International Journal of Biomedicine 13(2) (2023) 281-285
http://dx.doi.org/10.21103/Article13(2)_OA15

ORIGINAL ARTICLE

Dentistry

INTERNATIONAL JOURNAL OF BIOMEDICINE

The Occlusal Characteristics of Kosovar Adolescents

Blertë Zylfiu-Latifi[1], Blerim Kamberi[2], Senka Meštrović[3]

[1]*School of Dental Medicine, Postgraduate Studies, Department of Orthodontics, University of Zagreb, Zagreb, Croatia*
[2]*Department of Endodontics and Restorative Dentistry, University of Prishtina, Prishtina, Kosovo*
[3]*Department of Orthodontics, University of Zagreb, Zagreb, Croatia*

Abstract

Background: This study aimed to evaluate the occlusal characteristics of the maxillary and mandibular dental arches in Kosovar adolescents in relation to gender.

Methods and Results: In a cross-sectional study, dental casts of 400 Kosovar schoolchildren (184 males and 216 females, mean age of 15.17 years) were evaluated. Little's index of incisor irregularity (LII), overjet, and overbite were measured with a digital caliper, and then analyzed and compared by gender. In both the maxilla and mandible, LII for males and females was significantly different, with male values being higher than female values. In contrast, no significant differences were observed in overbite and overjet.

Conclusion: In Kosovar adolescents, our findings show significant gender differences in Little's irregularity index. The overjet and overbite were higher in males than in females, but there were no statistical differences between genders in Kosovar adolescents for these parameters.(**International Journal of Biomedicine. 2023;13(2):281-285.**)

Keywords: adolescents • dental occlusion • Little's irregularity index • gender

For citation: Zylfiu-Latifi B, Kamberi B, Meštrović S. The Occlusal Characteristics of Kosovar Adolescents. International Journal of Biomedicine. 2023;13(2):281-285. doi:10.21103/Article13(2)_OA15

Introduction

Irregularity Incisor Index

Crowding of the anterior teeth is one of the most common signs of malocclusion and is one of the primary reasons for patients seeking orthodontic treatment.[1-3] Although crowding alone does not determine the orthodontic treatment needed, it is an important factor to consider.[4] Generally, it seems agreed that dental crowding is a multifactorial condition that cannot be produced by one specific cause alone. It is nevertheless important that the orthodontic treatment plan addresses as many of the patient's concerns as possible.[5]

There is considerable demand for orthodontic treatment due to aesthetic expectations related to the crowding of the maxillary incisors.[6] However, their exposure decreases with age, making the mandibular incisors' crowding more visible. This can also affect the appearance of the smile.[7]

On the other hand, according to Buschang, crowding of the lower incisors is common, with up to 40% of the general population having moderate to severe crowding.[8] An analysis of changes in occlusal characteristics in 27 individuals by Tibana and colleagues found no significant sexual dimorphism.[9]

The literature describes several techniques for quantifying crowding for epidemiological purposes. The irregularity index was proposed by R.M. Little[1] as a viable and consistent quantitative technique for measuring anterior crowding. Using this index, he calculated the rate of initial mal relationship and the outcome of initial crowding post-treatment and post-retention.

Overjet and Overbite

Orthodontists usually measure the overjet and overbite as part of the routine orthodontic diagnosis. Nonetheless, both values need to be assessed accurately, as they indicate the sagittal and vertical relationship between the incisors in the upper and lower jaws.

Some studies have found that the relationship between the upper and lower incisors from a vertical and horizontal perspective varies at different stages of facial development.[9]

***Corresponding author**: *Blertë Zylfiu-Latifi, DMD, School of Dental Medicine, Postgraduate Studies University of Zagreb, Zagreb, Croatia. E-mail: blertezylfiu@gmail.com*

A study of occlusal changes at every stage of a person's growth can be beneficial to orthodontists.[10] According to Tibana et al.,[9] orthodontists should know how occlusion varies during all growth phases.

The bite structure and position of the teeth in the mouth continually change throughout a person's growth until adulthood, according to Björk.[11] Teeth, dental arches, and their relationship, i.e., occlusion, change, as do their shapes and sizes.

A number of longitudinal studies published in the past few years have revealed increases in overjets and overbites between genders during the replacement of dentition.[11-13] A study by Sinclaire and Little[13] revealed that the occlusal characteristics of females changed more severely than those of males. In their longitudinal study of 33 sets of plaster casts of 18 females and 15 males aged 7 to 32, Heikinheimo et al.[14] reported that overjet increased in Finns with normal occlusions between ages 7 and 10. Thereafter, in males and females, there was a continual decrease up to age 32, peaking between 12 and 15. In contrast, they found that among females aged 7 to 32, overbite increased, while it decreased in males. However, in both genders, overbite increased between ages 7 and 12.

In his longitudinal study of overbites in 60 individuals (30 males and 30 females) from ages 8 to 20, Bergersen[15] noted that overbites decreased as the second and the third molars erupted during the teenage years. Furthermore, he found no differences between the overbites of males and females aged 8 to 20.

Among 27 individuals (14 women and 13 men) aged 21 to 28 years, Tibana and colleagues[9] discovered no changes in the overjet but an increase in the overbite at the completion of the observation time. However, no sexual dimorphism was observed.

Björk[11] noted that the variability of the overjet in Swedish boys was higher than the overbite at ages 12 and 20. The overjet usually alters with age, causing the mandible's anterior teeth to migrate forward relative to the maxilla. These typical aging changes are minor. However, differences among individuals, reflected in aging, are relatively high.

Meanwhile, other authors[11,13,16,17] have studied and described the changes of the bite related to gender and aging in growing individuals, utilizing dental casts or a series of radiographs. In the opinion of Björk,[11] the variations in an individual's bite during growth are attributed to dental, facial, and cranial development. Consequently, chewing, breathing, speaking, and mimicking contribute to forming or modifying the bite structure.

To our knowledge, there is no evidence of occlusal characteristics in the Kosovar population. Hence, this study was designed to examine the occlusal characteristics of Kosovar adolescents based on their gender.

Materials and Methods

Seven major cities in Kosovo were studied cross-sectionally. In order to calculate the sample size, we used statistics from the Kosovo Agency of Kosovo. Based on a list of primary and secondary schools, 400 Kosovar adolescents (184 males and 216 females) aged 13 to 19 years (mean age of 15.17 years) were randomly chosen using a multistage cluster sampling procedure. This study included the following participants: Kosovar nationality, ages 13 to 19, fully erupted permanent teeth, excluding third molars; no orthodontic history; no abrasions, no attrition, no big restorations; no fractured teeth; no abnormal tooth morphology; high-quality study casts. Study approval was obtained from the School of Dental Medicine Ethics Committee at the University of Zagreb (05-PA-30-XXIII-1/2021).

Materials and Methods

For the informed consent to be valid, it had to be signed either by the participant, if over 18 years old, or by a parent, if under 18. To make pre-orthodontic casts, alginate was used to take impressions of the mandible and maxilla and then poured into plaster models. A digital caliper (CD-6 ASX; Mitutoyo Corp., Kanagawa, Japan) with an accuracy of 0.01mm was used to measure 400 dental casts directly.

To assess the irregularity in the frontal upper and lower teeth, we used Little's irregularity index (LII).[1] The degree of anterior irregularity was estimated by summing the incisor and canine linear displacements. Overjet was defined as the distance measured in a parallel direction from the most pronounced position of the maxillary central incisor's incisal edge to the labial surface of the mandibular central incisor.[14] Further, overbite was determined in the vertical plane of the maxillary central incisor's incisal edge, with the labial surface of the mandibular central incisor parallel to the maxillary occlusal surface having the highest overlap.[14]

Thirty participants' dental casts were randomly selected for intra-observer reliability, and premeasurement was performed after 24 hours. To calculate any inaccuracy of the method, the formula of Dahlberg was used, which varied from -0.15 mm to 0.19 mm.[18]

Statistical analysis was performed using statistical software package SPSS version 25.0 (SPSS Inc, Armonk, NY: IBM Corp). The normality of distribution of continuous variables was tested by the Kolmogorov-Smirnov test with the Lilliefors correction and Shapiro-Wilk test. For data with normal distribution, inter-group comparisons were performed using Student's t-test. For nonparametric data, the Mann-Whitney U Test was used to compare the differences between the two independent groups. A probability value of $P<0.05$ was considered statistically significant.

Results

The general characteristics of schoolchildren are shown in Table 1. Table 2 summarizes occlusal parameter mean values, standard deviations (SD), and variances (VAR). The results show that males and females differ significantly in the index of maxillary and mandibular LII, with males having higher dimensions than females ($P=0.009$ and $P=0.006$, respectively) (Table 3). In contrast, no significant differences were observed in overbite and overjet ($P>0.05$ in both cases) (Table 3).

Table 1.

Characteristics of the participants (n=400).

	Gender, n (%)	Mean age, yrs.
Male	184 (46%)	15.30 ± 1.91
Female	216 (54%)	15.05 ± 1.91
Total	400	15.17 ± 1.91

Table 2.

Descriptive statistics of occlusal parameters (n=400).

	Mean	Minimum	Maximum	SD	VAR
Upper LII	4.52	1.1	13.50	1.77	3.158
Lower LII	2.74	0.7	9.6	1.24	1.543
Overjet	3.23	-3.5	12.0	1.92	3.712
Overbite	3.60	-6.0	7.8	1.70	2.908

Table 3.

Gender distribution of occlusal parameters (n=400).

	Female (n=216)		Male (n=184)		
	Mean Rank	Sum of Ranks	Mean Rank	Sum of Ranks	*P*-value^
Maxilla LII	186.48	40279.50	216.96	39920.50	0.009
Mandible LII	185.94	40164.00	217.59	40036.00	0.006
Overjet	192.25	41526.50	210.18	38673.50	0.118
Overbite	196.44	42431.00	205.27	37769.00	0.446

^- Mann Whitney U-test

Discussion

In our study, males showed higher irregularity indexes of incisors, overjets, and overbites than females, indicating gender differences in Kosovar adolescents. According to Morrison et al., the irregularity index serves as an epidemiological tool because it: a) improves the accuracy of screening examinations conducted in nonclinical settings; b) is easy to perform; c) requires little technical skill; and d) produces rapid results.[19]

According to our findings, the mean value of crowding was higher in maxillary incisors than in mandibular incisors (Table 2). This finding is supported by some studies that confirm that the increase in the crowding of upper incisors is more distinct than the increase in lower incisors during this period of human development.[16,20] Sampson [21] stated that breathing through the mouth, decay, and removal of teeth are the causes of overcrowding of incisors. However, our study excluded the subjects with extractions, extensive caries, and large fillings, due to the possible effects on occlusion. Moreover, Tibana et al.[9] stated that mouth breathing, as a parafunctional oral habit, is known to have severe effects on stomatognathic structures. An assessment of breathing could verify the association. It would be interesting to consider this in future studies, although our methodology did not take it into account.

Our study also found differences in the incisal irregularity index in males and females, with males having higher incisal irregularity than females in both jaws (Table 3). In contrast, Carter and McNamara found that only mandibular LII differed between genders. Males exhibited more LII than females; however, the change in irregularity was the same in both genders.[16] A few studies have reported that mandibular LII increases on average over the course of a lifetime, regardless of orthodontic therapy. As a result, tooth retention, interproximal reductions, or limited orthodontic treatment are needed when incisor alignment is required long-term.[22] In contrast, Buschang et al.[23] showed that adult females with Class II malocclusions had more maxillary incisor irregularities and fewer mandibular incisor irregularities than those with Class I malocclusion. Meanwhile, Ghaib et al. [24] found that male subjects with a Class II malocclusion had more upper LII, while female subjects with a Class I malocclusion showed a higher prevalence of crowded mandibular incisors.

Overjet values in our study differed between males and females, with males having average values higher than females but without statistical significance ($P>0.05$) (Table 3). This is in contrast with the findings of Lara-Carillo et al.[25] in the Mexican population, which reported that males had greater overjet than females in both Mazahua and Mestizo adolescents. In the most recent study, Olliver et al.[26] concluded in a review cohort study that overjet was about 0.5 mm higher, and overbite was about 0.5 mm lower in middle age than in adolescence. Regarding gender differences, females had higher overjet and overbite at age 45 than males. Several previous studies found no significant differences between men and women. In their study, Staley et al.[27] found that the genders had similar dimensions and did not differ significantly. In 1998, Carter and McNamara reported in their longitudinal study, which consisted of 53 subjects' dental casts, that untreated males had an overjet decrease of 0.6 mm between 13.8 and 17.2 years of age, whereas no difference was found in females. Furthermore, the overjet in the UMGS sample aged 17 to 48 did not change by sex.[16] When Bishara et al.[28] studied individuals aged 5 to 15, they reported minimal changes in overjet. In a later study with a group aged 25 to 45, Bishara et al.[20] corroborated the same findings. Further, Akgül and Toygar[29] analyzed 14 females and 16 males over a period of 22 to 32 years. They reported that the overjet did not show significant changes in either males or females. More recently, Stern et al.[30] found no statistical differences in overjet between men and women from birth until 26 years of age, in their longitudinal study on untreated German children with normal occlusion.

The present study found no significant differences between males and females with respect to overbite ($P>0.05$) (Table 3). Several previous studies found similar results, such as Carter and McNamara,[16] who found no difference in overbite between males and females, and Bauerle,[31] who found no significant sex differences at any age. Fleming also

found no differences in the extent of overbite in males and females for Class I malocclusions, although the mean values for females tended to be slightly higher.[32] More recently, Stern et al.[30] found no statistical differences in overbite between males and females from birth to age 26 in their longitudinal study of untreated German children with normal occlusion. In contrast, in the population of Mexico, Lara-Carillo et al.[25] reported that males had a greater overbite than females. On the other hand, Akgül and Toygar [29] found that the overbite increased significantly in females. However, according to Bergersen,[15] there is a consensus that overbite usually increases during mixed dentition and decreases during the teenage years. Researchers also agree that the rise in overbite may be caused by the increase in cuspid arch width, which typically occurs when the permanent maxillary incisors and canines erupt in the mouth.[12,33,34] Furthermore, the differences in overbite depth between men and women are insignificant.[31,32,35] Harris and Smith[36] revealed that, whereas genetic variation affects arch width and arch length to a substantial degree, more than genetic variability among families, environmental factors influence occlusal variables, including overjet, overbite, molar relationship, crowding, and rotations.

We are aware that our study has some limits. First, the sample was not equally distributed among the malocclusion classes. Second, the dental measurements were performed in 2D rather than using a 3D method.

While this study has some limitations, it also has some strengths. It was the first of its kind in our country and used a representative sample.

In conclusion, in Kosovar adolescents, our findings show significant gender differences in Little's irregularity index. These results provide basic information about occlusal characteristics in the young Kosovar population. In Kosovar orthodontics, they have significant clinical implications, particularly for improving diagnosis and treatment planning.

Acknowledgments

It was a pleasure to work with the schoolchildren, and we thank them for their time and attention.

Competing Interests

The authors declare that they have no competing interests.

References

1. Little RM. The irregularity index: a quantitative score of mandibular anterior alignment. Am J Orthod. 1975 Nov;68(5):554-63. doi: 10.1016/0002-9416(75)90086-x.
2. Gilmore CA, Little RM. Mandibular incisor dimensions and crowding. Am J Orthod. 1984 Dec;86(6):493-502. doi: 10.1016/s0002-9416(84)90355-5.
3. Gosney MB. An investigation into some of the factors influencing the desire for orthodontic treatment. Br J Orthod. 1986 Apr;13(2):87-94. doi: 10.1179/bjo.13.2.87.
4. Bernabé E, Flores-Mir C. Estimating arch length discrepancy through Little's Irregularity Index for epidemiological use. Eur J Orthod. 2006 Jun;28(3):269-73. doi: 10.1093/ejo/cji112.
5. Bishara SE. Textbook of Orthodontics, 1st ed., WB Saunders Co., Philadelphia, 2001.
6. Marques LS, Pordeus IA, Ramos-Jorge ML, Filogônio CA, Filogônio CB, Pereira LJ, Paiva SM. Factors associated with the desire for orthodontic treatment among Brazilian adolescents and their parents. BMC Oral Health. 2009 Dec 18;9:34. doi: 10.1186/1472-6831-9-34.
7. Dong JK, Jin TH, Cho HW, Oh SC. The esthetics of the smile: a review of some recent studies. Int J Prosthodont. 1999 Jan-Feb;12(1):9-19.
8. Buschang PH, Shulman JD. Incisor crowding in untreated persons 15-50 years of age: United States, 1988-1994. Angle Orthod. 2003 Oct;73(5):502-8. doi: 10.1043/0003-3219(2003)073<0502:ICIUPY>2.0.CO;2.
9. Tibana RH, Palagi LM, Miguel JA. Changes in dental arch measurements of young adults with normal occlusion--a longitudinal study. Angle Orthod. 2004 Oct;74(5):618-23. doi: 10.1043/0003-3219(2004)074<0618:CIDAMO>2.0.CO;2.
10. Arslan SG, Kama JD, Sahin S, Hamamci O. Longitudinal changes in dental arches from mixed to permanent dentition in a Turkish population. Am J Orthod Dentofacial Orthop. 2007 Nov;132(5):576.e15-21. doi: 10.1016/j.ajodo.2007.06.009.
11. Björk A.Variability and age changes in overjet and overbite: Report from a follow-up study of individuals from 12 to 20 years of age. Am J Orthod. 1953 Oct; 39(10):779–801. doi: 10.1016/0002-9416(53)90084-0
12. Moorrees CFA. The dentition of the growing child. A longitudinal study of dental development between 3 and 18 years of age. Cambridge: Harvard University Press, 1959.
13. Sinclair PM, Little RM. Maturation of untreated normal occlusions. Am J Orthod. 1983 Feb;83(2):114-23. doi: 10.1016/s0002-9416(83)90296-8.
14. Heikinheimo K, Nyström M, Heikinheimo T, Pirttiniemi P, Pirinen S. Dental arch width, overbite, and overjet in a Finnish population with normal occlusion between the ages of 7 and 32 years. Eur J Orthod. 2012 Aug;34(4):418-26. doi: 10.1093/ejo/cjr025.
15. Bergersen EO. A longitudinal study of anterior vertical overbite from eight to twenty years of age. Angle Orthod. 1988 Jul;58(3):237-56. doi: 10.1043/0003-3219(1988)058<0237:ALSOAV>2.0.CO;2.
16. Carter GA, McNamara JA Jr. Longitudinal dental arch changes in adults. Am J Orthod Dentofacial Orthop. 1998 Jul;114(1):88-99. doi: 10.1016/s0889-5406(98)70243-4.
17. SILLMAN JH. Serial study of good occlusion from birth to 12 years of age. Am J Orthod. 1951 Jul;37(7):481-507. doi: 10.1016/0002-9416(51)90070-x.
18. Dahlberg G. Statistical methods for medical and biological students. George Allen & Unwin Cambridge, 1940.
19. Morrison AS, Rothman KJ, Greenland S. Screening Modern Epidemiology. Lippincott-Raven Publishers, Philadelphia, 1998.
20. Bishara SE, Treder JE, Damon P, Olsen M. Changes in the dental arches and dentition between 25 and 45 years of age. Angle Orthod. 1996;66(6):417-22. doi: 10.1043/0003-3219(1996)066<0417:CITDAA>2.3.CO;2.
21. Samspon WJ. Current controversies in late incisor crowding. Ann Acad Med Singap. 1995 Jan;24(1):129-37.

22. Sheridan JJ. Air-rotor stripping. J Clin Orthod. 1985 Jan;19(1):43-59.
23. Buschang PH, Stroud J, Alexander RG. Differences in dental arch morphology among adult females with untreated Class I and Class II malocclusion. Eur J Orthod. 1994 Feb;16(1):47-52. doi: 10.1093/ejo/16.1.47.
24. Ghaib NH, Mohammed-Salih HS, Al-Atabi HS. Irregularity Index with Gender Differences using Exocad System. Med J Babylon 2016;13(4):885–895.
25. Lara-Carillo E, Gonzalez-Perez JC, Kubodera-Ito T, Montiel-Bastida NM, Esquivel-Pereyra GI. Dental arch morphology of Mazahua and mestizo teenagers from central Mexico. Braz J Oral Sci. 2009;8(2):92–96. doi: 10.20396/BJOS.V812.8642252
26. Olliver SJ, Broadbent JM, Prasad S, Cai C, Thomson WM, Farella M. Changes in incisor relationship over the life course - Findings from a cohort study. J Dent. 2022 Feb;117:103919. doi: 10.1016/j.jdent.2021.103919.
27. Staley RN, Stuntz WR, Peterson LC. A comparison of arch widths in adults with normal occlusion and adults with class II, Division 1 malocclusion. Am J Orthod. 1985 Aug;88(2):163-9. doi: 10.1016/0002-9416(85)90241-6.
28. Bishara SE, Peterson LC, Bishara EC. Changes in facial dimensions and relationships between the ages of 5 and 25 years. Am J Orthod. 1984 Mar;85(3):238-52. doi: 10.1016/0002-9416(84)90063-0.
29. Akgül AA, Toygar TU. Natural craniofacial changes in the third decade of life: a longitudinal study. Am J Orthod Dentofacial Orthop. 2002 Nov;122(5):512-22. doi: 10.1067/mod.2002.128861.
30. Stern S, Finke H, Strosinski M, Mueller-Hagedorn S, McNamara JA, Stahl F. Longitudinal changes in the dental arches and soft tissue profile of untreated subjects with normal occlusion. J Orofac Orthop. 2020 May;81(3):192-208. doi: 10.1007/s00056-020-00221-x.
31. Bauerle, JR. A longitudinal study of incisor overbite from the deciduous dentition to age 15. University of Iowa, M.S. thesis, 1949.
32. Fleming, HB. An investigation of the vertical overbite during the eruption of the permanent dentition. Angle Orthod. 1961;31:53–62. doi: 10.1043/0003-3219(1961)031<0053:AIOTVO>2.0.CO;2
33. Barrow GV, White JR. Developmental changes of the maxillary and mandibular dental arches. Angle Orthod. 1952;22:41–46. doi: 10.1043/0003-3219(1952)022<0041:DCOTMA>2.0.CO;2
34. Henriques AC. The growth of the palate and the growth of the face during the period of the changing dentition. Am J Orthod. 1953;39:836–358. doi: 10.1016/0002-9416(53)90044-x
35. Herness LE, Rule JT, Williams BH. A longitudinal cephalometric study of incisor overbite from ages five to eleven. Angle Orthod. 1973 Jul;43(3):279-88. doi: 10.1043/0003-3219(1973)043<0279:ALCSOI>2.0.CO;2.
36. Harris EF, Smith RJ. A study of occlusion and arch widths in families. Am J Orthod. 1980 Aug;78(2):155-63. doi: 10.1016/0002-9416(80)90057-3.