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Morphology of third molar teeth with incompletely formed apices on the basis of panoramic radiograms

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Third molar teeth are causative factors of many oral pathologies. Lower third molars are the most often retained teeth and the origin of considerable pain. The aim of the study is a presentation of the morphology of third molars with incompletely formed apices on the basis of panoramic radiograms. The material comprised routine panoramic radiograms taken in the years 1996–2000. In the cases where third molars with incompletely formed apices were found, there was determined the location of the teeth in the alveolar process. The angle between occlusal plane and tooth axis was measured, which allowed determination of angularity of the teeth. Retromolar space width ratio was also calculated as a prognostic radiographic feature on which an estimation of future eruption of mandibular third molars could be based. In retained teeth the reasons for impaction, such as incorrect angularity, insufficient retromolar space, presence of pathological lesions impeding eruption, were analysed. Panoramic radiograms proved useful in diagnostics of morphology of third molars with incompletely formed apices.

key words: retromolar space ratio, tooth inclination, eruption

INTRODUCTION

Third molar teeth, especially mandibular ones, are the cause of numerous oral pathologies. They are the most often retained and impacted teeth, after the maxillary third molar, and are frequently the origin of considerable pain and complications. They are also a causative factor of pathologies, including periodontitis, osteomyelitis, inflammation of oral mucosa, crowding of mandibular incisors or even neuralgias, and association with neoplastic lesions [2, 4]. Therefore extraction of an impacted mandibular third molar is one of the most often performed procedures in oral surgery. The knowledge of morphology of the third molar and prognosis on its eruption influences the clinical decision about its extraction and allows the prediction of complications of the procedure [1].

Panoramic radiography is a radiological technique in which there is produced a single tomographic X-ray image of curved facial structures, including the maxillary and mandibular dental arches together with their supporting structures. On the basis of panoramic radiograms it is possible to evaluate developing third molars and their surrounding tissues [3].

The aim of the paper is a presentation of the morphology of third molars with incompletely formed apices on the basis of panoramic radiograms.

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MATERIAL AND METHODS

The material consisted of routine panoramic radiograms taken in the years 1996–2000 in the Department of Dental and Maxillofacial Radiology of the Medical University of Lublin by means of DM 2002 CC Proline (Planmeca, Helsinki, Finland). For the purpose of this study there were qualified 25 adolescent female patients who had two panoramic views taken within several years and who attended a follow-up radiological study at 16 years of age.

On the two subsequent radiograms there was defined the position of the developing mandibular third molars in the bone. In order to do this, the following were determined [3, 4]:

1. The line of the occlusal plane running through the buccal cusps of premolars and molars.
2. The axis of the developing molar that passed through the centre of the crown width and the centre of root bifurcation of a given tooth.
3. The angle between the occlusal plane and the axis of the tooth (Fig. 1).

On the basis of this angle the following classification [3, 4, 13] of the position of the mandibular molar was applied:

1. Improper position of the tooth in the mandibular bone:
   a. Mesioangular (impaction towards second molar) — the angle range from +10 to +80 degrees;
   b. Distoangular (impaction towards ramus of the mandible) — the angle range from +100 to +170 degrees;
   c. Horizontal — the angle range from +350 to +10 degrees as well as from +170 to +190 degrees;
   d. Inversion of the tooth — other angles;
   e. Transverse position.
2. Proper position — vertical — the angle range from +80 to +100 degrees.

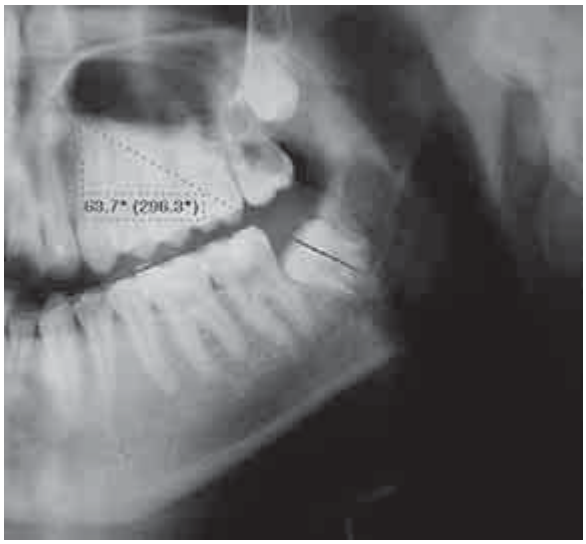

Figure 1. Measurement of the inclination of a third mandibular molar — the angle between the occlusal plane and tooth axis is +63.7 degrees, which means that the tooth is mesioangular.

Furthermore, for the mandibular molars there was calculated the so-called retromolar space ratio, being a prognostic factor for the possibility of tooth eruption [4, 7]. For this reason there was measured the retromolar space (X) — that is the distance between the point of intersection of the occlusal plane with the tangent to distal surface of the second molar, and the point of intersection of the occlusal plane with anterior margin of mandibular ramus. There was also measured the mesiodistal width of the third molar crown (Y). The retromolar space index was calculated using the X to Y ratio. If the ratio is below 1, even a properly positioned tooth lacks retromolar space and will not erupt in the dental arch. When the ratio is over 1, the width of the retromolar space is sufficient in order to allow eruption in the dental arch.

On analysis of the radiograms attention was paid to the presence of any pathological lesions that would impede eruption.

For statistical analysis of the results T-Student's test was used.

RESULTS

As far as the morphology of the analysed molars is concerned, all teeth were two-rooted and located over the mandibular canal. No pathologic lesions were found that would contribute to retention of the teeth.

Among the studied 50 teeth on the first radiogram, only one tooth was in horizontal position (angle equalled +8 degrees) (Fig. 2) and four were in proper vertical position, which favoured eruption (angles from +87 to +91 degrees). The remaining teeth were in mesioangular position, with angles ranging from as low as +14 to as high as +78 degrees (mean +51.8) (Fig. 1).

On the follow-up radiograms four vertically positioned molars did not change their inclination, however unfavourable retromolar indices did not allow eruption of two of them (Fig. 3). The horizontally located tooth slightly changed its inclination from +8 to +18 degrees and reached mesioangular position (Fig. 4). Only one of the 50 teeth turned to the vertical position in the period of observation, however the angle change was not extensive — from +78

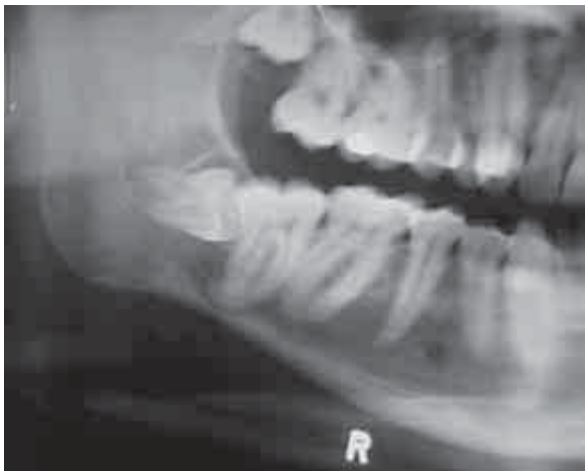

Figure 2. Mandibular third molar in horizontal position on the first radiogram.

Figure 3. Shortage of retromolar space impeding eruption of a vertically positioned lower third molar.

Figure 4. The same molar as in Figure 2 on the follow-up image. Horizontally located tooth slightly changed its inclination from +8 to +18 degrees and reached mesioangular position.

to +89 degrees. The mean mesioangulation of the remaining teeth equalled +55.14 degrees. As far as the overall changes of inclination were concerned, in the case of 5 teeth it was unchanged (including 4 in proper vertical inclination). In twenty-seven (54%) teeth their inclination increased towards more favourable values — by 2 to 33 degrees (mean 8.95). In eighteen (36%) it decreased by 1 to 33 degrees (mean –11.93). Among the 13 right and 14 left mandibular third molars in which the measured angle was increased, the mean value of the change equalled 11.08 degrees on the right, and 12.85 degrees on the left, which was not statistically significant. Nine right and 9 left third molars moved towards less favourable inclinations — on average by 10.22 and 7.67 degrees, respectively, which was not statistically significant.

Mean retromolar space index equalled 0.536 on the first radiogram and changed to 0.744 on the second panoramic image. The differences between two sides of the mandible were not statistically significant. The change towards higher values of the index was caused by the fact that in the majority of teeth (41 molars) the width of the retromolar space progressed towards more favourable values: it was increased by minimum 0.02 to maximum 0.96, with an average of 0.28. In 7 cases this increase produced values of the retromolar space index equal to 1 or passed it, which was a good prognosis for eruption. In one case the retromolar space index remained stable, and in the remaining 8 molars it decreased by a minimum 0.03 to a maximum 0.23 (mean: 0.1275).

Detailed results of measurements are presented in Table 1.

DISCUSSION

It is believed that significant clinical changes in the status of third molars take place not only before or during eruption, but after the normal age of eruption, as well [13]. These changes depend on the space available in the retromolar region — the teeth erupt if there is enough space and if their inclination is favourable [12, 13].

The prevalence of third molars that remain unerupted and impacted varies in different areas of the world and the reported rates range from 77% in Finnish students [8] to 34% in 20-year-old Jordanians [3, 5] to none in rural Nigerians [6]. It was found that the numbers of partially erupted and impacted lower third molars increased in populations of well-developed countries, while they erupted early in underdeveloped regions of the world [6, 9]. One of

Table 1. Retromolar space index and inclination of mandibular third molars in the examined patients

			Retromolar space index				Inclination			
	1st radiogram	2nd radiogram	1st radiogram		2nd radiogram		1st radiogram		2nd radiogram	
			Left	Right	Left	Right	Left	Right	Left	Right
1.	1997	2000	1.08	0.81	0.85	0.63	64	65	59	52
2.	1997	2000	0.87	0.64	1.21	0.75	78	51	89	49
3.	1997	2000	0.37	0.66	1.33	0.92	61	59	59	69
4.	1997	2000	0.3	0.5	0.63	0.63	74	75	51	62
5.	1996	2000	0.23	0.66	0.54	0.52	48	72	67	77
6.	1998	2000	0.5	0.61	0.66	0.58	55	66	63	63
7.	1998	2000	0.13	0.31	0.78	0.92	25	41	58	55
8.	1998	2000	0.93	0.54	1.07	0.62	40	47	52	44
9.	1997	2000	0.58	0.5	1.33	1.23	66	57	60	46
10.	1998	2000	0.43	0.63	0.58	0.78	44	45	43	41
11.	1997	2000	1.36	1.00	1.4	0.9	24	27	23	27
12.	1998	2000	0.08	0.08	0.25	0.33	30	8	17	18
13.	1998	2000	0.97	0.47	1.00	0.58	68	67	70	69
14.	1996	2000	0.67	0.59	1.16	0.9	14	17	20	23
15.	1998	2000	0.27	0.25	0.81	0.91	38	77	42	63
16.	1997	2000	0.7	0.58	0.55	0.8	56	40	52	65
17.	1999	2000	0.41	0.54	0.76	0.64	60	64	68	79
18.	1999	2000	0.72	0.91	0.84	0.76	58	50	74	17
19.	1996	2000	0.66	0.54	0.72	0.81	64	39	50	50
20.	1995	2000	0.25	0.15	0.61	0.66	48	28	56	44
21.	1999	2001	0.21	0.25	0.30	0.38	41	46	65	64
22.	1999	2000	0.25	0.25	0.33	0.50	90	91	90	91
23.	1998	2000	0.20	0.75	0.20	0.80	25	22	42	34
24.	1999	2000	0.84	1.08	0.91	1.1	87	90	87	90
25.	1999	2000	0.24	0.26	0.36	0.36	42	46	52	56

the causative factors of the decrease in complete eruption of mandibular third molars is limitation of extractions of other teeth in the dental arch, apart from orthodontic indications, in the industrialised countries [9].

It is stated that unerupted molars are at a continuous risk of developing some kind of pathological condition that will make their extraction necessary [10]. Therefore, it is essential to evaluate the morphology of third molars with incompletely formed apices and determine the factors allowing prediction of their future eruption or impaction, which will influence clinician's decisions on prophylactic third molar extraction [2, 3].

In the studies of Garcia et al. [2], all of the third molars that erupted over a 10-year period were vertically positioned. For that reason it was concluded that all vertically positioned unerupted non-bone impacted third molars should have been considered as having the potential to erupt in adults. In contrast, the teeth that are angularly or horizontally positioned are impacted [2, 11].

In a group of 254 adult Danes, about 40% of mandibular molars were vertical, while 30% were mesioangular. Only about 1% were found in transverse position [14].

In the own material the majority of teeth were positioned improperly, mainly mesioangularly, and only 4 were in proper vertical position at the time of the first radiographic examination. In the follow-up period the inclination of over half of the mandibular

third molars changed to more favourable, while in 36% the angle values decreased.

The assessment of retromolar space is carried out by means of a ratio, as distortions and magnifications are inherent features of panoramic tomography, therefore rendering linear measurements impossible. When the retromolar space ratio is at least 1, the majority of third molars erupt [1], which was confirmed in the current study. Retromolar space was insufficient in most of the cases, but it progressed towards more advantageous widths. However, only 14% of the studied teeth reached values favouring eruption in the follow-up period.

Panoramic radiograms applied in the presented study should be treated as indispensable in the diagnosis of mandibular third molar retention as they allow for evaluation of teeth morphology, position, inclination, calculation of the retromolar space index as well as reveal pathological lesions responsible for tooth retention and impaction. They are also helpful in the prediction of eruption as well as prognosis on the difficulty of extraction of these teeth [2, 4, 13]. Nevertheless panoramic imaging is only a radiographic study, and the evidence of proper eruption course does not necessarily mean that the teeth are clinically healthy [3].

CONCLUSIONS

On the basis of the obtained results, it could be concluded that:

1. The majority of teeth were positioned improperly, mainly mesioangularly, and only 4 were in the proper vertical position.
2. In the follow-up period the inclination of over half of the mandibular third molars changed to more favourable, while in 36% the angle values decreased.
3. Retromolar space was insufficient in most of the cases, but it progressed towards more advantageous widths. However, only 14% of the studied teeth reached values favouring eruption in the follow-up period.
4. No statistically significant differences were noted between two sides of the mandible.
5. There was presented the usefulness of panoramic radiograms for evaluation of morphology of mandibular third molars with incompletely formed apices as a means of prediction of their eruption.

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