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Presence of Third Molar Germs in Orthodontic Patients with Class II/2 and Class III Malocclusions

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A B S T R A C T

The aim of this study was to determine the presence of third molar germs in patients with Class II/2 and Class III malocclusions. The study comprised 146 examinees from Zagreb and Istria. Examinees with Class II/2 malocclusions amounted to 77 and those with Class III 69. With regard to development of dentition the examinees were divided into two groups: Group I subjects with early mixed dentition (23 subjects with Class II/2 and 21 subjects with Class III), and Group II subjects with late mixed dentition (54 subjects with Class II/2 and 48 subjects with Class III). Assessments were made from panoramic radiographs and lateral cephalograms. The Pearson χ^2-test and Fisher's exact test was used to determine statistical significance in differences. Assessments showed that third molar germs were present significantly more often in the upper jaw in Class II/2 (58% vs. *44%) and in the lower jaw in Class III (83%* vs. *69%). In subjects with Class II/2 all third molar germs were present statistically more often in late mixed dentition, which was also determined for maxillary third molar germs in Class III. The presence of mandibular third molar germs in Class III examinees was almost equal in both periods of mixed dentitions. The study confirmed correlation between the presence of third molar germs and sagital maxillomandibular relationship and encourages investigation of the differences in calcifications of all permanent teeth in such malocclusions.*

Key words: *third molar germs, malocclusion, Class II/2, Class III, Croatia*

Introduction

Third molars differ from other molars in several respects. They are more variable in size, shape, timing of formation and eruption and agenesis[1,2]. The relationship between third molars and crowding has been debated for many years[3–6]. Merifield[7] advocated posterior crowding and suggested that orthodontists should consider the entire dentition. Richardson[8,9] reported that molar crowding implies crowding at the back of the first molar. It has been recognised that third molars have a great effect on posterior crowding. Posterior crowding is thought to have an inhibitory effect on eruption of the second and third molars and may cause relapse after orthodontic treatment, regardless of whether or not premolars have been extracted. Sato[10] suggested that posterior crowding due to the existence of third molars influenced the dentofacial skeletal structure and the development of malocclusions. On the other hand, there have been many reports that describe the congenital absence of third molars in European American[7] and Asian patients. In Japan, many investigators and clinicians, especially orthodontists, believe that an increase in agenesis of permanent teeth is related to degeneration of dentofacial development over the past 5000 years[18]. Is there a tendency for a higher incidence of agenesis of third molars? Unfortunately, there have only been a few reports on chronological changes in third molar agenesis or on the relationship between the agenesis of third molars and dentofacial structures[22]. Skeletal Class II patients generally

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have a large maxilla and/or small mandible, whereas skeletal Class III patients generally have a small maxilla and/or large mandible. Is there any connection between this statement and the timing of the formation and eruption of third molars in respective jaws? The percentage of Japanese orthodontic patients with one or more third molar ageneses is lower in skeletal Class II patients than in skeletal Class III patients. Some reports also speculate that the same genes may regulate both craniofacial and tooth morphogenesis[17]. Recently, Peck et al.[24] stated that Class II/2 anomalies may actually be polygenic and additive in nature, through combined expression of genetically determined anatomical components and are closely associated with congenital tooth anomalies[25]. Segregation analysis of the prognathic mandible in 37 families of patients confirmed the role of genetic influence in the aetiology of this trait[26] and a genome-wide linkage analysis identifies loci susceptible to mandibular prognathism[27]. On the basis of these facts we investigated the existence of third molar germs in Croatian orthodontic patients with Class II/2 and Class III malocclusions with positive familiar pattern and examined the relationship between the existence of third molars germs and such sagital maxillomandibular jaw relationship. Third molars or third molar germs refer to both impacted germs and erupted teeth.

Subjects and Methods

The study was conducted in 146 subjects (61 males and 85 females) with Class II/2 (77 subjects) and Class III malocclusions (69 subjects), inhabitants of the region of Istria and the city of Zagreb in Croatia. All patients were divided into two groups, according to the period of eruption of permanent teeth: Group I patients in early mixed dentition, period of eruption of permanent incisors (23 subjects with Class II/2 and 21 subjects with Class III), and Group II patients in late mixed dentition, period of eruption of permanent canines, premolars and second molars (54 subjects with Class II/2 and 48 subjects with Class III). The cases were selected according to the clinical charts, study models, lateral cephalograms, panoramic radiographs and interviews with parents in order to determine the hereditary patterns. Subjects with congenital deformities, such as cleft palate and anomalies in the number of teeth beside third molars, were excluded from the study. All cases were accepted after full agreement of the three investigators. Standard panoramic radiographs and lateral cephalograms taken were used to determine the presence of third molar germs and to measure the ANB angle and the inclination of the maxillary incisors. The ANB angle of each subject and the inclination of upper incisors was measured from the lateral cephalograms. Subjects were classified according to sagital malocclusion. Subjects with skeletal Class II/2 as an ANB angle of more than 4.5° and skeletal Class III as an ANB angle of less than 0.5°. Maxillary incisor angulation was used as selection criteria for Class II/2 subjects (U1:ANS-PNS less than 105.5°). Lateral cephalograms were taken by a standardised technique with the jaws in centric occlusion. The magnification of each film was standardised to 8%. Each cephalograph was digitalised using Microtek Scan Maker i900 and processed in Dolphin software. Cephalometric landmarks were marked on each patient's lateral head film. To minimise possible errors in landmark identification, each landmark was determined by two authors. In cases in which a landmark identification mismatch occurred, the point was again examined and decided on by the two other orthodontists. The percentage of the presence of each of the four third molar germs was calculated. Percentages of third molar germs in the Class II/2 group and Class III group were compared using the Pearson χ^2-test. The same test was used to compare the presence of the third molar germs between the jaws. Comparison of the presence of third molar germs in two periods of mixed dentition in Class II/2 and Class III anomalies were calculated using Fischer's exact test.

Results

The presence of third molar germs was determined as the presence of 18 or 28 in the upper and 38 or 48 in the lower jaw. The presence of 18 was not significant be-

TABLE 1
PRESENCE OF GERMS OF 18, 28, 38 AND 48 IN CLASS II/2 AND CLASS III MALOCCLUSIONS

	Third molar germs							
	18		28		38		48	
	no	yes	no	yes	no	yes	no	yes
Class II/2	33	44	31	46	23	54	24	53
% (of total in Class II/2)	43%	57%	40%	60%	30%	70%	31%	69%
Class III	38	31	39	30	11	58	13	56
% (of total in Class III)	55%	45%	57%	43%	16%	84%	19%	81%
p (Pearson χ^2-test)	0.140		0.049		0.046		0.087	

p – level of statistical significance, 18 – right upper third molar, 28 – left upper third molar, 38 – left lower third molar, 48 – right lower third molar

TABLE 2
PREVALENCE OF THIRD MOLAR GERMS WITH RESPEC TO THE JAW (UPPER OR LOWER)

	Upper jaw (18 or 28)		Lower jaw (38 or 48)		p (Pearson χ^2) – comparison of jaws
	no	yes	no	yes	
Class II/2	64	90	47	107	0.051
% (of total in Class II/2)	42%	58%	31%	69%	
Class III	77	61	24	114	<0.001
% (of total in Class III)	56%	44%	17%	83%	
p (Pearson χ^2) – comparison of class	0.015		0.009		

p – level of statistical significance, 18 – right upper third molar, 28 – left upper third molar, 38 – left lower third molar, 48 – right lower third molar

tween the examined malocclusions (57% Class II/2 *vs*. 45% Class III). The presence of 28 was significantly higher in subjects with Class II/2 malocclusion (60% Class II/2 *vs*. 43% Class III). The presence of 38 (70% Class II/2 *vs*. 84% Class III) and 48 (69% Class II/2 *vs*. 81% Class III) was significantly higher in subjects with Class III malocclusion (Table 1). Pearson χ^2-test showed that the presence of third molar germs in the upper jaw was statistically more significant in patients with Class II/2 (58% *vs*. 44%) and the presence of third molar germs in the lower jaw was statistically more significant in patients with Class III malocclusion (83% *vs*. 69%). Correlation of the presence of third molar germs respectively by class and malocclusion shows that in both malocclusions the presence of third molar germs was higher in the mandible, which was significant in Class II/2 (69% *vs*. 58%) and highly significant in subjects with Class III malocclusion (83% *vs*. 44%) (Table 2). Table 3 shows the presence of third molar germs respectively for the period of mixed dentition and malocclusion. The presence of all third molar germs (18, 28, 38 and 48) in subjects with Class II/2 was more statistically significant in Group II than in Group I. The presence of maxillary third molar germs (both 18 and 28) was more significant in Group II, but the presence of mandibular one (both 38 and 48) was almost the same in both periods of mixed dentition. Correlation of the presence of third molar germs in each period of mixed dentition malocclusions respectively shows: in Group I there were no significant differences in the presence of 18 between malocclusions (17% *vs*. 14%, p= 0.998). The presence of 28 in subjects with Class II/2 was higher but not statistically significant (30% *vs*. 11%, p=0.137). The presence of 38 was statistically significantly higher in subjects with Class III (81% *vs*. 35%, p=0.003) as was the presence of 48 (81% *vs*. 43%, p= 0.015). In Group II: the presence of 18 was not significantly higher in subjects with Class II/2 than in subjects with Class III (74% *vs*. 58%, p=0.098), as was the with presence of 28 (72% *vs*. 58%, p=0.150). The presence of 38 was not significant between subjects with Class II/2

TABLE 3
PREVALENCE OF THIRD MOLAR GERMS WITH RESPEC TO DEVELOPMENT OF DENTITION AND MALOCCLUSION

	Groups	Third molar germs							
		18		28		38		48	
		no	yes	no	yes	no	yes	no	yes
Class II/2	I	19	4	16	7	15	8	13	10
		83%	17%	70%	30%	65%	35%	57%	43%
	II	14	40	15	39	8	46	11	43
		26%	74%	28%	72%	15%	85%	20%	80%
p (Fisher's exact test)		<0.001		<0.001		<0.001		0.003	
Class III	I	18	3	19	2	4	17	4	17
		86%	14%	90%	10%	19%	81%	19%	81%
	II	20	28	20	28	7	41	9	39
		42%	58%	42%	58%	15%	85%	19%	81%
p (Fisher's exact test)		0.001		<0.001		0.725		1.000	

p – level of statistical significance, 18 – right upper third molar, 28 – left upper third molar, 38 – left lower third molar, 48 – right lower third molar

TABLE 4
PRESENCE OF THIRD MOLAR GERMS WITH RESPEC TO GENDER AND MALOCCLUSIONS

Class	Sex	Third molar germs							
		18		28		38		48	
		no	yes	no	yes	no	yes	no	yes
II/2	M	17	17	17	17	13	21	12	22
		50%	50%	50%	50%	38%	62%	35%	65%
	F	16	27	14	29	10	33	12	31
		37%	63%	33%	67%	23%	77%	28%	72%
p (Fisher's exact test)		0.354		0.161		0.211		0.621	
III	M	17	10	17	10	5	22	6	21
		63%	37%	63%	37%	19%	81%	22%	78%
	F	21	21	22	20	6	36	7	35
		50%	50%	52%	48%	14%	86%	17%	83%
p (Fisher's exact test)		0.329		0.459		0.740		0.753	

p – level of statistical significance, M – male, F – female, 18 – right upper third molar, 28 – left upper third molar, 38 – left lower third molar, 48 – right lower third molar

and Class III (85% *vs*. 55%, p=1.000), as was 48 between Class II/2 and Class III (80% *vs*. 81%, p=0.998). Table 4 shows that there were no significant differences in the presence of third molar germs between genders.

Discussion

Massler et al.[28] reported that third molar crypt formation begins at 3 to 4 years of age. Calcification starts at 7 to 10 years of age, and calcification of the crown is completed at 12 to 16 years of age. Eruption begins at 17 to 21 years of age. This means that few people younger than 15 years old would have had a third molar extracted because of dental disease such as pericoronitis. Maxillary third molar germs were present significantly more often in patients with Class II/2 (58% *vs*. 44%). Mandibular third molar germs were present significantly more often in patients with Class III (83% *vs*. 69%). Kajii et al.[29] reported that the frequency of maxillary third molar agenesis significantly increases with a smaller maxilla. Because skeletal Class II patients generally have a large maxilla and/or small mandible[23] and skeletal Class III patients generally have a small maxilla and/or large mandible, these results also explain why the percentage of skeletal Class II patients missing one or more third molars is lower than that of skeletal Class III patients[22].Therefore, a space deficiency for eruption of not only mandibular third molars but also mandibular second molars is often found in Class II patients[30,31]. In subjects with Class II/2 all third molar germs were present statistically more often in late mixed dentition. Maxillary third molar germs in Class II subjects were present statistically more often in late mixed dentition and the presence of mandibular third molar germs were almost equal in both dentitions. There have been some reports comparing the agenesis of third molars in different races. The presence and calcification of the third molar crypt begins later in patient with Class II/2 malocclusion, which would be connected with the earlier presence of space in the jaws for crypt formation in subjects with Class III. Retromolar space and direction of facial growth do not affect vertical and sagital changing of the position of the once formed crypt[32]. Brothwell et al.[33] and Stewart[34] reported that third molar agenesis in the Mongolian population, including the Japanese population, is higher than that in the European/ American population. They also reported that the highest frequency of third molar germs was found in black subjects. We speculate that one of reasons for these racial differences is that the Mongolian population may have more skeletal Class III patients who have a small maxilla than the European/American population. There seems to be a difference in third molar agenesis in the upper and lower arches between Asians and European/Americans. Specifically, mandibular third molar agenesis is lower than maxillary third molar agenesis in Asians[17–19,22] but not in European/Americans[1,11–15]. This suggestion is supported by results reported by Hillson[35]. On the other hand, some reports have suggested that homeobox genes and growth factor regulate craniofacial and tooth morphogenesis. A mutation of the MSX1 gene at chromosome 4p16.1 causes agenesis of second premolars and third molars in humans[36,37] PAX9 at chromosome 14q12-q13 is also associated with tooth agenesis[38], especially molar agenesis[39]. Thus, some polygenetic inheritance controlling maxillary dimensions may be related to genes on formation of third molar germs. The study confirms correlation between the presence of third molar germs and sagital maxillomandibular relationship and suggests the need for a future study, to investigate the development of all permanent teeth in examinees with Class II/2 and III ma- locclusions.

Conclusions

Maxillary third molar germs were present significantly more often in patients with Class II/2. Mandibular third molar germs were present significantly more often in patients with Class III. In subjects with Class II/2 all third molar germs were present statistically more often in late mixed dentition. Maxillary third molar germs in Class III subjects were present statistically more often in late mixed dentition and the presence of mandibular third molar germs were almost equal in both dentitions. There were no significant correlations between genders. The study confirmed correlation between the presence of third molar germs and sagital maxillomandibular relationship in Croatian orthodontic patients.

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PRISUTNOST ZAMETAKA UMNJAKA KOD ORTODONTSKIH PACIJENATA S MALOKLUZIJAMA KLASE II/2 I KLASE III

SAŽETAK

Cilj rada bio je odrediti razlike u prisutnosti umnjaka kod pacijenata s malokluzijama klase II/2 i klase III. Istraživanje je provedeno na 146 ispitanika porijeklom iz Zagreba i Istre. Ispitanika s malokluzijom klase II/2 bilo je 77, a onih s klasom III 69. Glede razvoja denticije ispitanici su podijeljeni u dvije grupe: grupa I oni s ranim stadijem mješovite denticije (23 s klasom II/2 i 21 s klasom III); grupa II oni s kasnim stadijem razvoja denticije (54 s klasom II/2 i 48 s klasom III). Raščlamba je vršena na ortopantomogramskim i LL telerendgenskim snimkama glave. Prikupljeni podaci statistički su obrađeni pomoću χ^2-Pearson testa i Fisher egzaktnog testa. Raščlamba pokazuje da je u gornjoj čeljusti statistički značajna viša prisutnost umnjaka u klasi II/2 (58%–44%), a u donjoj čeljusti u klasi III (83%–69%). U ispitanika s malokluzijom klase II/2 svi su umnjaci bili češće prisutni u stadiju kasne mješiovite denticije, što je utvrđeno i za gornje umnjake kod ispitanika s klasom III. Prisutnost donjih umnjaka u ispitanika klase III podjednaka je u obje faze mješovite denticije. Ispitivanje je potvrdilo povezanost prisustva umnjaka i sagitalnih međučeljusnih odnosa. Ono je i poticaj da se kod ovih malokluzija ispita razlika u mineralizaciji svih trajnih zuba obje čeljusti.