Changes in the Position of Mandibular Third Molars Following Extraction and Non-Extraction Orthodontic Treatments

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Abstract

Introduction: Impaction of third molars can be associated with a number of sequelae, each requiring a different type of treatment. The purpose of this study was to assess the changes in the position of lower third molars following extraction and non-extraction orthodontic treatments. **Methods:** Pre- and post-treatment panoramic radiographs of 26 class I malocclusion patients (4 male and 22 female) who were treated on a non-extraction basis were compared with those of 30 class I malocclusion patients (5 male and 25 female) who received orthodontic treatment following the extraction of all first premolars. In each group, the lower third molar angulations and their distance from the lower border of the mandible were assessed. **Results:** Paired *t*-tests and independent *t*-tests detected significant changes in the position of the lower third molars in the extraction group. Both the left and right molars became more upright and their distance from the lower border of the mandible increased. Similar changes were only seen in the position of the right mandibular third molars in the non-extraction group. **Conclusion:** Tooth extractions can bring about favorable changes in the position of mandibular third molars and possibly reduce their incidence of impaction.

Key Words: Extraction, non-extraction, orthodontics, third molar.

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Introduction

Mandibular third molars have attracted the interest of the orthodontic professionals, not only because of their position and eruptive pattern but also because of their possible role in the development of late incisor crowding (1). Richardson (2) explains that "The mandibular third molar develops in the ramus of the mandible with its occlusal surface at an angle to the mandibular plane and in order for it to erupt with a normal occlusal relationship it must undergo an up righting movement of greater or lesser degree depending on its original angulation to the mandibular plane". In another study, Richardson et al. (3) demonstrated that between the ages of 14 and 16 years, the normally erupting third molars moved into a position where one would expect them to erupt into normal occlusion. As these teeth uprighted the angle between their occlusal surface in relation to either the occlusal plane or the mandibular plane decreased. These changes seem to continue as in another radiographic study of impacted third molars; Venta et al. (4) concluded that 44% of the sample age of 20 to 32 years had a positive change in their state of impaction.

The average age of third molar eruption ranges from 17-21 years, but the roots are not fully formed until 18-25 years (5). Various population studies have demonstrated that these teeth have the highest incidence of impaction than any other (6). Nedeljkovic et al. (7) have shown that the eruptive potential of mandibular third molars is related to their mesiodistal width and the retromolar space. Therefore the smaller the retromolar space the less likely the chances of their eruption. Forsberg (8) explained that the main reason for the high frequency of mandibular third molar impaction is generally believed to be lack of space between the distal surface of the second molar and the ascending ramus.

This has also been confirmed by Richardson et al. (3) who conducted a radiographic study of mandibular third molars.

Impacted mandibular third molars have been implicated as one of the factors in late incisor crowding. As the pressure from the back of the arch in the presence of a third molar rises crowding develops or increases after establishment of the permanent dentition (9). They can also be associated with pathological changes such as follicular cysts, resorption of second permanent molar roots as well as pericoronitis (10).

Opinions are divided as to whether orthodontic treatment can bring about positive changes in the position of third molars and aid their subsequent eruption. Some investigators who measured angles between the third molar long axes and the occlusal plane found that there were no significant differences in the change in third molar angulation between the samples of class I patients who had undergone a non-extraction treatment and those who were treated following the extractions of all first premolars (11). Others such as Elsey and Rock (12) and Saysel et al. (13) have shown that extraction of lower premolars followed by fixed appliance orthodontic treatment allowed the up righting and improvement in mandibular third molar angulation relative to the occlusal plane.

Ay et al. (14) also reported that in those patients who required first permanent molar extraction, the position of third molars improved as a result of increased retromolar space. The purpose of this study was to investigate the changes in the position and angulation of mandibular third molars in class I cases following extraction and non-extraction orthodontic treatments.

Materials and Methods

In this retrospective study, pre- and post-treatment panoramic radiographs of 56 patients (47 female and 9 male) were divided in two groups. Group A comprised of 26 patients (22 female and 4 male) who had undergone non-extraction orthodontic treatment. Group B comprised of 30 patients (25 female and 5 male) who had undergone orthodontic treatment involving the extraction of all first premolar teeth. The average pre-treatment age of the patients in group A and B were 13.1 and 12.5 years, respectively. The average length of treatment was 20.4 months in group A and 28.5 months in group B.

The criteria for inclusion in this study were as follows:

1. All patients had class I skeletal and dental relationships
2. All patients had unerupted mandibular third molars which were visible on panoramic radiographs.
3. All patients were treated by a single orthodontist using Standard Edgewise 22 upper and lower fixed appliances.
4. All radiographs were undertaken in a single centre using the same radiographic machine (Planmeca, Helsinki, Finland).

The extraction and non-extraction group had more and less than 5mm crowding in each arch, respectively.

The pre-treatment radiographs were taken approximately 2 weeks before the start of treatment and the post-treatment radiographs were taken during the retention phase. The mesiodistal inclination of the third molars was determined by establishing the occlusal planes of first, second, and third molars. A line was drawn along the cusp tips of each tooth and the long axis of each molar tooth was then determined by drawing a perpendicular to the occlusal plane. The angles between the long axes of the first and third as well as the second and third molars were measured for each case in the pre- and post-treatment stages. Positive values were assigned to those third molars that had a mesial angulation and negative values were assigned to those with a distal inclination. Finally, in order to measure the vertical changes of the mandibular third molars, a line was drawn parallel to the lower border of the mandible and a vertical line was dropped perpendicular to it from the mesiobuccal cusp of the third molars.

This distance was measure for all pre- and post-treatment radiographs and measured in millimeters (to an accuracy of 0.5 mm) (Fig. 1).

The data were stored and analyzed using SPSS for Windows. The pre- and post-treatment changes within each group were analyzed using the paired *t*-test. Independent *t*-test was used to analyze the data between groups A and B.

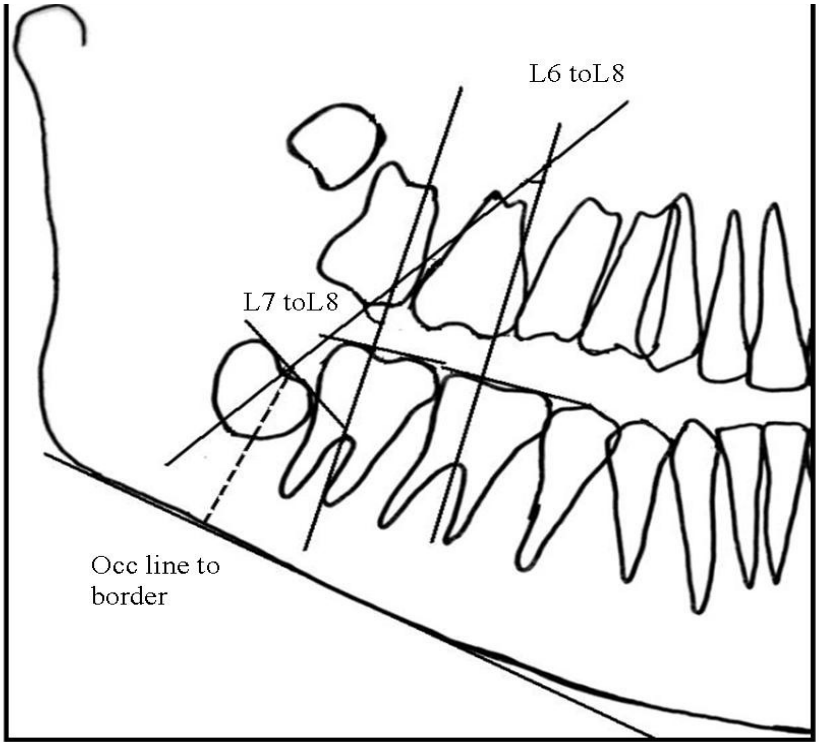

Figure 1. Third molar angulations with first and second molar and its distance from lower border

Results

Comparing the pre- and post-treatment angulations of the mandibular third molars in the non-extraction group revealed that only the right molars showed any signs of improvement. They had significantly uprighted and their distance from the lower border of the mandible had increased ($P<0.05$) as seen in Table 1. However, in the extraction group, both the lower right and left third molar angulations improved significantly as did their distance from the lower border of the mandible ($P<0.05$). The results are shown in Table 2. The comparison of the total changes in the position of third molars relative to the first and second molars and to the lower border in two groups revealed that right third molar in two groups did not differ significantly in uprighting and growth but the left third molars in the non extraction group deteriorated significantly, as seen in Table 3.

Table 1. Comparison of changes in the position of mandibular left and right third molars in the non-extraction orthodontic group (A) before (T0) and after (T1) treatment.

	Right 3rd molar			**Left 3rd molar**		
	T0	T1	P-value	T0	T1	P-value
Angle with 2nd molar	27.4±12.8	20.9±10.2	0.04	23.4±8.26	25.07±13.7	0.52
Angle with 1st molar	38.7±11.9	32.2±12.1	0.00	31.6±10.36	31.4±11.2	0.907
Distance to lower border (mm)	27.7±3.6	30.1±4.44	0.004	27.4±3.6	28.7±4.44	0.151

Table 2. Comparison of changes in the position of mandibular left and right third molars in the extraction group (B) before (T0) and after (T1) treatment

	Right 3rd molar			Left 3rd molar		
	T0	T1	P-value	T0	T1	P-value
Angle with 2nd molar	24.5±10.5	14.6±11.8	0.002	22.2±13.7	15.6±13.4	0.019
Angle with 1st molar	34.9±12.8	25.2±11.1	0.005	32.1±13.1	25.0±11.4	0.008
Distance to lower border (mm)	27.5±3.2	32.2±5.6	0.000	26.9±3.5	32.4±5.8	0.000

Table 3. Comparison of changes in between groups A and B

	Right 3rd molar			Left 3rd molar		
	A	B	P-value	A	B	P-value
Angle with 2nd molar	-6.4±15.1	-9±6.3	0.421	1.6±12.9	-6.7±14.8	0.019
Angle with 1st molar	-6.5±15.8	-9.6±14.5	0.438	-0.19±8.3	-7.1±13.6	0.25
Distance to lower border (mm)	2.4±3.8	4.6±4.9	0.64	-1.15±3.9	-5.4±3.9	0.000

Discussion

In this study, two groups of patients with class I malocclusion underwent upper and lower fixed appliance orthodontic treatment. The patients in group B had all first premolars extracted prior to their orthodontic treatment, whilst the patients in group A underwent non-extraction orthodontic treatment. Changes in lower third molar angulation and their vertical positions were determined for each group. The data revealed that in the extraction group (B) both lower third molars improved their angulation and became more upright. They also moved more occlusally. Similar changes were also associated with the right mandibular molars of the non-extraction group. However, the position of the left lower third molars in the non extraction group deteriorated. This study suggests that the forward movements of the first and second lower molars following extractions and space closure, increases the retro molar space and therefore reduces the level of impaction of the third molars. This study supports the findings of Saysel et al. (13). However, in that study, the occlusal plane was used as one of the reference planes in measuring the changes in third molar position. But as the occlusal plane itself changes throughout treatment it was not found to be reliable and was not used as a reference plane in this study.

Studies by Elsey and Rock (12) and Kim et al. (5) confirm our findings that closure of premolar extraction spaces improves the inclination of mandibular third molars. Elsey and Rock (12) found the mean angular change of 7 degrees, which is approximately in line with the findings in the extraction group of our study. In our study, the changes in mandibular third molar angulations in relation to the long axis of the second molar in the extraction group was 6.7 degrees on the left and 9.9 degrees on the right.

Artun et al. (15) also demonstrated similar findings but that study was based on assessing changes of mandibular third molar angulation using lateral cephalograms. However, measurements of angular changes on cephalograms may introduce superimposition errors.

Our results are in disagreement with the findings of Staggers et al. (11) who reported no significant changes in the position of third molars before and after treatment in extraction and non extraction cases. This difference of findings may be as a result of the methods used in the studies. As Staggers et al. (11) used the occlusal plane as her reference plane and as explained this plane undergoes changes during orthodontic treatment as is therefore not a reliable reference plane. The findings of this study indicate that there are other factors involved in the changes of lower third molar angulation and their movement in the occlusal direction other than closure of extraction spaces. This was demonstrated by the improvement of the right mandibular third molar

angulations in the non-extraction group. The factor which we think would influence these changes may be forces of mastication, these subjects may have used the right side of the mouth for most of their chewing activities which itself can lead to interproximal wear and therefore creation of space. According to Diernberger et al. (16) in 64% of women with chewing preferences, the preference was for the right side.

As the majority of the patients in this study completed their treatment before the age of 19 it is not possible to predict the final clinical position of the lower third molars as it is understood that the majority of these teeth erupt between the ages of 17-21 years (5). This study demonstrates the uprighting capabilities of the lower third molars in first premolar extraction cases.

Our findings showed that the lower left third molar angulation in the non-extraction treatment group deteriorated and consequently these teeth became more horizontal. From their studies Kandasamy and Woods (17) concluded that in non-extraction treatments, the molars have a greater chance of becoming distoangular which may lead to an increased chance of impaction. Although many impacted teeth will remain asymptomatic, some may be associated with future pathological changes. Orthodontists are required to assess and inspect the development of the third lower molars and to be aware of its influences on the dentition throughout and after active treatment.

This study supports the theory of improvement of lower third molar angulation following orthodontic treatments which have involved the loss of all first premolars. We suggest further studies to determine the reasons between the difference of position of the left and right sides and a comparison with those individuals who have not undergone any form of treatment.

Conclusion

1. In those patients who received orthodontic treatment following the extraction of all first premolars, the lower third molars became more vertical. This is viewed as helpful in assisting the eruption of these teeth.

2. The left mandibular molars in the non extraction group became more horizontal. This may impede their chances of eruption.

3. The right lower molars in the non extraction group improved and became more vertical.

4. Orthodontic treatments that involve extractions can improve the position of the mandibular molars.

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