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Radiographic Changes in the Position of Mandibular Third Molar after Treatment of Extraction and Non-Extraction Patients

Abstract

An observational study is carried out to investigate the changes in the angle of placement of impacted wisdom teeth and the level of impaction in orthodontic patients who have the largest volume of prophylactic extraction of wisdom teeth, in order to take the first steps towards defining growth prediction models to be picked up. The data required for this study were obtained from patients who had been referred to orthodontic offices for the treatment of their malocclusions. The study was conducted on 164 third-molar teeth. In this study, changes in the longitudinal axis of the mandibular third molars relative to the lower wall of the inferior alveolar nerve canal were also measured. Finally, the obtained data were analyzed descriptively and analytically using SPSS version 16 software. During the study, there were 164 teeth that had an angle of more than 15 degrees, among which 154 teeth were in the B or C primary growth level (10 teeth in the jaw had a low initial growth level of A. If we consider the growth conditions for a wisdom tooth to be placed at an angle of less than 15 degrees and the growth level of A, among the 154 mentioned teeth, 36 teeth reached these conditions at the end of the study. In growth prediction studies, the most important issue is to judge based on angle change rather than growth level change and angle change is a more important and reliable criterion.

Keywords: *Mandibular Third Molar, Tooth Eruption, Radiographic Changes, Impaction*

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Introduction

Changing the position of third molar teeth during growth is an unpredictable phenomenon.[1] Although the average age of third molar teeth eruption has been reported to be 20 years old, the time of eruption of these teeth among different populations has been reported to be different from 14 to 24 years old.[2,3] The change in the position of the unerupted third molar continues at least until the middle of the third decade of life, and these changes can be favorable or unfavorable.[4,5] It is generally accepted that racial variations in facial growth, jaw size, and tooth size have an effect on growth pattern or nesting status.[6] While the highest prevalence of impaction is mentioned in third molar teeth,[7-10] the said amount in orthodontic patients is also estimated at up to 50%.[11] Knowing the state of the eruption of wisdom teeth becomes important when we know that the complications and problems resulting from non-eruption or semi-eruption are very diverse. Estimating the possibility of the eruption of third molar teeth before the age of 24 is important because we know that in addition to the possible complications and problems resulting from the complete eruption of wisdom teeth, the complications, and complications of surgery after the age of 25 also increase with age.[4,12] Hence, there are methods for estimating the impaction of wisdom teeth, and most of these methods have examined the wisdom teeth of the mandible.[13-19] Hidden wisdom teeth may potentially be a source of jaw cysts or tumors. Wisdom teeth that find enough space to grow in the mouth may grow completely and in their correct place, but if there is not enough space for these teeth to grow completely, they may grow in a semi-hidden form, and these teeth may also grow horizontally or be seen diagonally. An impacted tooth is a stuck or trapped tooth that is prevented from growing due to a physical obstacle or barrier in its growth path[14] or it can be said that an impacted tooth is a tooth that cannot be placed in the dental arch at the expected time. The term unerupted includes the latent teeth as well as the teeth that are involved in the process of eruption. Teeth are often impacted due to the insufficient length of the dental arch and the space in which they will be placed.[15] Third molars are often hidden because they are the last teeth to grow and therefore most likely do not have enough space to grow.[16] According to research conducted on 3874 patients over 10 years of age, 17% of patients had at least one impacted tooth, of which 40% were related to impacted third molar teeth[7] and in another study, the prevalence of impacted third molar teeth was estimated at 85%.[17] Impressed teeth can be divided into mesiangular, horizontal, vertical, and distoangular types based on their radiographic appearance in the sagittal view.[15]

There is a strong relationship between the age and the beginning of the formation of third molars and the developmental stage of the second molar. Delay in the formation of tooth buds is one of the effective factors in the congenital absence of the third molar of the lower jaw in such a way that if the bud of the third molar of the lower jaw does not appear until the formation of the second molar, the probability of its absence will be 100%.[18] Following the studies conducted on mandible growth, mandible growth has been considered as a set of changes in three dimensions, which includes condyle growth and ramus bone remodeling. Inadequate growth of the condyle is known to be one of the causes of lack of space for wisdom tooth growth. The normal growth of lower permanent molars is at least dependent on the normal growth of the mandible. The impact rate of the third molar tooth is higher than other teeth, the reasons for which can mentioned are the low alveolar space for the third molar, insufficient analysis of the retromolar, the limited slope of the anterior edge of the ramus, the angle of this tooth and the lack of bone growth behind the tuberosity of the upper jaw. The

more posterior teeth grow anteriorly; the more retromolar space will increase.[19] Local factors such as dental crowding, inappropriate position of the tooth bud, extra teeth, lack of space in the dental arch, cysts, undissolved dental roots, undissolved alveolar bone, and oral habits such as finger sucking and self-harm are the main causes, despite differences. A race in the growth sequence, the third molar teeth in all races are the last teeth that grow and this is a factor for the high prevalence of third molar impaction.[20] One of the causes of lower third molar recession is not rotating the tooth from the mesiangular position to the vertical position. During natural development, the lower third molar grows at a horizontal angle, and when the teeth and jaw grow and develop the horizontal angle changes to mesiangular and then to vertical, which does not rotate from mesiangular to vertical. They are hidden. In some sources, lack of sufficient space has been mentioned as the most common cause of the third molar recession.[21]

In a study to determine the risk factors for the development of radiographic distal surface caries (rDSC) in patients who attend routine dental check-ups during an era of National Institute for Health Care Excellence third molar surgery guidelines. The detected rate of rDSC was 63.9% and rDSC was distributed homogenously across all five socioeconomic groups ($p = 0.425$). Risk factors associated with rDSC ($p < 0.001$) were identified as partially erupted mesioangular impacted mandibular third molars, third molars with compromised molar-to-molar contact points, and loss of lamina dura of ≥ 2 mm, male gender, increasing age, and a higher modified Decayed Missing Filled Tooth score. rDSC was significantly associated with the angulation of third molars, the compromised contact position of the adjacent third molar, the periodontal status of the distal aspect of the second molar, and the cumulative history of oral health in a population governed by specific third molar guidelines. An active approach to third molar surgical management could reduce rDSC and serve this population, irrespective of the patient's socioeconomic or deprivation status.[22]

Vilela and Vitoi evaluate the changes in position and eruption state of lower 3M during 3.6 years, as well as identify factors that may be related to early diagnosis of dental retention of these teeth in adolescent patients. The results showed that vertical position was the most prevalent and the C-level and class II positions were predominant. The changes occurring in the 3M position during the study interval were not statistically significant. After the final evaluation (T2) it was concluded that unpredictable changes in lower 3Ms position and eruption may occur. The variables race (P = 0.03) and anterior border of the mandibular ramus (P = 0.007) seem to influence the level of eruption, also suggesting an influence on this tooth retention within dental arches over the years.[23]

Therefore, an observational study is carried out to investigate the changes in the angle of placement of impacted wisdom teeth and the level of impaction in orthodontic patients who have the largest volume of prophylactic extraction of wisdom teeth, in order to take the first steps toward defining growth prediction models to be picked up.

Materials and Methods

The data required for this study were obtained from patients who had been referred to orthodontic offices for the treatment of their malocclusions (87% had dental malocclusions). These people were 84 people (36 men and 48 women) who must have preserved at least one of their third molar teeth during the study. The study was conducted on 164 mandibular third molar teeth. Among these, 68 teeth belonged to male patients and 96 teeth belonged to female patients. Also, teeth included in this study that: 1-were not lost during orthodontic treatment and were present in the final radiographic stereotype. 2- The second molar tooth adjacent to it should be available so that the angle changes can be measured. 3- The second molar tooth adjacent to the third molar, whose longitudinal axis was our measurement scale, should not be included in the orthodontic treatment plan and should not undergo angle changes during the study. 4- The adjacent second molar tooth should not have extensive distal decay so that the wisdom tooth does not lean into this space. 5- The wisdom tooth should not have a clear buccal or lingual inclination in the initial radiograph so that their angle change can be checked in a computer scan (The image should not be distorted) 6- The image quality of the 7th and 8th teeth in the panoramic radiograph should be optimal so that the necessary investigations can be carried out. The studied samples were in the age range of 8/21-7/14, and the period they were studied was 9 to 38 months. At the beginning and end of the study, a panoramic radiograph was prepared from the patients. In this study, changes in the axial inclination of the mandibular third molar tooth relative to the longitudinal axis of the adjacent second molar tooth were measured. This classification is as follows:

15-<distangular<-75, horizontal>±75, mesiangular>75>15 and vertical±15

In this study, changes in the longitudinal axis of the mandibular third molars relative to the lower wall of the inferior alveolar nerve canal were also measured. Also, the growth level of mandibular wisdom teeth compared to the occlusal plane of the adjacent second molar (A, B, and C) and the relationship of the mandibular wisdom teeth with the anterior border of the ramus (I, II, and III) was compared at the beginning and the end of the study. Panoramic stereotypes were digitized after computer scanning. Then, the longitudinal axis of the wisdom teeth and adjacent second molar teeth, as well as the tangent line was drawn on the lower wall of the lower alveolar nerve canal under the wisdom tooth. Then the angular changes were measured. Other stages of drawing and measuring were done by computer. Finally, the data obtained were analyzed descriptively and analytically using SPSS software version 16, and in order to analyze the data obtained from the chi-square test, and T-test was used for two dependent samples (Paired samples T-test & chi-square-test). (α=0.05 and 95% confidence interval)

Results

Preliminary studies of the changes in the angle of the lower jaw teeth in the sagittal axis showed that among 158 lower jaw third molar teeth, 54 teeth (34%) were in a vertical position (between 0° and 15°) and 104 teeth (66%) were in a mesiangular position (inclination). They had mesial from 15° to 75°, but none of the teeth had a distangular or horizontal position. In the final examination at the end of the study, the number of teeth with a vertical position decreased to 52 teeth (32%), but the number of mesioangular teeth increased to 106 teeth (68%).

During the study, among the mesiangular wisdom teeth of the lower jaw, 18 teeth (11%) showed a decrease in their angle and changed their position to a vertical position, of which 10 (56%) had an angle of 15° to 25° and 8 teeth (% 44) had an angle of 25° to 40°, but no tooth with an angle of more than 40° changed its position to the vertical position. Also, among the 54 molars of the lower jaw that had a vertical position, 20 teeth (37%) had an increased angle and changed their position to a mesiangular position, of which 18 teeth (90%) had an initial angle between 10° and 15° and 2 teeth (10%) had an angle less than 10°.

It was also found that the average angle difference in methods 1 and 2 had no significant statistical difference with each other (P>0.05). Therefore, this finding proves that the study of wisdom tooth angle change based on the longitudinal axis of adjacent tooth 7 has high reliability.

The data obtained from the final angle of the third molar teeth, after removing the initial angle effect, were used in covariance analysis using 2 factors. Factor A: female versus male Factor B: upper jaw versus lower jaw

Covariance analysis showed that after removing the effect of the initial angle, only the jaw factor has an effect on the final angle (P<0.01), but gender and the mutual factor of jaw and gender do not affect the final angle (P≥0.05). In addition, this analysis showed that only 42.4% of the changes in the final angle are controlled by the jaw, sex, the interaction between sex and jaw, and the initial angle, and the rest of the changes (57.6%) are determined by other factors.

In **Table 1**, changes in the growth surface of mandibular molar teeth during this study are shown based on their initial placement angle.

Table 1. Follow-up of the position and growth surface of the mandibular third molar teeth

Jaw	Angulation	Position				
		A	B	C	Total	*P*
Mandible	Mesioangular	4	76	24	104	0.000
	Distoangular					0.000
	Horizontal	84	14	11	109	0.000
	Vertical	26	22	4	52	0.000
	Total	122	32	69		
	P				0.000	

During the initial examination, 104 teeth of the third molar of the mandible were in the mesiangular position, of which 2 teeth were in level A, 28 teeth were in level B, and 74 teeth were in level C. During the study period, all 2 teeth in level A were placed in the same level and position, and out of 28 teeth in level B, 8 teeth were placed in the same level B, but their position changed to vertical and 4 teeth were also in the same level A and changed their position to vertical position. Among the 74 teeth in level C, 46 teeth reached level B by maintaining their position, but 6 teeth changed their position to a vertical position, of which 2 teeth are in level A and 4 teeth are in level B. they got. Also, during the initial examination, 54 of the mandibular third molar teeth were in a vertical position, of which 6 were in A level, 18 were in B level and 30 were in C level. During the study, 2 of the teeth in level A changed their position while maintaining their level and became mesiangular, the other 4 teeth remained at the same level and position. Among the 18 teeth in level B, 4 changed their position to mesioangular by maintaining their level, and 6 changed their position to level A by maintaining their vertical position. Among the 30 teeth in level C, 14 teeth changed their position to mesiangular, among which 4 teeth kept their position C, but 10 teeth also changed their position to level B. Also, 12 teeth out of these 30 teeth changed their level by maintaining their vertical position, out of which 6 teeth changed to B level and 6 teeth changed to A level. The remaining 4 teeth in level C had maintained their position and level at the end of the study (**Figure 1**).

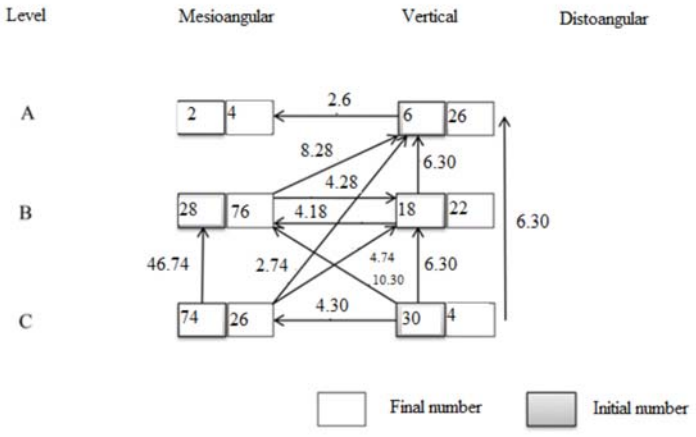

Figure 1. Monitoring the position and growth surface of the mandibular third molar teeth (number = 158).

At the end of the study, there were no other teeth in class III, that is, all teeth had a growing trend in this regard. Similarly, from the data obtained to show a significant relationship between the change of surface (A, B, C) and the position (vertical, mesiangular, and distangular) of the third molar teeth, the results showed that there is a significant relationship between the change of the surface and the change of the position of the third molar teeth of the lower jaw ($P<0.01$).

Discussion

Changing the position of the third molar teeth during growth is an unpredictable phenomenon,[1] the delay in growth is the reason for a large number of wisdom teeth to be impacted, so wisdom teeth include 98% of all impacts.[24] In the present study, during the follow-up period, in the lower jaw, 31% of the teeth moved towards becoming more vertical by decreasing the placement angle, and 69% of them moved towards being more buried in the jaw bone by increasing the angle. Also, 24% of the teeth changed their sagittal position. In the maxilla, 58% of the teeth became closer to the vertical position by decreasing the placement angle, and 42% of them showed an increase in the angle to be further away from the sagittal axis of the adjacent second molar. The sagittal position of 26% of the teeth was also changed. There was no tooth in both the mandible and the maxilla that did not change angle during the study.

Marques et al in a radiographic study of 55 mandibular third molars in 34 Danish dental students (with an average age of 20.6 years) found that the sagittal position of 28% of the teeth changed in 4 years [25] compared to 24% in our study. Of these, one-third changed from mesiangular to vertical, one-third from mesiangular to distangular, and one-third from vertical to distangular.

In a Jordanian study (mean age 19.7 years) of 59 unerupted mesioangular third molars, Hattab found that 44% of the teeth became vertical, 34% showed decreased angulation and progressed to become more vertical, 7% increased the angle and sunk into the bone more, and no change was seen in 15% of the teeth during the study.[24]

In the present study, during the study period, 11% of the teeth reached the eruption level A (14% in the mandible and 8% in the maxilla). In their study on 821 samples in the New Zealand population (with an average age of 18 years), Kruger et al. found that 34% of impacted teeth had fully erupted by the age of 26 (compared to 11% in the present study).[26]

In another study, it reported in a study on 81 graduate students (with an average age of 20.7 years) that 22% of teeth erupted.[27] In the present study, out of 314 examined teeth, only 29 teeth (about 9%) reached the occlusal level during the study (12% of mandibular impacted wisdom teeth and 6% of maxillary impacted wisdom teeth).

In a study conducted by Nance et al. on 237 adults (from 14 to 45 years old, with an average age of 25.9 years), about one-third of vertical mandibular latent teeth reached the occlusal level during the study (2.2 years) (28%) in the maxilla and 29% in the mandible.[28]

Sant'Ana et al in their study (with an average age of 18 years) reported a higher percentage compared to our study (42% in the maxilla and 49.5% in the mandible).[29]

Considering that in other studies, the average age of the samples and the percentage of teeth that had reached the growth level A was higher than in our study, it may be possible to speculate that at younger ages, changes in the growth level are less than at older ages takes place. This relationship is the opposite in the case of angle changes, that is, angle changes occur more at younger ages. In addition, in our study, all the teeth had a change in angle and none of them remained in place at the beginning and end of the study, maybe because the average age of the samples in our study was lower than in other studies and we said that at a younger age, the angle changes are more. Of course, previous scientific findings also support the fact that the third molar teeth first change their angle and then reach a higher level.[14]

Conclusion

The analysis carried out showed that the measurement of wisdom tooth angle changes based on the longitudinal axis of the adjacent second molar has high reliability, and because this measurement is easier, it is acceptable as a suitable method for this style of study.

According to the data of the study, the tooth surface always has an improving trend during growth, but the angle change during growth can be favorable or unfavorable. Therefore, in growth prediction studies, the most important issue is to judge based on angle change rather than growth level change and angle change is a more important and reliable criterion.

Of course, it may be possible to deal with clinical cases using the results obtained from this study, for example, if a wisdom tooth has an angle of more than 30 degrees at the age of 16, with a shorter follow-up period (for example, until 17 or 18 years old), if a change It didn't have a good angle, let's remove it. Or if the same tooth has an angle of more than 35 degrees, it can be removed at this age with a high probability of not growing at an older age.

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Conflict of interest
None.

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Ethics statement

None.

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