 6. Ograničenja indeksa B u slučaju atricije
Figure 7 Limitations of B index in gingival recession cases.
Slika 7. Ograničenja indeksa B u slučaju gingivne recesije

Statistical analysis

For the evaluation of intra-examiner calibration first, a satisfactory degree of agreement (kappa value > 0.6) was obtained in all investigators for the horizontal component of A index over 3 plaster casts measured twice.

Concordance of intra-examiner and inter-examiner analysis of the recorded measurements was carried out for each GO index using the weighted Kappa index (*K*) with a confidence interval of 95% using SPSS 20 program (SPSS Corporation, Chicago, USA).

Conventional interpretations of the strength of agreement for Kappa values were adopted (Altman, 1991) as follows: <0.20 poor concordance; 0.21-0.40 fair concordance; 0.41-0.60 moderate concordance; 0.61-0.80 good concordance; 0.81-1.00 very good concordance. Negative results were interpreted as 0.00.

Statistička analiza

Za procjenu kalibracije unutar ispitivača, kod svih je postignut zadovoljavajući stupanj slaganja (kappa vrijednost > 0,6) za horizontalnu komponentu indeksa A na trima sadrenim modelima mjerenima dva puta.

Usklađenost analize mjerenja unutar ispitivača i između ispitivača provedena je za svaki indeks gingivne hiperplazije korištenjem ponderiranoga kappa indeksa (K) s intervalom pouzdanosti od 95 % s pomoću programa SPSS 20 (SPSS Corporation, Chicago, SAD).

Prihvaćeno je konvencionalno tumačenje stupnja podudarnosti za kappa vrijednosti (Altman, 1991.) kako slijedi: < 0,20 loša podudarnost; 0,21 – 0,40 mala podudarnost; 0,41 – 0,60 umjerena podudarnost; 0,61 – 0,80 dobra podudarnost; 0,81 –1,00 vrlo dobra podudarnost. Negativni rezultati interpretirani su kao 0,00.

Results

Intra-examiner reliability

For the intra-examiner reliability, the kappa values for the horizontal component of A index for Examiners 1, 2 and 3 were 0.876, 0.724 and 0.784, respectively; and for the vertical component 0.823, 0.512 and 0.791, respectively (Table 1). Statistical analysis demonstrated good and very good concordance reproducibility for the horizontal component, while moderate to very good concordance was obtained for the vertical component of A index.

The kappa values for the horizontal component of B index for Examiners 1, 2 and 3 were 0.868, 0.587 and 0.787, respectively, and for the vertical component 0.855, 0.724 and 0.653, respectively (Table 2). Evaluation of kappa values manifested good to very good concordance, except for Examiner 2 who had moderate concordance for the horizontal component of B index.

While Examiners 1 and 3 presented a very good intra-examiner concordance for C index with the kappa values of 0.855, and 0.830, respectively, a good concordance was established for Examiner 2 (kappa value 0.758) (Table 3).

Inter-examiner reliability

For the inter-examiner reliability, the kappa values for horizontal component of A index showed fair, good and moderate concordance between Examiners 1-2, 1-3 and 2-3, respectively (kappa values 0.255, 0.626 and 0.570, respectively) (Table 4). The concordance for vertical component of this index between the examiners appeared to be fair with kappa values of 0.248, 0.235 and 0.279 between Examiners 1-2, 1-3 and 2-3, respectively (Table 4).

The kappa values for the horizontal component of B index were 0.595, 0.582 and 0.393 between Examiners 1-2, 1-3 and 2-3, respectively, and indicated moderate concordance between Examiners 1-2, 1-3, and fair concordance between Examiners 2-3 (Table 5). For the vertical component of B index, the kappa values between Examiners 1-2, 1-3 and 2-3 were 0.635, 0.508 and 0.372, respectively, and yielded good, moderate and fair concordance, respectively.

The kappa values for C index were 0.804, 0.717 and 0.716 between Examiners 1-2, 1-3 and 2-3, respectively and pointed to good to very good concordance (Table 6).

Discussion

The incidence of gingival enlargement is increasing in the community due to the ever-increasing number of patients who are using medications that may induce GO as a side effect. However, there is a need for a standard index to be used by clinicians, dental students and researchers for the quantification of the enlargement in large or small populations to ensure reproducibility by independent examiners especially in large ones, and to avoid any scientific discrepancies that might appear while comparing the results of different studies that had used diverse GO indices.

To our knowledge, there is only one study (1) comparing the concordance between two different GO indices; the first GO index (GOi) is originally described by Angelopou-

Rezultati

Pouzdanost unutar ispitivača

Za pouzdanost unutar ispitivača, kappa vrijednosti za horizontalnu komponentu indeksa A za ispitivače 1, 2 i 3 bile su 0,876, 0,724, odnosno 0,784, a za vertikalnu komponentu 0,823, 0,512, odnosno 0,791 (tablica 1.). Statistička analiza pokazala je dobru i vrlo dobru ponovljivost podudarnosti za horizontalnu komponentu, a za vertikalnu komponentu indeksa A dobivena je umjerena do vrlo dobra podudarnost.

Kappa vrijednosti za horizontalnu komponentu indeksa B za ispitivače 1, 2 i 3 bile su 0,868, 0,587, odnosno 0,787, a za vertikalnu komponentu 0,855, 0,724, odnosno 0,653 (tablica 2.). Procjena kappa vrijednosti pokazala je dobru do vrlo dobru podudarnost, osim za ispitivača 2 koji je imao umjerenu podudarnost za horizontalnu komponentu indeksa B.

Dok su ispitivači 1 i 3 pokazali vrlo dobru podudarnost unutar ispitivača, za indeks C s kappa vrijednostima od 0,855, odnosno 0,830, dobra podudarnost utvrđena je za ispitivača 2 (kappa vrijednost 0,758) (tablica 3.).

Pouzdanost između ispitivačax

Kad je riječ o pouzdanosti između ispitivača, kappa vrijednosti za horizontalnu komponentu indeksa A pokazale su lošu, dobru i umjerenu podudarnost između ispitivača 1 – 2, 1 – 3 i 2 – 3 (kappa vrijednosti 0,255, 0,626 i 0,570) (tablica 4.). Čini se da je podudarnost za vertikalnu komponentu ovog indeksa između ispitivača loša s kappa vrijednostima od 0,248, 0,235 i 0,279 između ispitivača 1 – 2, 1 – 3 i 2 – 3 (tablica 4.).

Kappa vrijednosti za horizontalnu komponentu indeksa B bile su 0,595, 0,582 i 0,393 između ispitivača 1 – 2, 1 – 3 i 2 – 3 i upućivale su na umjerenu podudarnost između ispitivača 1 – 2, 1 – 3 i umjerenu podudarnost između ispitivača 2 – 3 (tablica 5.). Za vertikalnu komponentu indeksa B, kappa vrijednosti između ispitivača 1 – 2, 1 – 3 i 2 – 3 bile su 0,635, 0,508 i 0,372, i dale su dobru, umjerenu i lošu podudarnost.

Kappa vrijednosti za indeks C bile su 0,804, 0,717 i 0,716 između ispitivača 1 – 2, 1 – 3 i 2 – 3, i upućivale su na dobru do vrlo dobru podudarnost (tablica 6.).

Rasprava

Incidencija hiperplazije gingive sve je češća u populaciji zbog sve više pacijenata koji uzimaju lijekove koji mogu izazvati HG kao nuspojavu. Međutim, postoji potreba za standardiziranim indeksom koji bi upotrebljavali kliničari, studenti dentalne medicine i istraživači za kvantifikaciju hiperplazije u velikim ili malim populacijama kako bi se osigurala ponovljivost neovisnih ispitivača, posebno u velikim populacijama, i da bi se izbjegla bilo kakva znanstvena odstupanja koja bi se mogla pojaviti uspoređujući rezultate različitih istraživanja u kojima su se upotrebljavali različiti indeksi HG-a.

Prema našim spoznajama u samo jednom istraživanju (1) uspoređuje se podudarnost između dvaju različitih indeksa

Table 1 Intra-examiner reliability of Examiner 1, 2 and 3 measuring horizontal and vertical components of A index.
Tablica 1. Podudarnost unutar ispitivača 1, 2 i 3 pri mjerenju horizontalne i vertikalne komponente indeksa A

			Papilla										Total
			Labial					Oral					
			3-2	2-1	1-1	1-2	2-3	3-2	2-1	1-1	1-2	2-3	
Examiner 1	Horizontal	Maxilla	0.888 (0.741-1.0)	0.894 (0.753-1.0)	0.943 (0.834-1.0)	0.835 (0.659-1.0)	0.820 (0.624-1.0)	0.846 (0.682-1.0)	0.840 (0.666-1.0)	0.849 (0.687-1.0)	0.741 (0.532-0.950)	0.946 (0.843-1.0)	0.876 (0.843-0.909)
		Mandible	1.000 (1.0-1.0)	0.873 (0.709-1.0)	0.740 (0.531-0.949)	0.934 (0.807-1.0)	0.902 (0.728-1.0)	0.751 (0.532-0.970)	0.895 (0.754-1.0)	0.838 (0.664-1.0)	0.949 (0.851-1.0)	0.767 (0.554-0.980)	
	Vertical	Maxilla	0.732 (0.585-0.879)	0.842 0.672-1.0)	0.478 (0.190-0.766)	0.839 (0.663-1.0)	0.857 0.665-1.0)	0.763 (0.540-0.986)	0,708 0.489-0.927)	0.810 0.624-0.996)	0.873 0.703-1.0)	0.826 0.640-1.0)	0.823 (0.786-0.860)
		Mandible	0.905 0.778-1.0)	0.713 0.506-0.920)	0.767 0.583-0.951)	0.798 (0.618-0.978)	0.749 (0.555-0.943)	0.801 (0.629-0.973)	0.712 (0.511-0.913)	0.887 (0.739-1.0)	0.701 (0.496-0.906)	0.751 (0.555-0.947)	
Examiner 2	Horizontal	Maxilla	0.670 (0.443-0.897)	0.679 (0.452-0.906)	0.453 (0.236-0.670)	0.684 (0.453-0.915)	0.777 (0.574-0.980)	0.749 (0.550-0.948)	0.646 (0.425-0.867)	0.600 (0.367-0.833)	0.601 (0.368-0.834)	0.749 (0.548-0.950)	0.724 (0.677-0.771)
		Mandible	0.836 (0.618-1.0)	0.745 (0.518-0.972)	0.737 (0.530-0.944)	0.813 (0.617-1.0)	0.744 (0.468-1.0)	0.757 (0.538-0.976)	0.783 (0.589-0.977)	0.741 (0.534-0.948)	0.767 (0.556-0.978)	0.697 (0.470-0.924)	
	Vertical	Maxilla	0.468 (0.225-0.711)	0.279 (0.029-0.529)	0.313 (0.023-0.603)	0.528 (0.278-0.778)	0.482 (0.245-0.719)	0.566 (0.325-0.807)	0.291 (0.030-0.549)	0.409 (0.164-0.654)	0.438 (0.193-0.683)	0.569 (0.340-0.798)	0.512 (0.460-0.564)
		Mandible	0.537 (0.308-0.766)	0.566 (0.253-0.879)	0.570 (0.343-0.797)	0.292 (0.059-0.525)	0.837 (0.671-1.0)	0.425 (0.192-0.658)	0.414 (0.185-0.643)	0.287 (0.050-0.560)	0.349 (0.101-0.597)	0.552 (0.321-0.783)	
Examiner 3	Horizontal	Maxilla	0.889 (0.741-1.0)	0.677 (0.454-0.900)	0.884 (0.732-1.0)	0.774 (0.545-0.943)	0.757 (0.538-0.976)	0.893 (0.750-1.0)	0.624 (0.378-0.870)	0.747 (0.550-0.944)	0.773 (0.566-0.980)	0.763 (0.550-0.976)	0.784 (0.739-0.829)
		Mandible	0.799 (0.582-1.0)	0.806 (0.612-1,0)	0.725 (0.508-0.942)	0.765 (0.554-0.976)	0.703 (0.476-0.930)	0.771 (0.562-0.980)	0.890 (0.747-1.0)	0.770 (0.559-0.981)	0.730 (0.525-0.935)	0.729 (0.483-0.975)	
	Vertical	Maxilla	0.828 (0.646-1.0)	0.795 (0.614-0.975)	0.790 (0.563-1.0)	0.750 (0.551-0.949)	0.932 (0.801-1.0)	0.943 (0.834-1.0)	0.753 (0.491-1.0)	0.772 (0.541-1.0)	0.678 (0.406-0.950)	0.846 (0.639-1.0)	0.791 (0.748-0.834)
		Mandible	0.729 (0.514-0.944)	0.653 (0.440-0.866)	0.715 (0.512-0.918)	0.793 (0.609-0.977)	0.673 (0.434-0.912)	0.867 (0.689-1.0)	0.740 (0.503-0.977)	0.672 (0.424-0.920)	0.881 (0.721-1.0)	0.637 (0.383-0.891)	
Intra-examiner concordance Kappa (95% CI)													

Table 2 Intra-examiner reliability of Examiner 1, 2 and 3 measuring horizontal and vertical components of B index.
Tablica 2. Podudarnost unutar ispitivača 1, 2 i 3 pri mjerenju horizontalne i vertikalne komponente indeksa B

			Papilla										Total
			Labial					Oral					
			3-2	2-1	1-1	1-2	2-3	3-2	2-1	1-1	1-2	2-3	
Examiner 1	Horizontal	Maxilla	0.768 (0.559-0.977)	0.947 (0.846-1.0)	0.943 (0.834-1.0)	0.831 (0.647-1,0)	0.762 (0.555-0.969)	0.899 (0.764-1.0)	0.894 (0.753-1.0)	0.700 (0.489-0.911)	0.840 (0.674-1.0)	0.945 (0.842-1.0)	0.868 (0.833-0.903)
		Mandible	1.000 (1.0-1.0)	0.876 (0.716-1.0)	0.791 (0.595-0.987)	0.867 (0.695-1.0)	0.917 (0.757-1.0)	0.626 (0.368-0.884)	0.895 (0.754-1.0)	0.837 (0.661-1.0)	0.949 (0.850-1.0)	0.835 (0.661-1.0)	
	Vertical	Maxilla	0.944 (0.837-1.0)	0.784 (0.588-0.980)	0.660 (0.441-0.879)	0.646 (0.411-0.881)	0.903 (0.774-1.0)	0.839 (0.669-1.0)	0.892 (0.751-1.0)	0.954 (0.849-1.0)	0.694 (0.475-0.913)	0.908 (0.785-1.0)	0.855 (0.820-0.890)
		Mandible	0.755 (0.552-0.958)	0.812 (0.622-1.0)	0.854 (0.698-1.0)	0.896 (0.757-1.0)	0.756 (0.541-0.971)	0.895 (0.754-1.0)	0.901 (0.768-1.0)	1.000 (1.0-1.0)	0.860 (0.710-1.0)	0.855 (0.699-1.0)	
Examiner 2	Horizontal	Maxilla	0.627 (0.373-0.881)	0.840 (0.670-1.0)	0.372 (0.112-0.632)	0.731 (0.516-0.946)	0.884 (0.728-1.0)	0.746 (0.541-0.951)	0.592 (0.351-0.833)	0.603 (0.370-0.836)	0.590 (0.338-0.842)	0.604 (0.377-0.831)	0.587 (0.537-0.637)
		Mandible	0.797 (0.596-0.998)	0.727 (0.502-0.952)	0.840 (0.672-1.0)	0.610 (0.334-0.886)	0.526 (0.234-0.818)	0.670 (0.435-0.905)	0.783 (0.589-0.977)	0.700 (0.489-0.911)	0.676 (0.443-0.909)	0.465 (0.181-0.749)	
	Vertical	Maxilla	0.726 (0.509-0.943)	0.587 (0.331-0.843)	0.618 (0.397-0.839)	0.381 (0.129-0.633)	0.545 (0.326-0.764)	0.522 (0.317-0.727)	0.390 (0.128-0.652)	0.478 (0.245-0.711)	0.354 (0.084-0.624)	0.590 (0.365-0.815)	0.724 (0.677-0.771)
		Mandible	0.697 (0.476-0.918)	0.758 (0.543-0.973)	0.606 (0.381-0.831)	0.586 (0.347-0.825)	0.250 (0.000-0.530)	0.370 (0.149-0.591)	0.620 (0.403-0.837)	0.700 (0.481-0.919)	0.574 (0.353-0.795)	0.648 (0.421-0.875)	
Examiner 3	Horizontal	Maxilla	0.889 (0.741-1.0)	0.677 (0.454-0.900)	0.884 (0.732-1.0)	0.774 (0.575-0.973)	0.757 (0.538-0.976)	0.893 (0.750-1.0)	0.624 (0.378-0.870)	0.747 (0.550-0.944)	0.773 (0.566-0.980)	0.817 (0.621-1.0)	0.787 (0.744-0.830)
		Mandible	0.799 (0.582-1.0)	0.806 (0.609-1.0)	0.725 (0.508-0.942)	0.765 (0.554-0.976)	0.703 (0.476-0.930)	0.771 (0.562-0.980)	0.890 (0.747-1.0)	0.770 (0.559-0.981)	0.730 (0.525-0.935)	0.729 (0.483-0.975)	
	Vertical	Maxilla	0.785 (0.584-0.986)	0.600 (0.314-0.886)	0.554 (0.321-0.787)	0.708 (0.465-0.951)	0.552 (0.276-0.828)	0.690 (0.483-0.897)	0.338 (0.068-0.608)	0.615 (0.384-0.846)	0.669 (0.442-0.896)	0.712 (0.503-0.921)	0.653 (0.603-0.703)
		Mandible	0.439 (0.181-0.697)	0.693 (0.445-0.941)	0.590 (0.322-0.858)	0.534 (0.274-0.794)	0.889 (0.741-1.0)	0.731 (0.522-0.940)	0.501 (0.251-0.751)	0.618 (0.368-0.868)	0.617 (0.400-0.834)	0.639 (0.406-0.872)	
Intra-examiner concordance Kappa (95% CI)													

Table 3 Intra-examiner reliability of Examiner 1, 2 and 3 measuring C index.
Tablica 3. Podudarnost unutar ispitivača 1, 2 i 3 pri mjerenju indeksa C

		Papilla					Total
		3-2	2-1	1-1	1-2	2-3	
Examiner 1	Maxilla	0.843 (0.677-1.0)	0.717 (0.520-0.914)	0.813 (0.639-0.987)	0.904 (0.775-1.0)	0.812 (0.642-0.982)	0.855 (0.806-0.904)
	Mandible	0.848 (0.692-1.0)	0.930 (0.801-1.0)	0.736 (0.539-0.933)	0.887 (0.740-1.0)	1.000 (1.0-1.0)	
Examiner 2	Maxilla	0.754 (0.560-0.948)	0.766 (0.586-0.946)	0.516 (0.268-0.764)	0.815 (0.647-0.983)	0.678 (0.469-0.887)	0.758 (0.700-0.816)
	Mandible	0.854 (0.698-1.0)	0.860 (0.690-1.0)	0.697 (0.492-0.902)	0.690 (0.459-0.921)	0.799 (0.623-0.975)	
Examiner 3	Maxilla	0.746 (0.545-0.947)	0.816 (0.650-0.982)	0.862 (0.715-1.0)	0.805 (0.629-0.981)	0.909 (0.788-1.0)	0.830 (0.778-0.882)
	Mandible	1.000 (1.0-1.000)	0.811 (0.610-1.0)	0.803 (0.631-0.975)	0.660 (0.414-0.906)	0.747 (0.551-0.943)	

Intra-examiner concordance Kappa (95% CI)

Table 4 Inter-examiner reliability of Examiners 1 and 2, Examiners 1 and 3, and Examiners 2 and 3 measuring horizontal and vertical components of A index.
Tablica 4. Podudarnost između ispitivača 1 i 2, ispitivača 1 i 3 i ispitivača 2 i 3 pri mjerenju horizontalne i vertikalne komponente indeksa A

			Papilla										Total
			Labial					Oral					
			3-2	2-1	1-1	1-2	2-3	3-2	2-1	1-1	1-2	2-3	
Examiners 1-2	Horizontal	Maxilla	0.223 (0.027-0.419)	0.077 (-0.115-0.269)	0.365 (0.095-0.635)	0.169 (-0.091-0.429)	0.122 (-0.077-0.321)	0.205 (-0.047-0.457)	0.062 (-0.169-0.293)	0.196 (-0.041-0.433)	0.081 (-0.156-0.318)	0.269 (0.048-0.490)	0.255 (0.195-0.315)
		Mandibule	0.238 (0.015-0.461)	0.191 (0.025-0.357)	0.272 (0.014-0.530)	0.333 (0.134-0.532)	0.215 (0.033-0.397)	0.204 (0.007-0.401)	0.182 (-0.015-0.379)	0.140 (-0.046-0.326)	0.114 (-0.095-0.323)	0.189 (-0.042-0.420)	
	Vertical	Maxilla	0.545 (0.285-0.805)	0.734 (0.519-0.949)	0.600 (0.340-0.860)	0.626 (0.381-0.871)	0.474 (0.177-0.771)	0.594 (0.348-0.840)	0.492 (0.238-0.746)	0.548 (0.300-0.796)	0.399 (0.137-0.661)	0.466 (0.237-0.695)	0.248 (0.198-0.298)
		Mandibule	0.672 (0.373-0.971)	0.805 (0.594-1.0)	0.680 (0.449-0.911)	0.414 (0.095-0.733)	0.541 (0.242-0.840)	0.514 (0.238-0.790)	0.733 (0.526-0.940)	0.681 (0.450-0.912)	0.642 (0.429-0.855)	0.141 (-0.149-0.431)	
Examiners 1-3	Horizontal	Maxilla	0.719 (0.494-0.944)	0.786 (0.592-0.980)	0.709 (0.476-0.942)	0.448 (0.174-0.722)	0.526 (0.231-0.821)	0.694 (0.481-0.907)	0.697 (0.486-0.908)	0.595 (0.358-0.832)	0.439 (0.179-0.699)	0.387 (0.176-0.598)	0.626 (0.574-0.678)
		Mandibule	0.635 (0.347-0.923)	0.485 (0.201-0.769)	0.733 (0.522-0.944)	0.579 (0.299-0.859)	0.489 (0.215-0.763)	0.501 (0.200-0.802)	0.677 (0.452-0.902)	0.609 (0.351-0.867)	0.798 (0.618-0.978)	0.443 (0.153-0.733)	
	Vertical	Maxilla	0.263 (0.038-0.488)	0.371 (0.107-0.635)	0.149 (-0.082-0.380)	0.306 (0.044-0.568)	0.174 (-0.143-0.491)	0.171 (-0.068-0.410)	-0.023 (-0.291-0.245)	0.143 (-0.054-0.340)	0.136 (-0.101-0.373)	0.325 (0.043-0.607)	0.235 (0.183-0.287)
		Mandibule	0.443 (0.224-0.662)	0.134 (-0.067-0.335)	0.149 (-0.082-0.380)	0.167 (-0.023-0.357)	0.123 (-0.090-0.336)	0.328 (0.119-0.537)	0.102 (-0.062-0.266)	0.269 (0.087-0.451)	0.132 (-0.091-0.355)	0.397 (0.139-0.655)	
Examiners 2-3	Horizontal	Maxilla	0.828 (0.650-1.000)	0.718 (0.487-0.949)	0.651 (0.399-0.903)	0.619 (0.371-0.867)	0.480 (0.188-0.772)	0.699 (0.488-0.910)	0.497 (0.245-0.749)	0.544 (0.301-0.787)	0.674 (0.451-0.897)	0.454 (0.229-0.679)	0.570 (0.508-0.632)
		Mandibule	0.635 (0.347-0.923)	0.414 (0.119-0.709)	0.726 (0.507-0.945)	0.511 (0.221-0.801)	0.490 (0.191-0.789)	0.411 (0.121-0.701)	0.776 (0.571-0.891)	0.728 (0.509-0.947)	0.785 (0.599-0.971)	0.574 (0.320-0.828)	
	Vertical	Maxilla	0.144 (-0.104-0.392)	0.188 (-0.037-0.413)	0.428 (0.180-0.716)	0.615 (0.380-0.850)	0.429 (0.204-0.654)	0.392 (0.138-0.646)	0.131 (-0.092-0.354)	0.073 (-0.162-0.308)	0.225 (0.010-0.440)	0.298 (0.081-0.515)	0.279 (0.227-0.331)
		Mandibule	0.218 (-0.025-0.461)	0.180 (-0.002-0.362)	0.136 (-0.120-0.392)	0.214 (0.046-0.382)	0.143 (-0.086-0.372)	0.115 (-0.082-0.312)	-0.003 (-0.159-0153)	0.305 (0.057-0.553)	0.299 (0.047-0.551)	0.344 (0.131-0.557)	

Inter-examiner concordance Kappa (95% CI)

Table 5 Inter-examiner reliability of Examiners 1 and 2, Examiners 1 and 3 and Examiners 2 and 3 measuring horizontal and vertical components of B index.
Tablica 5. Podudarnost između ispitivača 1 i 2, ispitivača 1 i 3 i ispitivača 2 i 3 pri mjerenju horizontalne i vertikalne komponente indeksa B

			Papilla										Total
			Vestibule					Oral					
			3-2	2-1	1-1	1-2	2-3	3-2	2-1	1-1	1-2	2-3	
Examiners 1-2	Horizontal	Maxilla	0.397 (0.139-0.655)	0.681 (0.456-0.906)	0.609 (0.361-0.857)	0.626 (0.397-0.855)	0.489 (0.239-0.739)	0.595 (0.349-0.841)	0.436 (0.170-0.702)	0.703 (0.496-0.910)	0.511 (0.282-0.740)	0.649 (0.432-0.866)	0.595 (0.550-0.640)
		Mandibule	0.568 (0.276-0.860)	0.623 (0.365-0.881)	0.733 (0.522-0.944)	0.451 (0.136-0.766)	0.681 (0.387-0.975)	0.429 (0.163-0.695)	0.565 (0.309-0.821)	0.791 (0.603-0.979)	0.586 (0.351-0.821)	0.296 (0.016-0.576)	
	Vertical	Maxilla	0.892 (0.749-1.0)	0.835 (0.663-1.0)	0.667 (0.465-0.878)	0.517 (0.272-0.762)	0.667 (0.456-0.878)	0.673 (0.458-0.888)	0.488 (0.226-0.750)	0.863 (0.715-1.0)	0.628 (0.383-0.873)	0.587 (0.364-0.810)	0.635 (0.588-0.682)
		Mandibule	0.704 (0.493-0.915)	0.812 (0.622-1.0)	0.809 (0.633-0.985)	0.696 (0.479-0.913)	0.651 (0.416-0.886)	0.571 (0.332-0.810)	0.799 (0.615-0.983)	0.852 (0.692-1.0)	0.907 (0.782-1.0)	0.609 (0.374-0.844)	
Examiners1-3	Horizontal	Maxilla	0.598 (0.342-0.854)	0.674 (0.445-0.903)	0.651 (0.399-0.903)	0.431 (0.151-0.711)	0.473 (0.203-0.743)	0.640 (0.409-0.871)	0.697 (0.486-0.908)	0.541 (0.291-0.791)	0.265 (0.015-0.515)	0.356 (0.157-0.555)	0.582 (0.528-0.636)
		Mandibule	0.635 (0.347-0.923)	0.427 (0.133-0.721)	0.733 (0.522-0.944)	0.511 (0.221-0.801)	0.579 (0.291-0.867)	0.439 (0.145-0.733)	0.676 (0.453-0.899)	0.620 (0.379-0.861)	0.745 (0.546-0.944)	0.427 (0.163-0.691)	
	Vertical	Maxilla	0.783 (0.584-0.982)	0.662 (0.431-0.893)	0.443 (0.268-0.711)	0.402 (0.128-0.676)	0.098 (-0.168-0.364)	0.490 (0.234-0.746)	0.398 (0.132-0.664)	0.494 (0.251-0.737)	0.624 (0.383-0.865)	0.531 (0.294-0.768)	0.508 (0.450-0.566)
		Mandibule	0.202 (-0.043-0.447)	0.570 (0.316-0.824)	0.501 (0.247-0.755)	0.425 (0.202-0.648)	0.434 (0.146-0.722)	0.416 (0.152-0.680)	0.648 (0.411-0.885)	0.287 (0.015-0.559)	0.577 (0.342-0.812)	0.554 (0.309-0.799)	
Examiners 2-3	Horizontal	Maxilla	0.451 (0.203-0.699)	0.727 (0.506-0.948)	0.602 (0.346-0.858)	0.513 (0.253-0.773)	0.532 (0.246-0.818)	0.597 (0.362-0.832)	0.453 (0.199-0.707)	0.553 (0.322-0.784)	0.427 (0.169-0.685)	0.416 (0.195-0.637)	0.393 (0.346-0.440)
		Mandibule	0.530 (0.233-0.827)	0.422 (0.113-0.731)	0.890 (0.742-1.0)	0.247 (-0.062-0.556)	0.299 (-0.036-0.634)	0.497 (0.215-0.779)	0.607 (0.357-0.857)	0.622 (0.377-0.867)	0.526 (0.272-0.780)	0.209 (-0.096-0.514)	
	Vertical	Maxilla	0.787 (0.590-0.984)	0.813 (0.614-1.0)	0.427 (0.001-0.491)	0.246 (-0.012-0.504)	0.330 (0.097-0.563)	0.576 (0.349-0.803)	0.581 (0.313-0.849)	0.536 (0.295-0.777)	0.442 (0.160-0.724)	0.766 (0.576-0.956)	0.372 (0.322-0.422)
		Mandibule	0.381 (0.127-0.635)	0.646 (0.404-0.888)	0.517 (0.278-0.756)	0.429 (0.208-0.650)	0.508 (0.265-0.751)	0.645 (0.389-0.901)	0.594 (0.346-0.842)	0.339 (0.085-0.593)	0.671 (0.458-0.884)	0.752 (0.555-0.949)	
Inter-examiner concordance Kappa (95% CI)													

Table 6 Inter-examiner reliability of Examiners 1 and 2, Examiners 1 and 3 and Examiners 2 and 3 measuring C index.
Tablica 6. Podudarnost između ispitivača 1 i 2, ispitivača 1 i 3 i ispitivača 2 i 3 pri mjerenju indeksa C

		Papilla					Total
		3-2	2-1	1-1	1-2	2-3	
Examiners 1-2	Maxilla	0.698 (0.489-0.907)	0.584 (0.361-0.807)	0.716 (0.513-0.739)	0.860 (0.712-1.0)	0.624 (0.401-0.847)	0.804 (0.750-0.858)
	Mandibule	1.0 (1.0-1.0)	1.0 (1.0-1.0)	0.946 (0.843-1.0)	0.765 (0.558-0.972)	0.803 (0.631-0.975)	
Examiners 1-3	Maxilla	0.690 (0.469-0.911)	0.635 (0.424-0.846)	0.724 (0.527-0.921)	0.579 (0.354-0.804)	0.730 (0.538-0.922)	0.717 (0.655-0.779)
	Mandibule	0.950 (0.856-1.0)	0.689 (0.462-0.916)	0.653 (0.438-0.868)	0.617 (0.380-0.854)	0.756 (0.570-0.942)	
Examiners 2-3	Maxilla	0.698 (0.485-0.911)	0.814 (0.644-0.984)	0.489 (0.248-0.730)	0.534 (0.297-0.771)	0.726 (0.534-0.918)	0.716 (0.654-0.778)
	Mandibule	0.950 (0.856-1.0)	0.689 (0.462-0.916)	0.657 (0.444-0.870)	0.710 (0.495-0.925)	0.752 (0.558-0.946)	
Inter-examiner concordance Kappa (95% CI)							

los and Goaz (16) and later modified by Miller and Damm (26), which resembles the vertical component of Gingival Hyperplasia Index described by Seymour et al. (8) and the second index is Miranda and Brunet index (MBi) (27-29) which represents the horizontal component of both Gingival Hyperplasia index (8) and Hyperplastic Index (18). The authors evaluated GOi on anterior gingival units on maxillary and mandibular plaster casts and reported an almost perfect concordance for the intra-examiner reliability with a global kappa value of 0.820 for the three examiners. The vertical component of A index, which was implemented in our study, and GOi description are compatible with each other. The vertical component findings of A index in our study supported the results of Miranda et al. (1). There was a very good agreement for Examiner 1, moderate agreement for Examiner 2, and good agreement for Examiner 3 with intra-examiner total kappa values of 0.823, 0.512 and 0.791, respectively.

Miranda et al. (1) showed a substantial concordance for the inter-examiner reliability of GOi with a global kappa value of 0.720. On contrary, the inter-examiner concordance in our study appeared to be markedly lower for the vertical component of A index with total kappa values of 0.248, 0.235 and 0.279 for Examiners 1-2, 1-3 and 2-3, respectively. The reason for this might be the differences among examiners in perception and understanding the vertical component of A index which lacks the full textual explanation of details in the original (8).

The horizontal component of both A index and B index which share identical criteria for assessing the horizontal dimension of GO, and are both compatible with MBi index used by Miranda et al. (1), revealed good to very good degree of agreement in terms of intra-examiner reliability which agrees with Miranda et al.(1) who scored a total kappa value of 0,830 for Mbi index.

Among examiners, the horizontal component of A index expressed a good agreement among Examiners 1-3 (*K*=0,626), moderate agreement among Examiners 2-3 (*K*=0,570), and fair agreement among examiners 1-2 (*K*=0,255). On the other hand, Miranda et al. (1) presented a good agreement between examiners with a total kappa value of 0,770 while using MBi.

The C index evaluated in our study was developed by Ellis et al. (9) who reported that the photographic scoring of GO provides an objective, non-invasive and easy-to-use method where no equipment is demanded other than the camera and the measurements can be done by a hygienist. They proposed that this technique is thus appropriate for large-scale population studies. Ellis et al.(9) reported that exact agreement for photographic scores were 38% when performed by the first examiner and 27% by the second examiner, and agreements within one unit are 71% and 75% for examiner 1 and examiner 2, respectively. Ellis et al. (9) study showed exact agreement of inter-examiner analysis in 13% of cases and 84% within one unit. In the present study, C index demonstrated very good intra-examiner agreement for both Examiner 1 and Examiner 3 with kappa values of 0.855 and 0.830, respectively. Examiner 2 had a good agreement with a kappa value of 0.758. In terms of inter-examiner evaluations, a good level of agreement was achieved with kappa

gingivne hiperplazije; prvi indeks HG-a (HGi) izvorno su opisali Angelopoulos i Goaz (16), a poslije su ga modificirali Miller i Damm (26), što nalikuje na vertikalnu komponentu indeksa gingivne hiperplazije koju su opisali Seymour i suradnici (8), a drugi indeks je Mirandov i Brunetov (MBi) (27 – 29) i to je zapravo horizontalna komponenta indeksa gingivne hiperplazije (8) i hiperplastičnog indeksa (18). Autori su procijenili HG na prednjim gingivnim jedinicama na gornjem i donjem sadrenom modelu i izvijestili o gotovo savršenoj podudarnosti za pouzdanost unutar ispitivača s ukupnom kappa vrijednošću od 0,820 za tri ispitivača. Vertikalna komponenta indeksa A, koja je implementirana u našem istraživanju, i opis HG-a uzajamno su kompatibilni. Nalazi vertikalne komponente indeksa A u našem istraživanju podržavaju rezultate Mirande i suradnika (1) s vrlo dobrim slaganjem za ispitivača 1, umjerenim slaganjem za ispitivača 2 i dobrim slaganjem za ispitivača 3 s ukupnim kappa vrijednostima unutar ispitivača od 0,823, 0,512, odnosno 0,791.

Miranda i suradnici (1) pokazali su značajnu podudarnost za pouzdanost HG-a među ispitivačima s ukupnom kappa vrijednošću od 0,720. Za razliku od toga, podudarnost među ispitivačima u našem istraživanju čini se znatno niža kad je riječ o vertikalnoj komponenti indeksa A s ukupnim kappa vrijednostima od 0,248, 0,235 i 0,279 za ispitivače 1 – 2, 1 – 3 i 2 – 3. Razlog mogu biti razlike među ispitivačima u percepciji i razumijevanju vertikalne komponente indeksa A kojoj nedostaje potpuno tekstualno objašnjenje detalja u izvorniku (8).

Horizontalna komponenta indeksa A i indeksa B koji dijele identične kriterije za procjenu horizontalne dimenzije HG-a, a oba su kompatibilna s MB indeksom koji upotrebljavaju Miranda i suradnici (1), otkrili su dobar do vrlo dobar stupanj slaganja kad je riječ o pouzdanosti unutar ispitivača što se slaže s Mirandom i suradnicima(1) koji su postigli ukupnu kappa vrijednost od 0,830 za MB indeks.

Među ispitivačima je horizontalna komponenta indeksa A pokazala dobro slaganje među ispitivačima 1 – 3 (K = 0,626), umjereno slaganje među ispitivačima 2 – 3 (K = 0,570) i dobro slaganje među ispitivačima 1 – 2 (K = 0,255). S druge strane, Miranda i suradnici (1) pokazali su dobro slaganje između ispitivača s ukupnom kappa vrijednošću od 0,770 pri korištenju MB-a.

Indeks C procijenjen u našem istraživanju studiji razvili su Ellis i suradnici (9) koji su izvijestili da je fotografsko ocjenjivanje HG-a objektivna, neinvazivna i jednostavna metoda za koju nije potrebna nikakva oprema osim kamere, a mjerenja može obaviti higijeničar. Zato su tu tehniku predložili kao prikladnu za velike populacije. Ellis i suradnici (9) izvijestili su da je točna podudarnost za fotografske rezultate iznosila 38 % kod prvog ispitivača i 27 % kod drugoga, a slaganja unutar jedne jedinice bila su 71 %, odnosno 75 % za ispitivača 1 i ispitivača 2. Ellis i suradnici (9) pokazali su točnu podudarnost analize između ispitivača u 13 % slučajeva i 84 % unutar jedne jedinice. U ovom istraživanju indeks C pokazao je vrlo dobro slaganje između ispitivača te za ispitivača 1 i za ispitivača 3 s kappa vrijednostima od 0,855, odnosno 0,830. Ispitivač 2 postigao je dobro slaganje s kappa vrijednošću od 0,758. Kad je riječ o procjeni među ispitivačima,

values ranging between 0.716 and 0.804. This photographic index appeared to be consistently the most ideal one due to its high sensitivity and specificity. On the other hand, while higher GO scores were achieved using this technique, A index and B index lacked that with less GO grades. It seems to be related to the indices site allocation criteria and the fact that most of the alterations of soft tissues take place on the buccal side of the anterior teeth which is examined only by C index (30). In addition, The C index (9) follows both the coronal movement of the tip of the papilla towards the incisal edge and the lateral spread of the papilla on the surface of the crown, which provides it with a more comprehensive concept for assessing GO.

Ellis et al. (9) stated that when comparing between Seymour et al. index (8) and the photographic technique, the first manifested intra-examiner results of exact agreement in 73.2% of cases which is higher than the results achieved by the photographic technique, but since inter-examiner agreement in one unit is 84% when using the photographic technique, they supported the use of this method in large-scale populations. In our study, which is consisted of a small-scale population, it is also recommended to use this technique with its high intra-examiner and inter-examiner agreements.

Although each of the examined GO indices was used in numerous studies, still a small number of their limitations might inhibit the actual assessing of the exact degree of GO. For instance, in the vertical component of the A index, there is no specific definition of the amount of encroachment of the interdental papilla for each grade. Nevertheless, there is a figure showing the division of the half of clinical crown into three thirds. This way of classification lacks specificity and clarity.

Back to the vertical component of B index which relies on the extent of GO in an apico-coronal direction, various cases where bruxism and attrition occur will cause a decrease in the anatomical length of the crown, and eventually disable the clinician from assessing GO accordingly (Figure 6). In addition, in cases where severe gingival recession occurs, the perception of the apico-coronal extension of the interdental papilla is definite, unlike the cases in which the periodontium is intact (Figure 7).

On the other hand, the horizontal part of both A index and B index, which share an identical criteria for assessing G.O. horizontally, do not take into consideration cases where various degrees of malocclusion (for e.g. crowding or proclination in the anterior teeth /buccally/palatally/lingually/) might occur and eventually prevent the clinician from making an accurate measurement of how much extent the gingival tissues are enlarged in a labio-lingual direction, thus, making it neither simple nor a straightforward procedure. Miranda et al. (1) had overcome this problem which might affect the clear visibility by choosing samples from patients who had undergone and completed orthodontic treatment and who were diagnosed with subsequent inflammatory GO due to accumulation of microbial dental plaque located on the buccal aspect of the teeth especially.

Finally, differentiating between "grade 0 and grade 1" in all indices remains a difficulty since it is hard to expect the

postignuta je dobra razina slaganja s kappa vrijednostima u rasponu između 0,716 i 0,804. Čini se da je taj fotografski indeks dosljedno najprikladniji zbog svoje visoke osjetljivosti i specifičnosti. S druge strane, dok su ovom tehnikom postignute više vrijednosti HG-a, indeks A i indeks B rezultirali su nižim ocjenama HG-a. Čini se da je to povezano s kriterijima mjesta i činjenicom da se većina promjena mekih tkiva događa na vestibularnoj strani prednjih zuba koje se procjenjuje samo indeksom C (30). Dodatno, indeks C (9) prati i koronarno pomicanje vrha papile prema incizalnom rubu i njezino lateralno širenje na površini krune, što mu daje sveobuhvatniji koncept za procjenu HG-a.

Ellis i suradnici (9) naveli su da su u usporedbi s indeksom Seymoura i suradnika (8) i fotografskom tehnikom, prvi očitovali rezultat točnog slaganja unutar ispitivača u 73,2 % slučajeva, što je više od rezultata postignutih fotografskom tehnikom, ali s obzirom na to da je slaganje između ispitivača u jednoj cjelini 84 % pri korištenju fotografske tehnike, podržali su korištenje te metode u velikim populacijama. U našem istraživanju koje se sastojalo od male populacije, također se preporučuje korištenje te tehnike zbog njezine visoke podudarnosti unutar ispitivača i između njih.

Iako je svaki od ispitivanih HG indeksa korišten u brojnim istraživanjima, neka njihova ograničenja još uvijek mogu spriječiti stvarnu procjenu točnog stupnja HG-a. Na primjer, u vertikalnoj komponenti indeksa A ne postoji specifična definicija količine zahvata interdentalne papile za svaki stupanj, nego slika koja prikazuje podjelu polovine kliničke krune na tri trećine. Takvom načinu klasifikacije nedostaju specifičnost i jasnoća.

Ako se govori o vertikalnoj komponenti indeksa B koja se oslanja na opseg HG-a u apikalno-koronalnom smjeru, različiti slučajevi s bruksizmom i atricijom prouzročit će smanjenje anatomske duljine krune i na kraju onemogućiti kliničaru da procijeni HG u skladu s tim (slika 6.). Uz to, ako je riječ o ozbiljnoj recesiji gingive, percepcija apikalno-koronalnog produžetka interdentalne papile definitivno je drukčija od slučajeva u kojima je parodont intaktan (slika 7.).

S druge strane, horizontalna komponenta indeksa A i indeksa B, koji dijele identične kriterije za procjenu HG-a horizontalno, ne uzima u obzir slučajeve s različitim stupnjevima malokluzije (npr., zbijenost ili proklinacija prednjih zuba /bukalno/palatalno/lingvalno/), što na kraju kliničaru može onemogućiti da točno izmjeri koliko su gingivna tkiva povećana u labijalno-lingvalnom smjeru. Dakle, postupak nije ni jednostavan, ni jasan. Miranda i suradnici (1) prevladali su taj problem koji bi mogao utjecati na jasnu vidljivost odabirom uzoraka pacijenata koji su bili podvrgnuti i završili su ortodontsku terapiju i kojima je dijagnosticiran kasniji upalni HG zbog nakupljanja mikrobnoga zubnog plaka koji se nalazi posebno na vestibularnom dijelu zuba.

Konačno, razlikovanje između „stupnja 0 i stupnja 1" u svim indeksima ostaje otežano jer je teško očekivati točnu lokaciju cementno-caklinskoga spojišta. U nekim slučajevima možemo procijeniti suprotnu stranu kako bismo otkrili stvarnu kliničku krunu i procijenili stupanj HG-a. No to se ograničenje ne primjećuje u horizontalnoj evaluaciji HG-a.

exact location of cemento-enamel junction. In some cases, we might evaluate the opposite side to check the actual clinical crown and decide the grade of GO. However, this limitation is not noticed in the horizontal evaluation of GO.

Conclusions

The results indicate that the C index evaluated via intraoral photographs is considered to be the most reliable and applicable method among the three indices utilized in this study to measure and determine the severity of GO. The horizontal aspect of A index and B index which were evaluated on plaster casts are suggested to be used where there is no dysmorphisms affecting the clarity. Nonetheless, C index is preferred in large or even small-scale populations due to its high levels of agreement among examiners as well as its inclusivity in tracking the enlargement towards the incisal edge and its lateral spread on the clinical crown. Hence, we can adapt this index for GO assessment and specify each grade with its suitable periodontal treatment (non-surgical / surgical).

Conflict of Interest

The authors have declared no conflict of interest.

Author's contribution: Concept and design of the study – **A.S.A., H.Ö.Ö., L.K.**; Literature review – **A.S.A.**; Data collection – **A.S.A.**; Investigation and visualization - **A.S.A., H.Ö.Ö., L.K.**; Methodology and measuring - **A.S.A., H.Ö.Ö., L.K.**; Interpretation and sample analysis - **A.S.A., H.Ö.Ö., L.K.**; Supervision – **L.K.**; Writing – **A.S.A.**; Review and editing - **H.Ö.Ö., L.K.**; Final writing of the version to be published – **A.S.A.**

Zaključak

Rezultati pokazuju da se indeks C, procijenjen na temelju intraoralnih fotografija, smatra najpouzdanijom i najprimjenjivijom metodom između triju indeksa korištenih u ovom istraživanju za mjerenje i određivanje stupnja HG-a. Horizontalna komponenta indeksa A i indeksa B, koji su procijenjeni na sadrenim modelima, trebala bi se upotrebljavati ondje gdje nema dismorfizama koji utječe na jasnoću. Unatoč tomu, indeks C je poželjan u velikim, ili čak malim populacijama, zbog visoke razine podudarnosti među ispitivačima i njegove inkluzivnosti u praćenju hiperplazije prema incizalnom rubu i njezina lateralnog širenja na kliničkoj kruni. Stoga možemo prilagoditi ovaj indeks za procjenu HG-a i specificirati svaki stupanj s odgovarajućom parodontološkom terapijom (nekirurškom/kirurškom).

Sukob interesa

Autori nisu bili u sukobu interesa.

Doprinos autora: **A. S. A., H. Ö. Ö., L. K.** – koncept i dizajn istraživanja; **A. S. A.** – pregled literature i prikupljanje podataka; **H. Ö. Ö., L. K., A.S.A.** – istraživanje i vizualizacija; **S. A., H. Ö. Ö., L. K.** – metodologija i mjerenje te interpretacija i analiza uzoraka; **L. K.** – nadzor; **A .S. A.** – pisanje; **H. Ö. Ö., L. K.** – revizija i uređivanje; **A. S. A.** – konačna verzija teksta.

Sažetak

Svrha istraživanja: Upotrijebljeni su brojni indeksi za ocjenjivanje stupnja hiperplazije gingive što je potaknulo sumnju u vezi s rezultatima o njezinoj prevalenciji i patogenosti. Cilj ovog istraživanja bio je procijeniti podudarnost triju različitih indeksa hiperplazije gingive koji su naširoko upotrebljavani u dosadašnjim istraživanjima te provjeriti njihovu pouzdanost i ponovljivost. **Materijal i metode:** U naše istraživanje uključeno je ukupno 30 sadrenih modela obiju čeljusti i 90 intraoralnih fotografija prikupljenih od 30 pacijenata s dijagnozom hiperplazije gingive. Tri educirana ispitivača dva su puta obavila mjerenja na sadrenim modelima koristeći se indeksom gingivne hiperplazije (indeks A) i hiperplastičnim indeksom (indeks B). Intraoralne fotografije također su procijenjene dva puta s pomoću indeksa C. **Rezultati:** Podudarnost zabilježenih mjerenja između ispitivača i unutar ispitivača analizirana je za svaki indeks s pomoću ponderiranog kappa testa (K) s intervalom pouzdanosti od 95 %. Indeks A pokazao je ukupne kappa vrijednosti između ispitivača između 0,724 i 0,876 za horizontalno mjerenje i 0,512 do 0,823 za vertikalno mjerenje, a ukupne kappa vrijednosti među ispitivačima bila je između 0,255 i 0,626 horizontalno i 0,235 do 0,279 vertikalno. Indeks B pokazivao je ukupne kappa vrijednosti unutar ispitivača između 0,587 i 0,868 horizontalno i 0,653 do 0,855 vertikalno i ukupne kappa vrijednosti među ispitivačima između 0,393 i 0,595 te 0,372 do 0,635 za horizontalna i vertikalna mjerenja. Indeks C postigao je najveću podudarnost između ispitivača s ukupnim kappa vrijednostima između 0,758 i 0,855 i ukupnim kappa vrijednostima između ispitivača između 0,716 i 0,804. **Zaključci:** Indeks C procijenjen putem intraoralnih fotografija smatra se najpouzdanijom i najprimjenjivijom metodom. Predlaže se za veće populacije zbog jasnih, detaljnih kriterija.

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Adresa za dopisivanje
Ahmad Safa Alkateb
Sveučilište Marmara
Institut zdravstvenih znanosti
Zavod za parodontologiju
Istanbul, Turska
GSM: +905465914486
safa.alkateb@outlook.com

MeSH pojmovi: hiperplazija gingive; ponovljivost rezultata; metode; dentalna fotografija
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