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Povezanost između eruptivnih stadija trećeg kutnjaka i dentalne dobi kod bosansko-hercegovačke djece i adolescenata

The Correlation between Third Molar Eruptive Stages and Dental Age in Bosnian and Herzegovinian Children and Adolescents

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Sažetak

Svrha: Svrha istraživanja bila je pronaći poveznicu između eruptivnih stadija trećih maksilarnih i mandibularnih kutnjaka s lijeve i desne strane čeljusti. **Materijali i metode:** Uzorak istraživanja činilo je 529 ortopantomograma (OPG-a) – 264 (49,9%) pripadalo je muškom spolu, a 265 (50,1%) ženskom spolu u dobi između 8 i 25 godina. Sudionici su bili prema Olzeovoj metodi podijeljeni u šest dobnih skupina. **Rezultati:** Dobivene su visoke vrijednosti Spearmanova koeficijenta povezanosti između eruptivnih stadija lijevih i desnih maksilarnih i mandibularnih trećih molara. Između spolova nisu pronađene statistički značajne razlike u eruptivnim stadijima. **Zaključak:** Prema dobivenim rezultatima za procjenu dentalne dobi u bosansko-hercegovačkoj populaciji, preporučujemo Olzeovu metodu i treće mandibularne molare. Treba istaknuti da su moguće razvojne asimetrije i da svaki dentalni antropolog mora biti svjestan te činjenice. Svaka strana čeljusti trebala bi se posebno procjenjivati.

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Ključne riječi

kutnjak, treći; zub, izrastanje; dob, određivanje pomoću zuba

Uvod

Procjena dobi djece važna je u pedodontiji, ortodontiji, endokrinologiji, arheologiji, dentalnoj antropologiji i forenzičnoj medicini (1–3).

Dob djeteta može se vrlo precizno procijeniti zato što se mnogi zubi istodobno razvijaju i kalcificiraju. Ta točnost smanjuje se kako se završava razvoj denticije (4–7).

Procjena dobi djeteta otežana je nakon navršanih 14 godina jer je kod svih zuba, osim onih neizniklih, završena apeksogeneza (8). Za razliku od ostalih trajnih zuba, treći kutnjaci jako se rijetko koriste za određivanje dobi jer znatno variraju u poziciji, veličini, vremenu formiranja i vremenu izbijanja. Unatoč tomu najstabilniji su biološki indikator za određivanje dobi u adolescenciji i mladosti (raspon od 15 do 23 godine) (9,10).

Introduction

Age estimation in children is a fundamental question in pediatric and orthodontic dentistry, pediatric- endocrinology, archeology, dental paleopathology and in forensic medicine (1-3).

The dental age can be assessed amongst children with greater accuracy. This is because many teeth are undergoing development and calcification simultaneously. However, this accuracy decreases with the completion of dental development (4-7).

Age estimation is especially difficult after the age of 14 years because all of the teeth, except unerupted ones, are in the process of completing their apical formation (8). Contrary to other permanent teeth, third molars are less frequently used for dental age determination due to their variability

Točnost u određivanju dobi na temelju trećih kutnjaka bitna je kada se trebaju odrediti godine pojedinca, a nema prijašnje dokumentacije o toj osobi. Nadalje ta metoda može biti korisna kod određivanja dobi osoba koje su doživjele gubitak pamćenja ili kod forenzičnih uzoraka, odnosno tijekom antropoloških istraživanja (4).

Trenutačno se primjenjuju mnogobrojne metode za određivanje dentalne dobi. Većina se temelji na analizi razvojnih stadija trećih molara koji se procjenjuju s ortopantomograma (OPG)(9).

Svrha ovog istraživanja bila je upozoriti na povezanost između eruptivnih stadija trećih kutnjaka s lijeve i desne strane čeljusti te gornje i donje čeljusti.

Materijali i metode

Uzorak za istraživanje sastojao se od 529 OPG-a – 264 (49,9 %) pripadala su muškom spolu, a 265 (50,1 %) ženskom. Svim sudionicima bio je zabilježen datum i zatim su podijeljeni u šest skupina. RTG-snimke skupljale su se dvije godine (2011. i 2012.) i posuđene su iz medicinske dokumentacije Stomatološkog fakulteta Sveučilišta u Sarajevu. Korištene su isključivo one bosansko-hercegovačkih pacijenta učinjene zbog određenih specijalističkih indikacija. Isto su tako analizirane isključivo snimke na kojima su bila sva četiri treća kutnjaka, a najmanje dva kutnjaka su imati normalan oblik. Ukupno je obrađeno 2 116 trećih molara – 1058 gornjih i 1058 donjih.

Erupcija trećih kutnjaka podijeljena je u četiri stadija – od A do D te raščlanjena prema Olzeovoj metodi:
 stadij A: okluzalna površina prekrivena alveolarnom kosti
 stadij B: potpuna resorpcija alveolarne kosti preko okluzalne površine
 stadij C: gingivu probija barem jedna kvržica kutnjaka
 stadij D: potpuna erupcija kutnjaka u okluzalnu ravninu (9, 11–16).

Statistika

Razlika u kronologiji nicanja trećih kutnjaka između sudionika i sudionica ispitana je t-testom. Spearmanov koeficijent korelacije izračunat je kako bi se odredila korelacija između eruptivnih stadija lijevih i desnih trećih kutnjaka lijeve i desne čeljusti. Statistička analiza obavljena je programom SPSS – verzija 15.

Rezultati

U ponovljenom nasumičnom uzorku od 53 ortopantomograma dobivene su jednake vrijednosti tako da je kappa vrijednost (potvrda pouzdanosti ispitivača) iznosila 1.

Statistička analiza otkrila je visok Spearmanov korelacijski koeficijent između eruptivnih stadija lijevih i desnih te gornjih i donjih trećih kutnjaka. Isti koeficijent pokazuje najveće vrijednosti ($r=0,989$) eruptivnih stadija trećih kutnjaka

in position, size, time of formation and time of eruption. However, third molars remain the most reliable biologic indicator available for estimation of age during adolescent and early adult period (span of 15-23 years) (9, 10).

The precision of age determination using third molars is crucially important when there is a need to determine the juvenile or adult status of an individual when no valid document is available. Furthermore, this form of age estimation can be applied to assess the age of patient suffering from amnesia and also on specimens of forensic or anthropological importance(4).

Numerous methods are currently used for dental age estimation. Most of the methods are based on developmental phases of third molars as seen on panoramic radiographs (OPGs)(9).

The aim of this study was to show correlation of eruptive developmental phases of third molars between the right and left side in the upper and lower jaws.

Materials and Methods

The sample of this study consisted of 529 OPGs of 264 (49.9%) male and 265 (50.1%) female subjects, aged 8 to 25 years, divided into six groups, with known dates of birth. Panoramic radiographs were collected during two years (2011-2012) from the archive of the School of Dental Medicine, University of Sarajevo. We have used OPGs of Bosnian and Herzegovinian patients exclusively, which were made according to strict specialist instructions. This investigation used only OPGs with all four third molars present, wherein at least two of them had normal shape. In total, 2116 third molars were analyzed; there were 1058 upper and 1058 lower molars.

Eruptive phases of third molars were classified according to 4 stages, from A to D, and analyzed by Olze method. Stage A: Occlusal plane covered with alveolar bone. Stage B: Alveolar emergence; complete resorption of alveolar bone over occlusal plane. Stage C: Gingival emergence; penetration of gingival by at least one dental cusp. Stage D: Complete emergence in occlusal plane(9, 11-16).

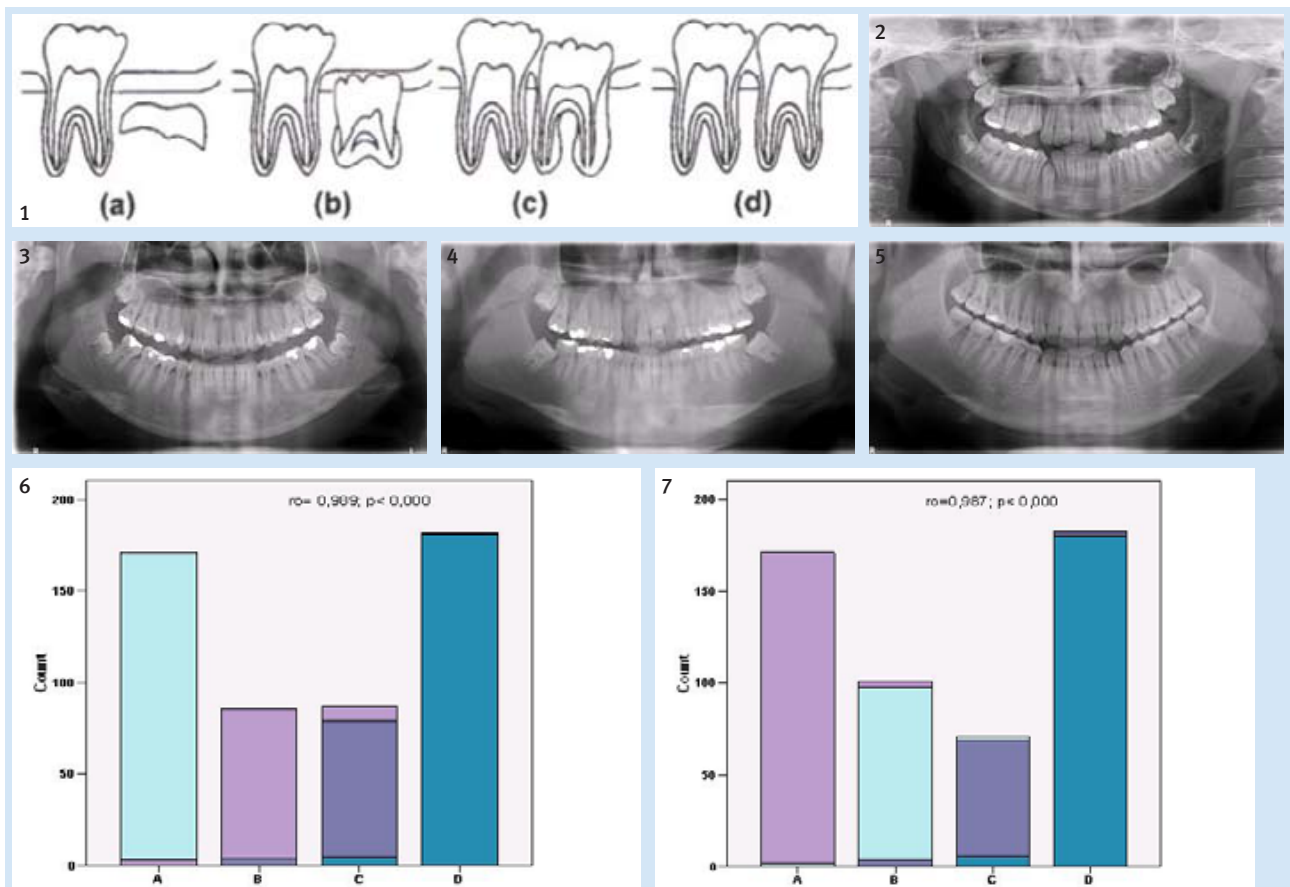
Statistics

Difference in chronology of the third molar eruption between males and females was tested using t-test. Spearman's correlation coefficients were computed to assess the correlation between eruptive stages of left and right third molars in both jaws. Statistical analysis was performed by SPSS program, 15 version.

Results

Identical findings were observed in a repeated random sample of 53 OPGs and therefore the kappa value (confirming intra-examiner reliability) was 1.

Statistical analysis revealed a high Spearman's correlation coefficient between eruptive developmental stages of the right and left lower and upper third molars. This coefficient shows the highest value ($r=0.989$) of third molars' eruptive devel-



Slika 1. Nicanje trećeg kutnjaka; stadiji od A do D. Preuzeto iz Olze A. et al. *Studies of the Chronological Course of Wisdom Tooth Eruption in a Black African Population. J Forensic Sci, 2007*; OPG-e je procijenio strani istraživač (A.S.)

Figure 1 Stages A to D of third molar eruption. It was taken over from Olze A. et al. *Studies of the Chronological Course of Wisdom Tooth Eruption in a Black African Population. J Forensic Sci, 2007*; OPG evaluation was performed by a single investigator (A.S.).

Slika 2. Treći mandibularni kutnjak u stadiju A; vidi se potpuna formacija krune zube unutar dentalnog folikula, a formacije korijena još nema; okluzalna površina prekrivena je alveolarnom kosti

Figure 2 Mandibular third molar in Stage A. The crown is completely formed within the dental follicle but the root has not yet begun to develop. The occlusal plane is covered with alveolar bone.

Slika 3. Treći mandibularni kutnjak u stadiju B; počeo je razvoj korijena i prisutna je potpuna resorpcija alveolarne kosti iznad okluzalne ravnine – alveolarno probijanje

Figure 3 Mandibular third molar in Stage B. The roots have started to develop and there is complete resorption of alveolar bone over occlusal plane- Alveolar emergence.

Slika 4. Treći mandibularni kutnjak u stadiju C; uočavaju se dvije trećine formacije korijena i zub je počeo izbijati iako još nije dosegnuo okluzalnu ravninu susjednog zuba – gingivalno probijanje

Figure 4 Mandibular third molar in Stage C. The roots have developed to two-thirds of their length and the tooth has started to erupt, although it has not yet reached the occlusal plane of the adjacent second molar- Gingival emergence.

Slika 5. Treći mandibularni kutnjak u stadiju D; korijen je potpuno razvijen, uključujući i formiranje apeksa; zub je dosegnuo okluzalnu površinu susjednih zuba – potpuno izrastanje u okluzalnu površinu

Figure 5 Mandibular third molar in stage D. The roots have completely developed, including closure of the apices, and the tooth has reached the level of the occlusal plane of the adjacent second molar- Complete emergence in occlusal plane.

Slika 6. Povezanost proporcije eruptivnih stadija trećih kutnjaka s desne i lijeve strane u gornjoj čeljusti

Figure 6 Correlation rates of third molars' eruptive phases between the right and left side in the upper jaw.

Slika 7. Povezanost proporcije eruptivnih stadija trećih kutnjaka s desne i lijeve strane u donjoj čeljusti

Figure 7 Correlation rates of third molars' eruptive phases between the right and left side in the lower jaw.

između desne strane u gornjoj čeljusti i lijeve strane u donjoj čeljusti. Slijede vrijednosti za $ro=0,987$ između desne i lijeve strane u gornjoj čeljusti; $ro=0,966$ između lijeve strane u obje čeljusti; $ro=0,964$ između desne strane u donjoj i lijeve strane u gornjoj čeljusti. Najmanje vrijednosti Spearmanova koeficijenta ($ro=0,961$) zabilježene su kod usporedbe desnih strana u obje čeljusti. Ista vrijednost dobivena je u usporedbi eruptivnih stadija trećih kutnjaka na desnoj strani gornje čeljusti i na lijevoj strani donje čeljusti. Istaknimo da u istraživanju nije bila zabilježena značajna razlika između razvojnih stadija trećih kutnjaka kod sudionika i sudionica.

opment phase between right side in the upper and left side in the lower jaw. This is followed by $ro=0,987$ between the right side in lower and left side in the upper jaw; $ro=0,966$ between left sides in both jaws; $ro=0,964$ between the right side in lower and left side in upper jaw. While Spearman's correlation coefficient has the smallest value ($ro=0,961$) comparing the right sides in both jaws. Also, it is same value ($ro=0,961$) for third molars' eruptive phases on the right side in the upper and left side in the lower jaw. Overall, no significant differences were found in third molar development between males and females.

Tablica 1. Redoslijed Spearmanove korelacije – eruptivne faze desne i lijeve strane gornje i donje čeljusti
Table 1 Spearman rank correlation- Third molars' eruptive phases on the right and left sides in the upper and lower jaw

			Upper (right)	Upper (left)	Lower (right)	Lower (left)
Spearman's rho	Gornji (desni) • Upper (right)	Correl. Coefficient	1.000	0.989**	0.961**	0.961**
		Sig. (p)	.	0.000	0.000	0.000
		N	526	526	526	526
	Gornji (lijevi) • Upper (left)	Correl. Coefficient	0.989**	1.000	0.964**	0.966**
		Sig. (p)	0.000	.	0.000	0.000
		N	526	526	526	526
	Donji (desni) • Lower (right)	Correl. Coefficient	0.961**	0.964**	1.000	0.987**
		Sig. (p)	0.000	0.000	.	0.000
		N	526	526	526	526
	Donji (lijevi) • Lower (left)	Correl. Coefficient	0.961**	0.966**	0.987**	1.000
		Sig. (p)	0.000	0.000	0.000	.
		N	526	526	526	526

** Statistički značajno p<0,01 • Statistically significant on p<0.01

Tablica 2. Statistički podatci o godinama izbijanja zuba 18, 28, 38 i 48 prema stadiju kod ispitanika
Table 2 Statistical data on the age of emergence of teeth 18, 28, 38 and 48, by stage, in males.

	n	Min.	Percentile 25	Median	Percentile 75	Max.	Mean	Std. Dev.	
18	A	84	8.00	9.00	10.00	12.00	10.92	2.59	
	B	42	11.00	13.00	14.00	16.00	23.00	14.55	2.09
	C	39	14.00	16.00	17.00	18.00	25.00	17.18	2.20
	D	97	17.00	20.00	22.00	24.00	25.00	21.88	2.25
28	A	82	8.00	9.00	10.00	12.00	22.00	10.77	2.42
	B	46	11.00	13.00	14.00	16.00	23.00	14.61	2.08
	C	36	14.00	16.00	17.00	18.00	22.00	17.17	1.70
	D	98	17.00	20.00	22.00	24.00	25.00	21.91	2.26
38	A	84	8.00	9.00	10.00	12.00	23.00	10.89	2.67
	B	49	11.00	14.00	15.00	16.00	19.00	14.90	1.87
	C	34	13.00	16.00	17.00	18.00	25.00	17.32	2.29
	D	95	17.00	20.00	22.00	24.00	25.00	21.96	2.20
48	A	82	8.00	9.00	10.00	12.00	22.00	10.70	2.29
	B	50	11.00	14.00	14.50	16.00	23.00	15.06	2.26
	C	34	13.00	16.00	17.00	18.00	22.00	17.15	1.92
	D	96	17.00	20.00	22.00	24.00	25.00	21.95	2.24

Tablica 3. Statistički podatci o godinama izbijanja zuba 18, 28, 38 i 48 prema stadiju kod ispitanica
Table 3 Statistical data on the age of emergence of teeth 18, 28, 38 and 48, by stage, in females.

	n	Min.	Percentile 25	Median	Percentile 75	Max.	Mean	Std. Dev.	
18	A	87	8.00	10.00	10.00	12.00	18.00	10.92	2.07
	B	44	11.00	14.00	14.50	15.00	21.00	14.80	1.91
	C	48	14.00	16.50	17.00	20.00	25.00	18.21	2.53
	D	85	17.00	21.00	22.00	24.00	25.00	21.99	2.14
28	A	86	8.00	10.00	10.00	12.00	18.00	10.86	2.01
	B	47	11.00	14.00	15.00	16.00	25.00	15.06	2.37
	C	43	14.00	16.00	17.00	19.00	25.00	17.88	2.18
	D	88	17.00	21.00	22.00	24.00	25.00	21.97	2.15
38	A	87	8.00	10.00	10.00	12.00	18.00	10.92	2.10
	B	52	11.00	14.00	15.00	16.50	25.00	15.25	2.29
	C	37	15.00	16.00	17.00	19.00	21.00	17.65	1.70
	D	88	17.00	21.00	22.00	24.00	25.00	22.14	2.04
48	A	90	8.00	10.00	10.50	12.00	18.00	10.98	2.10
	B	48	13.00	14.00	15.00	16.50	25.00	15.35	2.24
	C	36	15.00	16.00	17.00	19.50	22.00	17.83	1.92
	D	90	17.00	21.00	22.00	24.00	25.00	21.97	2.20

Statistički značajna razlika između muških i ženskih ispitanika (p<0,05) • Statistically significant difference between males and females (p<0.05)

Rasprava

Razvoj trećih kutnjaka važan je za određivanje dobi adolescenata i mladih odraslih ljudi. U nekoliko istraživanja autori su upozorili da se kronološki stadiji mineralizacije umnjaka razlikuju između populacija i rasa (4, 9, 17).

U našem istraživanju nismo pronašli statistički značajne razlike u eruptivnim stadijima trećih kutnjaka između desne i lijeve strane obiju čeljusti. Većina stručnjaka slaže se s tim zaključkom. Neki procjenjuju eruptivne stadije, a drugi samo razvoj trećih kutnjaka.

Tako su Prieto i njegovi suradnici (18) istaknuli u svojem istraživanju o razvoju umnjaka u španjolskoj populaciji u dobi od 14 do 21 godine vrlo visok korelacijski koeficijent između desne i lijeve strane čeljusti kod mladića i djevojaka. Zaključili su da umnjaci u toj populaciji ranije postižu određeni stadij razvoja i nicanja nego umnjaci u populaciji skandinavskih zemalja, ili u američkoj, njemačkoj, japanskoj i južno-afričkoj.

Kurita i suradnici (18) nisu pronašli statistički značajne razlike između eruptivnih stadija trećih kutnjaka s lijeve i desne strane, pa se može reći da su kod ispitanika u Brazilu sinkronizirani eruptivni stadiji trećih molara lijeve i desne strane.

Golovencu i njegovi kolege (4) istraživali su populaciju u Rumunjskoj na ispitanicima između 11 i 25 godina te zaključili kako nema statistički značajne razlike između razvoja umnjaka u obje čeljusti.

Legović i suradnici (20) proveli su istraživanje na djeci i adolescentima u Istri o eruptivnim stadijima trećih kutnjaka prema kronološkoj dobi te također nisu pronašli statistički značajne razlike u razvoju i eruptivnim stadijima trećih kutnjaka lijeve i desne strane čeljusti.

Li Guo je sa svojim kolegama (20) procjenjivao dentalnu dob kineske djece i adolescenata te nije pronašao statistički značajnu razliku u razvoju trećih kutnjaka s desne i lijeve strane obje čeljusti.

Orhan i suradnici (22) istraživali su populaciju djece u Turskoj te su došli do istih zaključaka kao i ostali autori.

S druge strane Van Vlierberghe i kolege (23) nisu pronašli povezanost u eruptivnim stadijima između desne i lijeve strane maksile. U gornjoj čeljusti su treći kutnjaci s desne strane imali nešto veće vrijednosti nego treći kutnjaci s lijeve strane, ali to se odnosilo samo na muškarce. Ocjenjivanje gornjih molara ponekad može otežati superpozicija maksilarnih sinusa ili tubera maksile preko korijena kutnjaka. Autori predlažu ocjenjivanje donjih molara kako bi se premostili ti problemi.

Knell (24) i Mincer (25) pronašli su asimetriju korijena lijevih i desnih zuba u obje čeljusti.

Zaključak

Prema dobivenim rezultatima možemo kod bosansko-hercegovačke populacije preporučiti korištenje umnjaka donje čeljusti pri ocjenjivanju dentalne dobi prema Olzeovoj metodi. Važno je istaknuti da forenzični stomatolozi moraju biti svjesni asimetrija u razvoju i erupciji trećih kutnjaka. Svaka strana čeljusti mora biti posebno procijenjena.

Discussion

Third molars' development is important for dental age estimation in adolescents and in early adult period. Several studies showed that chronological course of wisdom teeth mineralization varies slightly between different populations and races (4, 9, 17).

We have found no significant difference in eruptive phases of third molars between the right and left sides in both jaws in our investigation. Majority of authors agree with this statement. Some of them assess eruptive stages, but the others assess development of the third molars teeth.

Prieto et al. (18) found in their investigation of the development of wisdom teeth in Spanish population, aged 14 to 21 years old, a very high correlation coefficient between the right and left observed third molars in both males and females. They discovered that the wisdom teeth reached the same phases in Spanish population earlier than in Scandinavian, American, German, Japanese and South African population.

Kurita et al. (19) did not find a statistically significant difference in eruption stages of third molars between the right and left side, i.e. the wisdom teeth reached the same eruptive phases at almost the same time as in Brazilian children.

Golovencu et al. (4) estimated the dental age in Romanian population, aged 11-25 years, and they concluded that there were no significant differences between the development of wisdom teeth in both sides of jaws.

Legović et al. (20) did not find a significant difference between the development of third molars on both sides of the jaws in their investigation of eruptive phases of these teeth according to chronological age in Croatian (Istria) population of children and adolescents.

Li Guo et al. (21) estimated the dental age in Chinese children and adolescent population. They did not find any significant differences between the development on the right and left sides in the jaws.

In their age estimation of Turkish population of children and adolescents, Orhan et al. (22) obtained similar results to other authors.

On the other side, Van Vlierberghe et al. (23) found no correlation in eruptive phases between the right and left sides of the maxilla. In the upper jaws, the right side seemed to have a higher score than the left side but this difference was only significant for males. Therefore, scoring the upper molars is sometimes difficult when the bottom of the maxillary sinus or the maxillary tuberositas eclipse the roots. Authors recommend using wisdom teeth in lower jaws for assessing dental age to overcome this problem.

Knell et al. (24) and Mincer et al. (25) have found right-left asymmetry in developing teeth roots in both jaws.

Conclusion

Based on this study, we can recommend wisdom teeth in lower jaws for assessing the dental age by Olze method in Bosnian and Herzegovinian population. More importantly, it should be mentioned that forensic odontologists must be aware of the fact that asymmetry in development and eruption is possible. Both sides should be independently evaluated.

Abstract

Aim: The aim of this study was to assess the correlation of eruptive stages of third molars between right and left side in upper and lower jaws. **Material and methods:** The sample for this study consisted of 529 OPGs of 264 (49.9%) male and 265 (50.1%) female subjects, aged 8 to 25 years, divided into six groups, with known chronological age, by Olze method. **Results:** there was a high Spearman's correlation coefficient between eruptive stages of the right and left lower and upper third molars. Overall, no significant differences were found in third molar eruption between males and females. **Conclusion:** We recommend using third molars in lower jaws for assessing the dental age by Olze method on Bosnian and Herzegovinian population by using our results. It is important to mention that forensic odontologists must be aware of the fact that asymmetry in development is possible. Both sides should be independently evaluated.

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Key words

Molar, Third; Tooth Eruption; Age Determination by Teeth

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