Original Research

Evaluation of Mandibular Third Molar Positions in Various Vertical Skeletal Malocclusions

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Abstract

Introduction: The purpose of this study was to evaluate the relationship between the position of mandibular third molar (M3) and vertical skeletal malocclusions. **Methods:** Materials for the study consisted of panoramic radiographs and lateral cephalograms of 73 fifteen to nineteen-year-old class I patients (girls=66%, boys= 34%). Patients were classified into three groups based on four vertical cephalometric indices: FMA, PFH/AFH, LAFH/TAFH, and Y-axis. Analysis of the position of mandibular M3 and its relation to the bone and other teeth were determined by three variables on panoramic view: evaluation of the space for mandibular M3, vertical position of the mandibular M3 in relation to occlusal plane, and spatial relationship between the mandibular second molar (M2) and M3. **Results:** In girls, there was a significant relationship between the retromolar space in both sides of the jaw and different vertical skeletal malocclusions (P<0.001 and P=0.001, respectively). In boys, significant relationship existed between the retromolar space in both sides of the jaw, spatial relationship between the mandibular M2 and mandibular M3 in the left side of the jaw and various vertical skeletal malocclusions (P=0.021, P=0.026, and P=0.017, respectively). **Conclusion:** The present study showed significant correlation between the retromolar space and various vertical skeletal malocclusions in boys and girls.

Key Words: Mandibular third molar, retromolar space, vertical skeletal malocclusion.

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Introduction

Development of third molars (M3) and their effects on dental arches have been considered as an important issue in dental literature. Malerupted or unerupted third molars may have many sequelae including but not limited to pericoronitis, periodontal disease, and caries. The condition may also give rise to root resorption of the second molars (M2) and the development of cysts and tumors, as well as to systemic infections that proved to be life threatening. Furthermore, interfering in orthodontic treatment and distal movement of molar teeth are among other side effects (1-5).

The panoramic radiograph helps in diagnosis and allows the visualization of a series of anatomic structures and relevant factors. The simplicity of acquisition and the considerable amount of information obtained, combined with minimal amount of exposure to radiation, make the panoramic radiograph a well used diagnostic record in dentistry and orthodontics, especially in evaluating the position of third molars. Moreover, accurate measurement of structures on dental panoramic tomograms (DPTs) is possible, provided sufficient care is taken with head positioning (6).

In modern societies, impaction of the M3 is far more than any other tooth (7). One reason is the lack of retromolar space, due to the small size of the jaw (8-11). Whatever the etiologic factors of M3 impaction are, it has been established that impaction can be associated with the pattern of facial growth (12-16).

In this cross-sectional study, we evaluated the vertical position of M3 in relation to the occlusal plane and the angle between mandibular M2 and M3 and the amount of retromolar space in three patterns of vertical facial growth.

Materials and Methods

Materials for the study consisted of panoramic radiographs and lateral cephalograms of 73 patients (girls=66%, boys= 34%) taken on the same day. Orthodontic casts were also provided for each patient.

All subjects were 15 to 19-year-old skeletal class I (0<ANB<5) individuals, who had never underwent any type of orthodontic treatment. Other criteria for selecting the samples were the absence of hypodontia and no history of extraction of permanent teeth and the presence of both mandibular M3s.

Patients were classified into three groups: 13 skeletal deep bites, 30 skeletal open bites, and 30 patients with normal vertical skeletal condition. This classification was based on four cephalometric indices: FMA, PFH/AFH, LAFH/TAFH, and Y-axis (Table 1).

Each group was classified into three subgroups according to the severity of crowding: mild (0-3 mm), moderate (3-8 mm), and severe (>8mm). Crowding was measured on orthodontic casts by a digital caliper.

On each panoramic radiograph, the following parameters were traced on an acetate paper with an HB pencil:

1. Angle between the longitudinal axes of the M3 and M2: First, a line, called tooth occlusal plane, was drawn tangent to both mesiobuccal and distobuccal cusps of M2 and also M3. Then, another line was drawn perpendicular to the first line. These lines determined the longitudinal axes of the teeth. The angle formed between two perpendicular lines was measured. The angle recorded positive (+) for mesial inclination and negative (-) for distal inclination (Fig. 1).

2. Retromolar space: A line was drawn perpendicular to the occlusal plane of M2 while it was tangent to the most distal point the same tooth. The distance between the intersection of this line and the occlusal plane and the anterior border of the ramus was defined as the retromolar space (Fig. 2).

3. The nearest distance between M3 crown and occlusal plane: This distance was measured and shown in millimeters. The occlusal plane was drawn by joining the highest points of the lateral incisor and first molar crowns (Fig. 3).

All the tracings and measurements were carried out by the same examiner. To assess the reliability of the measurements, 10 samples were traced again after a 2 weeks. Reliability was determined by the method of test/retest. There was no significant difference between the two measurements.

Normality of distribution of the variables that determined the position of the M3s was tested by the Kolmogorov-Smirnov test. Except for the age, other variables were normal. For data analysis, ANOVA was used. P-values less than 0.05 were considered statistically significant.

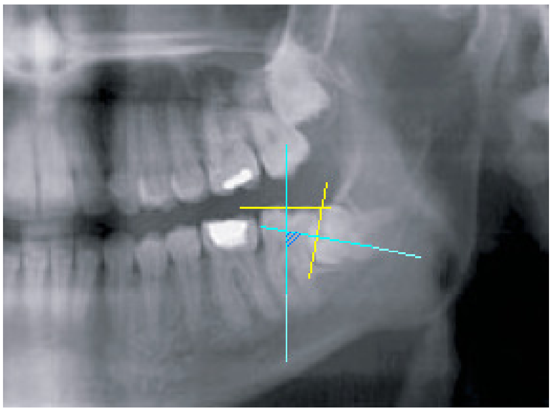

Figure 1. The angle between the longitudinal axes of the second and third molar

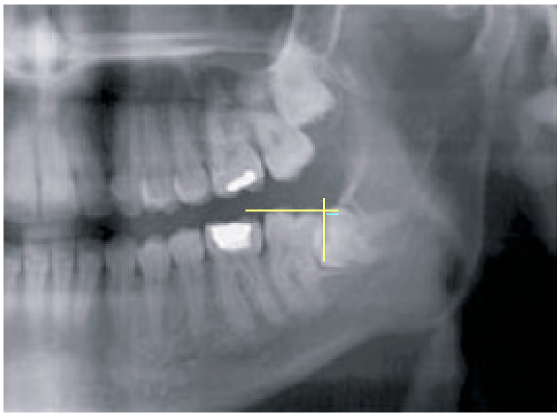

Figure 2. The retromolar space

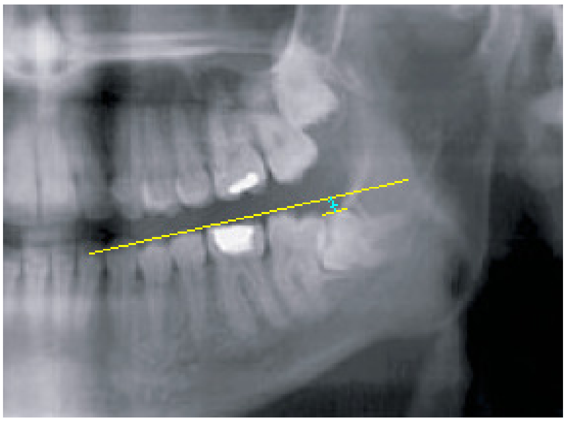

Figure 3. The space between M3 crown and the occlusal plane

Results

The survey data collected from 73 orthodontic patients (66% girls and 34% boys). As presented in Table 2, no significant differences were found between the age of boys and girls among groups (P=0.363, P=0.943). There was no significant difference in the amount of crowding either.

Table 3 shows the mean values (M) and standard deviations (SD) of four cephalometric indices (FMA, PFH/AFH, LAFH/TAFH, Y axis) in the three groups.

Variables related to M3 position in girls and boys in different vertical growth patterns are presented in Tables 4 and 5, respectively.

In girls and on both sides of the jaw, the retromolar space was significantly different among groups (right: P<0.001, left: P=0.001). As shown in Table 4, the greatest distance from the distal of the mandibular M2 to the anterior border of the ramus belonged to the patients with normal vertical growth pattern, followed by the open bite and then the deep bite groups.

In boys, the angle between the axes of M2 and M3 showed significant difference among groups only on the left side (P=0.017). The retromolar space also differed significantly among various types of vertical growth patterns on both sides (left: P=0.026, right: P=0.021).

Table 1. Cephalometric indices used for classification of the samples

	Cephalometric indices			
Groups	**FMA**	$\frac{PFH}{AFH}$	$\frac{lAFH}{TAFH}$	$Y-axis$
Open bite	≥28	≤63	≥57	≥64
Deep bite	≤22	≥69	≤51	≤56
Normal	22-28	63-69	51-57	56-64

Table 2. Mean and standard deviation of age in both sexes in various groups

	Groups						
	Open bite		**Normal**		**Deep bite**		
	N	**Age**	**N**	**Age**	**N**	**Age**	**P-value**
Female	20	15.5±1.09	19	15.47±1.07	9	15.33±1.02	0.943
Male	10	15.6±0.84	11	15.09±0.94	4	15.5±0.78	0.363

Table 3. Mean and standard deviation of the cephalometric indices in various groups

	Group			
	Open bite	**Normal**	**Deep bite**	**P-value**
FMA	36±4.63	26.89±1.48	21.67±0.71	<0.001*
PFH/AFH	61.8±2.12	64.79±2.39	67.33±2.44	<0.001*
LAFH/TAFH	56.5±1.57	55.42±1.21	52.89±1.53	<0.001*

*Indicates statistically significant at the 0.05

Table 4. Mean and standard deviation and dependence of variables related to M3 position in various groups in girls

		Groups			
Parameters		**Open Bite**	**Normal**	**Deep Bite**	**P-value**
Angle between M2	Left	23.5±9.79	23±14.21	23.89±11.72	0.982
and M3 (degree)	Right	21.63±9.83	26.68±13.58	23.22±9.14	0.382
Distance from M3 to	Left	0.55±2.49	0.76±2.46	0.94±1.91	0.911
occlusal Plane (mm)	Right	1.25±2.45	1.05±1.8	0.83±0.75	0.867
Retromolar space	Left	9.75±4.14	11.89±2.25	6.33±2.91	0.001*
(mm)	Right	9.4±3.86	12.81±2.35	7.16±3.64	<0.001*

*Indicates statistically significant at the 0.05

Table 5. Mean and standard deviation and dependence of variables related to M3 position in various groups in boys

		Groups			
Parameters		**Open bite**	**Normal**	**Deep bite**	**P-value**
Angle between M2 and	Left	15.3±6.11	31.64±7.31	29.5±3.78	0.017*
M3 (degree)	Right	26.4±5.87	30.27±10.09	28.22±6.48	0.777
Distance from M3 to	Left	1.1±1.67	1.13±1.58	0.87±0.25	0.982
occlusal Plane (mm)	Right	1.55±2.48	1.07±1.08	0.93±0.75	0.806
Retromolar space (mm)	Left	11.5±3.3	11.27±2.41	6.75±2.98	0.026*
	Right	12.4±3.53	12.09±3.33	6.5±3.69	0.021*

*Indicates statistically significant at the 0.05

Discussion

According to numerous investigations, the most important variable by which it is possible to predict the eruption of M3 by analyzing the panoramic radiographs is the retromolar space (8-11). In this study, the distance from the distal of M2 to the anterior border of the ramus was considered as retromolar space. In Richardson (17), Mollaoglu et al. (18) and Behbehani et al. (15) studies, this variable was used as a prediction factor for eruption or impaction of M3.

We showed that there was a considerable difference in the retromolar space among different types of vertical growth patterns. The greatest distance was determined in patients with normal vertical growth pattern, followed by open bite and deep bite groups. This result confirms the findings of Kaplan (19), who concluded that the lack of enough resorption in the anterior border of the ramus was accompanied with skeletal deep bite tendency.

In our study, both in females and males and in both sides of the jaws, there was no significant relationship between the nearest point of M3 to the occlusal plane and the angle between M2 and M3 longitudinal axes. Mollaoglu et al. (18); however, reported that when there was less retromolar space, the angle between M3 and mandibular base was larger. Consequently, the probability of M3 impaction increases.

While in boys, the angle between M2 and M3 longitudinal axes on the left side was significantly different among various types of vertical development, girls showed no considerable differences. The largest angle was measured in the normal group and the lowest was in the open bite group. The Y-axis correlated with the angle of M2 and M3 axes on the left side of the jaw, as well (the correlation table was not shown in the results). In previous studies, only Niedzielska et al. (11) recorded the angle between M3 axis and the mandibular base as a key factor to predict the position of M3. Although the parameters in this study are different from theirs, they could be used as prediction factors for eruption or impaction of M3. In other words, a change in the facial height is associated with the angle between M2 and M3 only on the left side in boys and the Y-axis could be a good predictor.

According to our study, no significant difference was determined in the space between the nearest point of the M3 crown to the occlusal plane on both sides and in both sexes, which means that there is no correlation between this variable and the change in facial height.

Compared to legoivc et al. (20) study, there are some differences which can indicate the real difference between various parameters in different sexes. On the other hand, they can be factors of an unbalanced distribution of the two sexes in this study since the total samples consisted of 34% males and 66% females, while in legoivc et al. (20) study, there were 130 samples with equal numbers of boys and girls.

Carrying out this study with more amounts of samples, a different distribution of age and sex and equivalent orthodontic parameters may result in fewer flaws in data analyses.

Conclusion

The present study showed significant relationship between the retromolar space and various types of vertical skeletal malocclusions in boys and girls.

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