Craniofacial Growth in Adolescence and its Influence on the Mandibular Incisor Crowding

Kraniofacijalni rast u adolescenciji i utjecaj na zbijenost mandibularnih sjekućita

Introduction

Irregularities in the relationship between teeth and jaws in adult age are related to the development of teeth and the entire craniofacial complex which can be influenced by numerous endogenous and exogenous factors (1-3). Growth is a result of remodeling and shifting, where facial bones grow upwards and backwards and shift downwards and forwards, and the lower jaw reaches the upper one through the development of the ramus and the action of the muscles of mastication (1, 4). The alteration of periods of intense and less intense growth, remodeling of the bones through apposition and resorption, development of sinuses, alveolar processes and tooth eruption through continuous changes in facial

Uvod

Nepravilnosti u odnosu zuba i čeljusti u odrasloj dobi povezane su s razvojem zuba i cjelokupnog kraniofacijalnog kompleksa na što mogu utjecati mnogobrojni endogeni i egzogeni čimbenici (1 – 3). Rast je rezultat preoblikovanja i premještanja, pri čemu kosti lica rastu gore i straga, prostorno pomicajući se prema dolje i naprijed, a donja čeljast sustije gornju razvojem ramusa i djelovanjem zvačnih mišića (1, 4). Izmjena razdoblja intenzivnog i manje intenzivnog rasta, preoblikovanje kostiju apozicijom i resorpcijom, razvoj sinusa i alveolarnih nastavaka, nicanje zuba i kontinuirana promjena proporcija kostiju lica stvara odnose koji se vide u odrasloj dobi (4).
skeleton proportions create relationships which are seen in adult age (4).

Growth can be observed and studied through direct and indirect methods. Direct methods define relationships of reference points directly on the jaws and teeth, and indirect methods use the level of growth or mineralization of certain body parts to determine the skeletal and dental age or sexual maturity of the subject (5-8). Crowding is an occlusal characteristic that becomes more frequent during development of the dentition (9). During adolescence, an occurrence of mandibular incisor crowding is observed, which is believed to be a late expression of primary crowding (9, 10). Etiological factors which should be considered are different growth dynamics and rotation of upper and lower jaws, occlusion, dental arch dimensions, tooth size, maturation of soft tissues, masticatory force and the eruption of third molars. (10-12). An early occurrence of late mandibular crowding occurs between the ages of 13 and 18 years and is considered to be mostly caused by maturational factors. Late occurrence of late mandibular crowding occurs after the age of 18 and is probably caused by regressive and degenerative factors (10, 11).

The aim of the research was to examine the dynamics of craniofacial growth during adolescence and the extent to which late mandibular crowding is related to the growth and development of the jaws and face. The hypotheses were that during adolescence the mandible grows more than the maxilla, with anterior rotation. It is assumed that both phenomena are more expressed in males than in females. The expected result is dentoalveolar compensation in the form of greater retroclination of lower than the proclination of upper incisors and a decrease in the lower dental arch length. The instance of mandibular incisor crowding is probably more expressed in males and more related to the growth of the mandible than the maxilla.

Material and methods

This research encompassed data from the Nittedal Growth Study in Norway. The data used are from 61 subjects who had not undergone orthodontic therapy, 49% of whom were male, observed from 12 to 21 years of age. The Nittedal Study started in Norway in 1972, and the subjects were children born between the years 1958 and 1972 in the Norwegian district of Nittedal. None of the subjects had significant malocclusion or any form of facial disharmony. A smaller number of subjects presented with minimal tooth rotation, less than 1 mm. A lateral cephalogram was obtained for each of the subjects at the age of 12 and 21. It was obtained using the Lumex B device (Siemens, Munich, Germany). The distance of the anode (radiation source) to the mid-sagittal plane was 1.8 m, and the head in the cephalostat was oriented with reference to the Frankfurt horizontal while the teeth were in maximum intercuspation.

A cephalometric analysis was performed on lateral cephalograms in the AudaxCeph program (AudaxCeph, Ljubljana, Slovenia). The following angles were used: sagittal position of the maxilla / maxillary prognathism angle (SNA), sagittal position of the mandible / mandibular prognathism angle (SNB), cusp tip to bony landmarks / maxillary incisor inclination angle (U1, U2, U3), mandibular incisor inclination angle (LM1, LM2, LM3), molar angle (M1, M2, M3), and a decrease in the lower dental arch length. The instance of mandibular incisor crowding is probably more expressed in males and related to the growth of the mandible than the maxilla.

Rast se može promatrati i proučavati izravnim i neizravnim metodama. Izravne metode definiraju odnose referentnih točaka izravno na čeljustima i zubima, a neizravne metode koriste se stupnjem rasta ili mineralizacije određenih dijelova tijela za procjenu skeletne i zubne dobi ili spolne zrelosti ispitanika (5 – 8). Zbijenost je karakteristika okluzije koja postaje sve češća tijekom razvoja denticije (9). U adolescenciji se uočava pojava zbijenosti mandibularnih sjekućica, tzv. tercijarna zbijenost, za koju se pretpostavlja da je kasna ekspresija primarne zbijenosti (9, 10). Mogući etiološki čimbenici su različita dinamika rasta i rotacija gornje i donje čeljusti, okluzija, dimenzije zubnih lukova, veličina zuba, zaštitavanje mekih tkiva, žvačne sile i nacrtanje tečnih krunjaka (10 – 12). Ranija pojava tercijarne zbijenosti u mandibuli događa se između 13. i 18. godine i smatra se da je uglavnom prouzročena maturacijskim čimbenicima. Kasnija pojava tercijarne zbijenosti donje čeljusti pojavljuje se nakon 18. godine i vjerojatno je prouzročena regresivnim i degenerativnim čimbenicima (10, 11).

Cilj istraživanja bio je ispitati dinamiku kraniofacaionalnog rasta tijekom adolescencije i procijeniti u kojoj je mjeri kasna zbijenost u mandibuli povezana s rastom i razvojem čeljusti i lica. Hipoteze su bile da u adolescenciji mandibula raste više od maksile, uz prednju rotaciju. Preratifikacija se da su oba fenomena izraženija kod muškaraca negoli kod žena. Očekivani rezultat je dentoalveolar kompenzacija u obliku veće retroinklinacije donjih sjekućica od proinklinacije gornjih sjekućica i smanjenje prednje dužine donjega zubnog luka. Pojava zbijenosti donjih sjekućica vjerojatno je izraženija kod muškaraca i povezivanja je s rastom mandibule negoli maksile.
(SNB), sagittal skeletal pattern / skeletal class angle (ANB), vertical skeletal pattern - Bjork's polygon and the interbasal angle (ANS-PNS: M-Go), and inclination of upper and lower incisors in relation to the skeletal maxillary and mandibular plane (13).

Plaster casts of mandibular dentition at 12 and 21 years of age were used to measure the anterior arch depth as the perpendicular from the interpremolar width (the contact point of the first and second premolars) to the most protruding lower incisor as well as the Little's Irregularity Index (14). The Index takes into account anatomical contact points of the anterior teeth and measures the deviation of the contact points. The ideal value of Little's Index is zero, and the value of the index grows with an increase in crowding.

Statistical analysis

A paired-samples t-test was used to compare the changes in facial and jaw growth parameters between the observed age groups, and an independent samples t-test to compare differences between genders. The effect size was quantified with $\eta^2$ according to the formula $\eta^2 = t^2 / (t^2-df)$, and Cohen's criteria were used for its interpretation: $\eta^2 = 0.02$ = small, $\eta^2 = 0.13$ = medium, and $\eta^2 = 0.26$ = large. The $\chi^2$ and Fisher's tests were used to compare the share of crowding categories between the types of craniofacial growth. The effect size was quantified with Cramer's $V$ and Cohen's criteria for interpretation, based on squared values of $V$. Correlations of the amount of crowding and changes in parameters of facial and jaw growth were checked on a scatterplot. The existence of linear or nonlinear relationships was checked visually. The Pearson's linear correlations was additionally performed as well as a linear regression where the dependent variable was the degree of crowding change between ages 12 and 21, and the predictors were as follows: gender, change in the maxillary and mandibular prognathism angles, sagittal skeletal class, rotational growth pattern and the anterior depth of the mandibular dental arch. A logistic regression analysis was used to determine which dental and craniofacial characteristics are predictors of the occurrence of crowding in the amounts >1, >2 and >3 mm. Dichotomous variables were used as predictors: gender, ANB <1° at the age of 12, increase of SNA <2°, increase of SNB >2°, reduction of the ANB angle >1° and >2°, reduction of the intermaxillary angle by >3°, reduction of Bjork's polygon by >3°, retroclination of mandibular incisors >2°, proclination of upper incisors >2° and reduction of anterior depth >1mm. All the statistical analyses were performed using the commercial software IBM SPSS 22 (IBM Corp, Armonk, USA).

Results

Both genders showed a significant increase in the angles of maxillary and mandibular prognathism with a large effect size ($\eta^2=0.526-0.567$; $p<0.001$) and a decrease in the skeletal class angle, which was significant only in males with a medium effect size ($\eta^2=0.188$; $p=0.015$; Figure 1). The mandible grew more than maxilla and more in males than females. The average increase in maxillary sagittal angle was 1.3±1.2° (95% CI 1.0-1.6°), mandibular 1.8±1.6° (95% CI 1.4-2.2) skeletal obrazac – Bjorkov polygon i međučeljusni kut (ANS-PNS: M-Go) te negib gorjnih i donjih sjekutica na skeletnu bazu (13).

Studijski modeli mandibularne denticije u dobi od 12 i 21 godine korišteni su za mjerenje prednje dužine zubnoga luka kao okomice najprominentnijeg donjeg sjekutica na interpretomalarnu širinu (kontaktna točka prvoga i drugoga pretkutnjaka) te Littleova indeksa nepravilnosti (14). Indeks uzima u obzir anatomske kontakte točke prednjih mandibularnih zuba te sumira njihovo odstupanje. Idealna vrijednost Littleova indeksa jest nula, a vrijednost indeksa raste s povećanjem zbijenosti.

Statistička analiza

Za usporedbu promjena parametara rasta lica i čeljusti između promatranih dobnih skupina korišten je t-test za zavisne uzorke, a za usporedbu razlika između spolova t-test za nezavisne uzorke. Veličina efekta kvantificirana je s $\chi^2$ prema formuli $\chi^2 = t^2 / (t^2-df)$, a za njezino tumačenje korišteni su Cohenov kriteriji: $\chi^2 = 0.02$ = mala veličina efekta, $0.13 - 0.26$ = srednja veličina efekta, $0.27 - 0.44$ = velika veličina efekta. Za usporedbu utječu kategorija zbijenosti između različitih tipova kraniofacijalnog rasta korišteni su $\chi^2$ i Fisherov test. Veličina efekta kvantificirana je s pomoću Cramerovog V, a Cohenov kriteriji za interpretaciju temeljili su se na kvadratnim vrijednostima V. Korelacije iznosa zbijenosti i promjena parametara rasta lica i čeljusti provjerene su na dijagramu raspršenja. Visuvalno je provjereno postojanje linearnih ili nelinearnih odnosa. Dodatno su provedene analize Pearsonove linearnе korelacije i linearna regresija gdje je zavisna varijabla bila stupanj promjene zbijenosti između 12. i 21. godine, a prediktori spol, promjena kutova maksilarnoga i mandibularnoga prognatizma, kuta skeletne klase, rotacijskog rasta i prednje dužine mandibularnoga zubnoga luka. Logističkom regresijskom analizom analizirano je koje su dentalne i kraniofacijalne karakteristike prediktori pojave zbijenosti > 1, > 2 i > 3 mm. Kao prediktori korištene su dihotomne varijable: spol, ANB <1° u dobi od 12 godina, porast SNA <2°, porast SNB >2°, smjanjenje kuta ANB >1° i >2°, smjanjenje međučeljusnoga kuta za >3°, smjanjenje Bjorkova poligona za >3°, retroinklinacija mandibularnih sjekutica >2°, proliknjenja maksilarnih sjekutica >2° i smjanjenje prednje dužine zubnoga luka >1 mm. Sve statističke analize obavljene su u komercijalnom softveru IBM SPSS 22 (IBM Corp, Armonk, SAD).

Rezultati

Kod oba spola zabilježeno je značajno povećanje kutova maksilarnoga i mandibularnoga prognatizma s velikom veličinom efekta ($\eta^2 = 0.526 – 0.567$; $p < 0.001$) i smjanjenje kuta skeletne klase, što je bilo značajno samo kod muškaraca s umjerenom veličinom efekta ($\eta^2 = 0.188$; $p = 0.015$; slika 1). Mandibula je rasla više od maksile te više kod muškaraca negoli kod žena. Prosječno povećanje kuta maksilarnoga prognatizma bilo je 1.3 ± 1,2° (95% CI 1.0 – 1,6), mandi-
Figure 1. Comparison of the changes in the skeletal sagittal jaw position between genders.
Slika 1. Usporedba promjena u skeletnoj sagitalnoj poziciji čeljusti između spolova.

Figure 2. Comparison between genders of the changes in vertical skeletal relationships and incisor proclination on the corresponding jaw base.
Slika 2. Usporedba promjene u skeletnim vertikalnim odnosima i proinklinaciji sjekutića na bazu čeljusti između spolova.

Figure 3. Changes of the mandibular dental arch.
Slika 3. Promjene mandibularnoga zubnoga luka.
while skeletal class angle decreased -0.5±1.2° (95% CI -0.2 -0.8). Between the ages of 12 and 21 years, a significant reduction in skeletal vertical dimension occurred in both genders with a large effect size (η2=0.527-0.593; p<0.001; Figure 2).

The average decrease in Bjork’s polygon was -2.9±2.6° (95% CI -2.3 -3.6), while in the intermaxillary angle it was -3.2±2.8° (95% CI -2.5 -3.9). Mandibular incisors showed a tendency for retroinclination in both genders (on average -1.0±3.9°; 95% CI 0.0 -1.9°), while maxillary incisors exhibited protrusion in males (1.7±4.9°; 95% CI -0.1 -3.5°) and a slight tendency toward retroinclination in females (-0.2±3.7°; 95% CI -1.6 -1.2°; Figure 2). Between the ages of 12 and 21 years, a significant increase of 1.8±1.7 mm on average (95% CI 1.3 -2.2; η2=0.520; p<0.001) occurred in Little’s Irregularity Index, and those findings were almost identical for men and women (Figure 3). The increase in irregularity of ≥4 mm occurred in 11.5% of cases, 1-3.9 mm in 55.7%, 0.1-0.9 mm in 21.3%, while 11.5% of cases did not undergo any changes or reductions of irregularity. The decrease in the mandibular dental arch depth was significant between the ages of 12 and 21 years in both genders with large effect size (η2=0.259; p<0.05). On average, it amounted to -0.6±1.1 mm (95% CI 0.4 -0.9°) (Figure 3).

The amount of change in incisors irregularity did not exhibit linear correlation with the amount of change in sagittal and vertical positions of jaw, inclination of incisors or dental arch depth. Less sagittal growth of maxilla (increase of SNA ≤2°) was more frequent in subjects with the occurrence of crowding, and anterior arch depth did not addititionally contribute to the model of prediction of the occurrence of mandibular incisors crowding.

Table 1. Logistic regression analysis for prediction of occurrence of late mandibular incisors crowding

| B       | SE      | p      | OR (95% CI) |
|---------|---------|--------|------------|
| Δ SNA ≤2° | 1.6     | 0.6    | 0.014      | 4.9 (1.4-17.2) |
| Δ ANB ≥1° | 1.6     | 0.8    | 0.036      | 4.8 (1.1-21.1) |

Negelkerke Pseudo • Negelkerkov pseudo R²=0.231; p=0.004. B – logistic coefficient • logistički koeficijent, SE – standard error • standardna pogreška, p – level of significance • razina značajnosti, OR – odds ratio • omjer izgleda, CI – confidence interval • interval pouzdanosti.
Discussion

This research has shown that the jaws grow during adolescence by moving forwards with the mandible growing more, i.e., longer than maxilla, which is more expressed in males. The occurrence of late mandibular incisor crowding is related to a certain extent to the amount of sagittal jaw growth.

The observed greater increase in the growth of the mandible, especially in males, is confirmed by the previous longitudinal studies (15, 16). It is considered that the craniofacial growth in males continues after the age of 18 (17). Some studies have noted a significant jaw growth potential in females during late adolescence (18). Great individual variations were observed within the group of subjects of different genders and of the same age, which raises a question of precision of growth prediction and its application in the prediction of the course and outcome of orthodontic treatment and retention (19). On the other hand, some researchers have not found any significant gender differences in the annual amount of mandibular growth in children and adolescents (20). The reduction of the skeletal class angle found in this study had also been previously reported, and has been related to a slight flattening of the profile (21). The flattening of the profile could be associated with the phenomenon of the human neoten, which represents slower physical development of features when compared to non-human primates, retaining juvenile facial characteristics in humans longer (22). The reduction of the skeletal vertical dimension occurs regardless of gender. While the vertical growth is the last to be completed, growth in width of both jaws has a tendency of completion before the adolescent growth spur and shows minimal change within the frame of adolescent changes (17).

The findings of this study have confirmed that the greater i.e., longer growth of the mandible in relation to the maxilla is followed by a dentoalveolar adaptation in the form of retroclination of lower incisors, and the proclination of upper incisors in males, and an decrease in the lower dental arch length. In females, the upper teeth also exhibit retroclination to a certain extent which might indicate a stronger influence of the lips in females. Some studies have also shown that a directed forward growth of the mandible, which could be potentially followed by a forward shift of mandibular teeth, is not present. In fact, a dentoalveolar adjustment occurs with the goal of obtaining intercuspidation (23). Previous studies have reported a lingual inclination present in the lower incisors in male subjects during the growth of the mandible (24).

The decrease in the mandibular dental arch depth in both genders between the ages of 12 and 21 years which was confirmed by this research had also been previously reported (25, 26). Some researchers have reported a more considerable decrease in females (27). A possible cause for the decrease in the mandibular dental arch depth is the earlier completion of the growth of the maxilla due to which the lower teeth resist against the upper ones, retrocline and consequently crowding occurs (28). Some studies have stated a decrease in the length of the maxilla and mandible (21, 29, 30) as a possible cause of late crowding. The increase in mandibular intercanine width during growth appears to reduce the risk of crowding (31).

Rasprava

Ovo istraživanje pokazuje da tijekom adolescencije čeljusti rastu prema naprijed, pri čemu mandibula raste više, odnosno dulje od maksile, što je jače izraženo kod muškaraca. Pojava kasne zbivenosti mandibularnih sjekutica u određenoj je mjeri povezana s količinom sagitnog rasta čeljusti.

Uočeni veći iznos rasta mandibule, osobito kod muškaraca, potvrđuju dosadašnja longitudinalna istraživanja (15, 16). Smatra se da se kraniofazijalni rast kod muškaraca nastavlja i nakon 18. godine (17). U nekim studijama istaknut je značajan potencijal rasta čeljusti kod žena tijekom kasne adolescencije (18). Uočene su velike individualne varijacije unutar skupine ispitanika različitog spola i iste dobi, pa se postavlja pitanje o preciznosti predviđanja rasta i njegovoj primjeni u predviđanju tijeka i ishoda ortodontske terapije i retencije (19). S druge strane, autori nekih istraživanja ne nalaze značajne spolne razlike u godišnjoj količini rasta mandibule kod djece i adolescenata (20). Smanjenje kuta skeletne klase u ovoj studiji reportirano je i ranije te je povezano s blagim poravnanjem profila donje trećine lica (21). Poravnanje profila moglo bi se povezati s fenomenom humane neotenije koja predstavlja sporiji fizički razvoj u usporedbi s nehumanim primatima, pri čemu se mladenačke značajke lica kod ljudi dulje zadržavaju (22). Smanjenje skeletne vertikalne dimenzije događa se bez obzira na spol. Iako je vertikalni rast posljednji koji se završava, transverzalni rast objavljuje čeljusti ima tendenciju završiti prije pubertetskog vrhunca rasta te pokazuje minimalne promjene u sklopu adolescentnih promjena (17).

Nalazi iz ove studije potvrđuju da veći, odnosno duži rast mandibule u odnosu na maksilu prati dentoalveolarnu adaptaciju u obliku retroinklinacije mandibularnih sjekutica, proinklinacije maksiarnih sjekutica kod muškaraca te smanjenja prednje dužine mandibularnoga zubnoga luka. Kod žena gornji zubi pokazuju u određenoj mjeri postojanje maksiarnih sjekutica kod djece i adolescenata, što je povezano s blagim poravnanjem profila donje trećine lica (21). Poravnanje profila moglo bi se povezati s fenomenom humane neotenije kod djece i adolescenata, koja predstavlja sporiji fizički razvoj u usporedbi s nehumanim primatima, pri čemu se mladenačke značajke lica kod ljudi dulje zadržavaju (22).

Smanjenje prednje dužine mandibularnoga zubnoga luka kod žena gornji zubi pokazuju u određenoj mjeri postojanje maksiarnih sjekutica, koja predstavlja sporiji fizički razvoj u usporedbi s nehumanim primatima, pri čemu se mladenačke značajke lica kod ljudi dulje zadržavaju (22). Smanjenje prednje dužine mandibularnoga zubnoga luka kod žena gornji zubi pokazuju u određenoj mjeri postojanje maksiarnih sjekutica, koja predstavlja sporiji fizički razvoj u usporedbi s nehumanim primatima, pri čemu se mladenačke značajke lica kod ljudi dulje zadržavaju (22).
A generational trend of facial height decrease has been reported (32). However, horizontal growth of the jaw does not indicate an increase in the degree of crowding (33), and some studies have not found a correlation between crowding and vertical skeletal dimensions (34, 35). Conversely, some studies have reported a bigger degree of late crowding in subjects with the hyperdivergent jaw growth and increased lower third of the face (21). Others cite increased upper portions of the face, an increase in the mandibular angle and a decrease in the length of the mandible, i.e., the SNB angle (36, 37). Increased values of Little’s Index mark a greater degree of crowding, although certain studies question the value of Little’s Index and have found it limited in accuracy and precision, which may also be a limitation of the present study (38). For a long time the eruption of third molars was considered the leading cause of crowding, but research has not found a causal connection because the eruption of third molars simply coincides in time with the occurrence of late mandibular incisor crowding (39, 40). The etiology of late mandibular incisor crowding is multifactorial. Leading theories suggest that the problem is caused either by mesial movement of posterior teeth or by lingual movement of anterior teeth. Other theories attribute late crowding to the growth of jaws, occlusion, dental arch dimensions, tooth size, masticatory forces. In addition, a periodontal disease with the loss of alveolar bone can also contribute to it (41).

Conclusion

During adolescence, between ages 12 to 21, a longer, i.e., greater growth of mandible is observed compared to maxilla. This is especially prominent in males. A greater mandibular growth is accompanied by mandibular incisor retroclination and a decrease in the mandibular dental arch depth and the occurrence of mandibular incisor crowding. The differential sagittal growth of the maxilla and mandible is related to the occurrence of late crowding. It has been established that mandible grows more in amount and for longer duration than maxilla.

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Conflict of interest

The authors declare no conflict of interest.
Sazetak
Cilj: Analizirati kraniofacijalni rast tijekom adolescencije u dobi od 12. do 21. godine i njegovu povezanost s kasnom zbijaonosti mandibularnih sjekutića. Metode: U studiju je sudjelovalo 61 ortodontski netretirani ispitanik (49% muškaraca). Za procjenu rasta čeljusti i nagiba sjekutića korišten je laterolateralni kefalogram. Izmjereni su Littleov indeks nepravilnosti i prednja dužina donjeg zubnog luka. Rezultati: Uočeno je smanjenje kute skeletne klase (ANB) kod oba spola, iako značajno samo kod muškaraca (p = 0,188; p < 0,015). Mandibula je rasla više od maksila i to više kod muškaraca negoli kod žena. No, skeletna vertikalna dimenzija pokazala je značajno smanjenje u oba spola (p = 0,572 – 0,593, < p < 0,001). Mandibularni sjekutici imali su tendenciju retinoklinacije u oba spola, a maksilarni su bili skloni proklinaciji kod muškaraca te blagoj retinoklinaciji kod žena. Primijećeno je smanjenje prednje dužine donjeg zubnog luka u oba spola (p = 0,259; p < 0,05). Povećanje nepravilnosti sjekutića u prosjeku je iznosilo 1,8 ± 1,7 mm (95% CI 1,3 – 2,2; n = 0,520; p < 0,001), a uočeno je u oba spola. Logistička regresija otkrila je da su manji sagitale rast maksile (povećanje kuta SNA ≥ 2°) i smanjenje konveksiteta sagitalnog međučeljusnog odnosa (smanjenje ANB ≥ 1°) bili značajni prediktori nastanka zbijaonosti. Littleov indeks nepravilnosti ≥ 1 mm dajući omjere izgleda od 4,9 i 4,8.

Zaključci: Diferencijalni rast maksile i mandibule povezan je s pojavom kasne zbijaonosti mandibularnih sjekutića u prosjeku od manje količine sagitale nepravilnosti kod žena. Zbijaonost se najčešće javlja kod žena u dobi od 16 do 20 godina. Nepravilnosti među sjekutićima, posebno ANB ≥ 1°, i konveksiteta međučeljusnog odnosa ≥ 2°, su značajni prediktori za zbijaonost kod žena.

Autorske ključne riječi: kraniofacijalni rast, adolescencija, kefalometrija, zbijaonost

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