

# Influence of orthodontic treatment with first premolar extraction on the angulation of the mandibular third molar

Huda M. Al Kuwari, BDS, MSc, Arwa A. Talakey, BDS, Reem M. Al-Sabli, BDS, Anisa H. Albadr, BDS.

## ABSTRACT

**الأهداف:** تقدير مدى تأثير خلع الضواحك الأمامية الأولى لغرض تقويم الأسنان في تحسن زاوية أضرار العقل في الفك السفلي واستخلاص النتائج لمعرفة مدى تأثير هذا الأمر في وضع الخطة العلاجية المناسبة في مجال تقويم الأسنان لحالات التقويم الحدية.

**الطريقة:** شارك في هذه الدراسة 80 مشارك من مرضى تقويم الأسنان خضعوا جميعهم لعلاج تقويم الأسنان باستعمال جهاز تقويم الأسنان الثابت. جميع المرضى المشاركين كان لديهم صور أشعاعيه بانورامية قبل العلاج وبعده، تم تقسيم هذه العينة إلى قسمين عينة البحث وتتكون من 40 حالة تم علاجها بجهاز التقويم الثابت وخلع الضواحك الأمامية وعينة المراقبة وتتكون من 40 حالة تم علاجها بجهاز التقويم الثابت بدون خلع للضواحك الأمامية ومن ثم تم تحديد ورسم أضرار العقل قبل العلاج وبعده في جميع الحالات وتمت مقارنتها ببعض لمعرفة مدى تأثيرها بخلع الضواحك بهدف علاج التقويم.

**النتائج:** أظهرت النتائج وجود فارق إحصائي هام في زاوية أضرار العقل في عينات البحث. كما أوضحت الدراسة عدم وجود فرق إحصائي يذكر بين الإناث والذكور وهذا يشير إلى أن خلع الضواحك الأمامية الأولى لها تأثير على تحسن زاوية أضرار العقل في كلا الجنسين ( $p=0.001$ ,  $p=0.006$ ).

**خاتمة:** يستنتج من الدراسة الحالية أن علاج تقويم الأسنان بخلع الضواحك الأمامية له تأثير إيجابي في تحسن زاوية أضرار العقل في الفك السفلي مما قد يؤدي إلى احتمال بزوغه في الموقع الأفضل في المستقبل.

**Objectives:** To evaluate the influence of orthodontic treatment that involved first premolars extraction on the angulation of the developing mandibular third molars, and whether this will result in an improvement in its path of eruption during tooth development.

**Methods:** A cross-sectional radiographic study was conducted using 80 panoramic radiographs of 40

orthodontic patients previously treated at the College of Dentistry, King Saud University, Riyadh, Kingdom of Saudi Arabia. The sample consisted of 2 groups, extraction and non-extraction orthodontic therapy group with equal number of patients in each group. The orthodontic treatment of the extraction group involved the extraction of first premolars, whilst non-extraction group had received orthodontic therapy without teeth extraction. The angulation of the right and left third mandibular molars was measured in each patient separately, and the data was analyzed using the non-parametric Mann-Whitney Test.

**Results:** The present data has shown significant improvement in the third molars angulation in the extraction orthodontic therapy group compared to non-extraction group, Although this finding was significant in both genders, females tend to show better response in the improvement of third molar angulation to extraction therapy than males ( $p=0.001$ ,  $p=0.006$ ).

**Conclusions:** Orthodontic treatment with first premolars extraction has improved the third molars angulation during their course of eruptions and consequently supports the decision of the orthodontic extraction therapy approach in borderline cases.

*Saudi Med J 2013; Vol. 34 (6): 639-643*

*From the Department of Pediatric Dentistry and Orthodontics (Al Kuwari, Al-Sabli, Al-Sabli), and the Department of Periodontics and Community Dentistry (Talakey, Albadr), College of Dentistry, King Saud University, Riyadh, Kingdom of Saudi Arabia.*

*Received 18th March 2013. Accepted 12th May 2013.*

*Address correspondence and reprint request to: Dr. Huda Al Kuwari, Department of Pediatric Dentistry and Orthodontics, College of Dentistry, King Saud University, PO Box 60169, Riyadh 11545, Kingdom of Saudi Arabia. E-mail: bkuwari@hotmail.com*

Impaction of third molars is considered among the main challenges that face dental profession. It is caused mainly due to lack of available space in the dental arch for their eruption.<sup>1</sup> The third molars teeth are more frequently affected than any other tooth in the dental arches and it is more seen impacted in the mandibular jaw compared to the maxillary jaw. The frequency of third molar impaction varies between 9.5 % in American males to 39% in Finns.<sup>2-6</sup> During the third molars development it continue changing its angulation and it undergo important pre-eruptive rotational movements. These rotational movements are extremely important and it can cause tooth impaction if it fail to occur. Previous literatures has revealed number of biological factors that play a role in determining whether the third molars becomes impacted or gain better chance to erupt in the dental arch, these factors include; mesial drift of the posterior teeth due to excessive inter-proximal attrition, increase in the mandibular length caused by sufficient growth, the direction of condylar growth, the variation in the ramus resorption, the pattern and direction of eruption of the mandibular dentition, the path of eruption of the third molars, the available retromolar space.<sup>7,8</sup> It has been reported that the use of orthodontic appliance which is designed to hold back the mandibular molars or actively tips them distally may lead to unfavorable rotational movements of third molar during its development and might result later in tooth impaction. On the contrary, extraction of premolars teeth during orthodontic treatment tends to produce favorable mesial movement and up-righting rotational changes during third molar development and consequently increase the possibility of their eruption.<sup>9,10</sup> Jain and Valiathan<sup>11</sup> were able to demonstrate significant reduction in the frequency of mandibular third molar impaction in orthodontic patients treated with premolar extractions compared to patients treated without extraction. Other clinicians were able to modify orthodontic treatment mechanics to minimize the potential of third molar impaction.<sup>5,12</sup> Many investigators<sup>10,11,13</sup> reported that the premolar extraction during orthodontic treatment showed improvement in the angulation of the developing lower third molar and allowing to a better chance of its eruption. However, this does not necessarily mean that it will erupt in a good position. In fact other authors suggest that the angulation of the third

molar improves with time regardless the orthodontic treatment is carried out with or without extraction.<sup>14</sup> Therefore, the influence of orthodontic treatment with premolars extraction on the rotational movement of the third molar during development, and subsequent improvement of its angulation and path of eruption still remain controversy in previous literatures. Further investigation of this aspect is important and will add more evidence to previous literature to support clinicians for taking the proper decision while setting up patient's treatment plan. The objective of this study was to determine the influence of orthodontic treatment with first premolars extraction on the angulations of the mandibular third molars as an important predisposing factor for their eruption.<sup>11</sup>

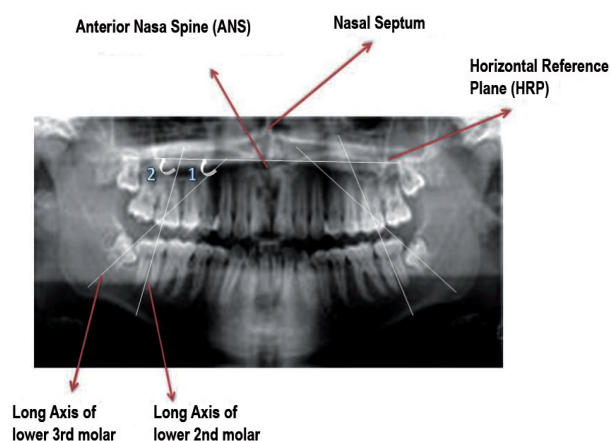
**Methods.** This study was carried out during the period between August 2011 and March 2012, and was approved by the Ethical Committee in the College of Dentistry Research Center, Deanship of Scientific Research, at King Saud University, under research project no. FR 0010. The research was conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki.

All panoramic radiographs of patients who completed their orthodontic treatment at the Orthodontic Department in the College of Dentistry during the period from January 2009 to July 2011 were collected and examined. The age of the present sample ranged between 12-15 years wherein the third molar is not yet erupted and still under development. The following inclusion criteria were implemented for the selection of the present sample: all panoramic radiographs were taken maximum one month before treatment and immediately at the end of the orthodontic treatment, the crown of the mandibular third molars is completely formed at the time of commencement of the orthodontic treatment, the radiographs should be of good quality without distortions, patients had no tooth agenesis, and no facial deformities.

Forty patients were selected for this study, 20 of them belong to non-extraction orthodontic therapy group, while another 20 patients represented the extraction orthodontic therapy group. In each group, both genders were represented equally (10 males and 10 females). Two panoramic radiograph (before and after treatment) were examined for each patient forming a total number of 80 panoramic radiographs included in this study. The right and left side of the patient were measured in this study and data were recorded and used for tabulation and later statistical analysis. Each panoramic radiograph was traced using matte acetate

**Disclosure.** Authors have no conflict of interests, and the work was not supported or funded by any drug company.

papers and proper illumination. A black lead pencil (3 H), ruler, right-angled triangle and protractor were used for the tracing. A standardized technique of tracing was used to trace the outlines of the mandible, nasal septum, hard palate and the mandibular second and third molars teeth. The outline of the nasal septum was bisected and a horizontal reference plane (HRP) was drawn perpendicular to the midline bisecting the nasal septum and through the outline of the hard palate. The angles between the HRP and the long axis of the third molar crowns were measured on the pre-treatment (T1) and post-treatment (T2) radiographs based on the method published by Jain and Valiathan<sup>11</sup> (Figure 1). The identification of anatomical landmark on radiographs were confirmed by a certified dental radiologist. The method error was determined by retracing 10 radiographs randomly selecting from each group. The measurements were carried out twice by the same examiner 15 days apart to determine the intra-examination reliability and by another examiner to determine the inter-examiner reliability. The method error were evaluated using coefficient reliability test.



**Figure 1** - Diagram of the angulation measurements.

The data were analyzed using an SPSS program for windows (version 16.0 SPSS Inc., Chicago, USA). Variables were recorded and categorized as follows: Patient name, patient file number, gender, molar type, location, and examiner identification, and orthodontic diagnosis, pre- and post-treatment third molar angulations. The data were not normally distributed so non-parametric Mann-Whitney Test were used for all analysis and the level of significance was set at <0.05.

**Results.** This study was conducted retrospectively using panoramic radiographs of patients who completed their orthodontic therapy. The study consists of 40 patients male and female and involved the examination of 80 panoramic radiographs pre- and post-treatment. A high reliability of measurement was indicated using correlation reliability test for both the intra- and inter-examiner reliability. The correlation coefficient value for intra-examiner was 0.99 and 1:00 for the inter-examiner reliability. The results revealed a significant difference between non-extraction and extraction orthodontic therapy group in the angulation of mandibular third molars in male sample ( $p=0.006$ ). The third molar angulations showed a significant improvement in post-treatment record (T2) compared to pre-treatment record (T1). In male sample, the non-extraction therapy group showed a mean improvement in the third molar angulation of 2.35, while extraction therapy group indicated a mean of 9.30 improvement in tooth angulation after treatment. The female sample showed higher significance level ( $p=0.001$ ) compared to male sample ( $p=0.006$ ) with mean improvement in tooth angulations of 2.41 in non-extraction therapy group and 9.5 in extraction therapy group after treatment (Table 1).

Although male and female patients showed significant differences between pre- and post-treatment measurements, when comparing their data for non-extraction and extraction therapy group, it showed no

**Table 1** - Comparison of angular measurements of third molar long axis in degree between extraction and non-extraction group in both genders.

Gender	Groups	T1 Mean±SD	T2 Mean±SD	Difference T2-T1 Mean±SD	Median	Minimum	Maximum	P-value
Male	Non-extraction n=10 (20 teeth)	43.650±8.821	46.000±8.271	2.350±5.224	1.500	-6.000	17.000	0.006
	Extraction n=10 (20 teeth)	40.500±12.630	49.800±14.983	9.300±12.224	7.500	-15.000	45.000	
Female	Non-Extraction n=10 (20 teeth)	38.450±9.467	40.950±9.708	2.500±0.946	2.000	1.000	4.000	0.001
	Extraction n=10 (20 teeth)	35.500±8.531	45.000±6.274	9.500±8.629	5.500	1.000	24.000	

<sup>†</sup>Mann-Whitney Test, T1 - pre-treatment measurement, T2 - post-treatment measurement, Unit of measurement - degree

**Table 2** - Comparison of angular measurements of third molar long axis in degree between extraction and non-extraction group using male and female pooled data.

Groups	T1 Mean±SD	T2 Mean±SD	Difference T2-T1 Mean±SD	Median	Minimum	Maximum	P-value
Non-extraction n=20 (40 teeth)	41.050±9.408	43.475±9.263	2.425±3.706	2.000	-6.000	17.000	0.000
Extraction n=20 (40 Teeth)	38.000±10.936	47.400±11.595	9.400±10.446	6.000	-15.000	45.000	

<sup>†</sup>Mann-Whitney Test, T1 - pre-treatment measurement, T2 - post-treatment measurement, unit of measurement - degree

statistical difference between them. Therefore, in this study their results were pooled together and managed as one data for comparison between non-extraction and extraction therapy groups (Table 2). The findings indicated that the effect of orthodontic extraction of first premolars has a significant influence on the improvement of the angulation of the third molar between extraction and non-extraction group (Table 2).

**Discussion.** The presence, position and angulation of mandibular third molars remain an important clinical finding to orthodontists during the setup of patient's treatment plan. This is due to its influence during ongoing orthodontic treatment as well as on the subsequent stability of treatment results. In addition several studies have reported number of potential problems that were associated with impacted and mal-positioned third molars on the other permanent teeth.<sup>15</sup> In this study, panoramic radiographs were used as it proved to be more reliable indicator in evaluating third molars angulation according to Olive et al<sup>16</sup> and Larheim et al.<sup>17</sup> Although the sample of the present study may appear small, the numbers of radiograph observations were doubled by carrying out measurement for each side of the patient separately. Data of the right and left side was managed as a single case in each patient, furthermore the sample size it was based on the judgment of professional statistician. The present findings contradicted with the findings reported by Graber and Kaineg<sup>18</sup> who showed that the extraction of premolars during orthodontic treatment does not enhance normal eruption of third molars. This study confirmed that an orthodontic treatment carried out with extraction of first premolars teeth has improved the angulation of the third molar during development. This was in agreement with several other studies.<sup>3,13,19-21</sup> The possible explanation of this finding might be due to an extra dental arch space that might have been provided to the third molar area as a result of mesial migration of teeth in the buccal segment during orthodontic treatment.

Jain and Valiathan<sup>11</sup> recommended that an evaluation of the angulation of the third molar is more significant in borderline orthodontic extraction cases. This is due to the effect of orthodontic extraction on the improvement of the third molar angulation and subsequent chance of their normal eruption post-treatment.

The present study revealed slight and insignificant improvement in the third molar angulation in non-extraction group after orthodontic treatment. This finding does not agree with the study published by Saysel et al<sup>13</sup> who reported a worsening of mandibular third molar angulations with non-extraction treatment approach.

In conclusion, orthodontic treatment with first premolars extraction has improved the third molars angulation during their course of eruption and consequently support decision of orthodontic extraction therapy approach in borderline cases.

**Acknowledgment.** Our great appreciation is extended to all the participants in this study. We would like to thank Mr. Nassr Al-Maflehi for his great assistance in the statistical consultation and analysis.

## References

1. Forsberg CM, Vingren B, Wesslén U. Mandibular third molar eruption in relation to available space as assessed on lateral cephalograms. *Swed Dent J* 1989; 13: 23-31.
2. Yavuz I, Baydaş B, Ikbak A, Dağsuyu IM, Ceylan I. Effects of early loss of permanent first molars on the development of third molars. *Am J Orthod Dentofacial Orthop* 2006; 130: 634-638.
3. Elsey MJ, Rock WP. Influence of orthodontic treatment on development of third molars. *Br J Oral Maxillofac Surg* 2000; 38: 350-353.
4. Stagers JA, Germane N, Fortson WM. A comparison of the effects of first premolar extractions on third molar angulation. *Angle Orthod* 1992; 62: 135-138.
5. Richardson ME. The early developmental position of the lower third molar relative to certain jaw dimensions. *Angle Orthod* 1970; 40: 226-230.
6. Aitasalo K, Lehtinen R, Oksala E. An orthopantomographic study of prevalence of impacted teeth. *Int J Oral Surg* 1972; 1: 117-120.

7. Kaplan RG. Some factors related to mandibular third molar impaction. *Angle Orthod* 1975; 45: 153-158.
8. Bjork A, Jensen E, Palling M. Mandibular growth and third molar impaction. *Acta Odontol Scand* 1956; 14: 231-272.
9. Güngörmüş M. Pathological status and changes in mandibular third molar position during orthodontic treatment. *J Contemp Dent Pract* 2002; 15: 11-22.
10. Kim TW, Artun J, Behbehani F, Artese F. Prevalence of third molar impaction in orthodontic patients treated non-extraction and with extraction of 4 premolars. *Am J Orthod Dentofac Orthop* 2003; 123: 138-145.
11. Jain S, Valiathan A. Influence of first premolar extraction on mandibular third molar angulation. *Angle Orthod* 2009; 79: 1143-1148.
12. Swessi DM, Stephens CD. The spontaneous effects of lower first premolar extraction on the mesiodistal angulation of adjacent teeth and the relationship of this to extraction space closure in the long term. *Eur J Orthod* 1993; 15: 503-511.
13. Saysel MY, Meral GD, Kocadereli I, Taşar F. The effects of first premolar extractions on third molar angulations. *Angle Orthod* 2005; 75: 719-722.
14. Tarazona B, Paredes V, Llamas JM, Cibrian R, Gandía JL. Influence of first and second premolar extraction or non-extraction treatments on mandibular third molar angulation and position. A comparative study. *Med Oral Patol Oral Cir Bucal* 2010; 15: e760-e766.
15. Phillips C, White RP Jr. How predictable is the position of third molars over time? *J Oral Maxillofac Surg* 2012; 70: S11-S14.
16. Olive RJ, Basford KE. Transverse dento-skeletal relationships and third molar impaction. *Angle Orthod* 1981; 51: 41-47.
17. Larheim TA, Svanaes DB. Reproducibility of rotational panoramic radiograph: mandibular linear dimensions and angles. *Am J Orthod Dentofacial Orthop* 1986; 90: 45-51.
18. Graber TM, Kaineg TF. The mandibular third molar; its predictive status and role in lower incisor crowding. *Proc Finn Dent Soc* 1981; 77: 37-44.
19. Bayram M, Ozer M, Arici S. Effects of first molar extraction on third molar angulation and eruption space. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009; 107: e14-e20.
20. Ay S, Agar U, Bıçakçı AA, Köşger HH. Changes in mandibular third molar angle and position after unilateral mandibular first molar extraction. *Am J Orthod Dentofacial Orthop* 2006; 129: 36-41.
21. Nanda RS. Reappraising "Wits." Readers' forum. *Am J Orthod Dentofacial Orthop* 2004; 125: 18A.

#### Related Articles

Pektas ZO, Gunhan O. Cytologically diagnosed metastatic small cell lung carcinoma in the mandibular soft tissue. *Saudi Med J* 2013; 34: 539-541.

Taher NM. Atomic force microscopy and tridimensional topography analysis of human enamel after resinous infiltration and storage in water. *Saudi Med J* 2013; 34: 408-414.

Filipovic-Zore I, Divic Z, Duski R, Gnjatovic N, Galic N, Prebeg D. Impact of ozone on healing after alveolectomy of impacted lower third molars. *Saudi Med J* 2011; 32: 642-644.