Mesioangular impacted lower third molars: angulation before and after orthodontic treatment with premolar extraction

D F Hartono, B M Soegiharto* and S Sumardi

Department of Orthodontics, Faculty of Dentistry, Universitas Indonesia, Jakarta 10430, Indonesia

*E-mail: benny_soegiharto@yahoo.com

Abstract. Impaction of the lower third molars is due to the lack of space in the retromolar pad. Extraction of premolars in orthodontic treatment helps the uprighting of mesioangular impacted third molars so that they can erupt normally. The aim of this study was to measure changes in angulation during orthodontic treatment of mesioangular impacted lower third molars. This retrospective, cross-sectional analytical study used 25 samples of panoramic radiographs from patients aged 10–21 years before and after orthodontic treatment. Angulation was measured using the long axis of the lower second molars as the reference plane. The Wilcoxon test and paired t-test ($p < 0.05$) showed no significant changes in lower third molar angulation on both sides ($p > 0.05$). Radiographs showed a tendency for an increase in angulation, although the change was not statistically significant ($p > 0.05$). These increases occurred most frequently in the adult group (17–21 years old). It can be concluded that the extraction of premolars in orthodontic treatment did not significantly affect the angulation of impacted third molars.

1. Introduction

The impaction of teeth due to lack of space is not uncommon in orthodontic treatment. The third molar is the last permanent tooth affected by the jaw arch to erupt or become impacted [1, 2]. Third molar impaction occurs because of a lack of space in the retromolar pad area, the tendency of change in angulations during tooth development, or failure in uprighting [3]. Teeth are commonly extracted before orthodontic treatment to decrease the incidence of crowding and avoid interfering with the success of orthodontic treatment, either during the treatment period or treatment outcome [4, 5, 6, 7].

The need for space is notable in orthodontic treatment. The most common malocclusion is Class I, where the bite is normal but there is overcrowding. Extraction is one method of gaining space. In orthodontic treatment of crowding in mandibular anterior teeth, mandibular first premolar extraction is generally performed for moderate-to-severe cases of crowding [8].

Nance et al. suggested that if a mesioangular impacted third molar tooth can be uprighted during the developmental stage, the tooth may erupt without disrupting other teeth in the arch [9]. Extraction has positive effects on mesial shifting and uprighting of the third molar before eruption [8]. Faubion found that 55% of subjects who had undergone orthodontic treatment with premolar extraction have a better final position of the third mandibular molar than the position before treatment, allowing it to erupt without impaction [10].

Russell et al. and Poosti et al. showed a positive affect from premolar extractions for the angulation of mesioangular impacted the third mandibular molars in orthodontic treatment in

---

*Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.*

Published under licence by IOP Publishing Ltd
Caucasians and African Americans [4, 11]. Against this background, the current study aimed to observe changes in the angulation of mesioangular impacted mandibular third molars before and after orthodontic treatment with premolar tooth extraction.

2. Methods
This retrospective analytical study reviewed panoramic radiographic images of patients seen at the Teaching Dental Hospital, Faculty of Dentistry, Universitas Indonesia from September to October 2013. A total of 24 samples of radiographs before and after orthodontic treatment with premolar 1 or premolar 2 extractions were included. The study sample comprised 21 female subjects and 4 male subjects with a mean age of 14.92 years. The inclusion criteria were ≥10 years of age and with permanent teeth as well as Class 1 skeletal malocclusion, fixed orthodontic treatment with or without additional mandibular anchorage, complete medical records including panoramic and cephalometric radiographs before and after treatment and mandibular premolar extraction, an unerupted mandibular third molar with left and right mesioangular impaction, and complete dental examination before the extraction of the first or second mandibular premolars.

The angulation of the lower third molar was determined based on the methodology described by Poosti (2012) [11]. The angulation was measured by drawing an outline form of the occlusal line of the mandibular second and third molars and then drawing a perpendicular line to the long axis of the tooth. The point of the two lines was the angulation of the third molar against the second mandibular tooth (Figure 1). A 6° change in angulation was considered clinically significant.

Data were collected and processed with SPSS software. Data analysis obtained the difference in the angulation of mesioangular impacted lower third molars before and after orthodontic treatment with premolar extraction. The Shapiro–Wilk normality test results showed left side abnormal data distribution; therefore, the non-parametric Wilcoxon test was used. The right side showed normal data distribution; therefore, the so paired t-test was used. A comparison of changes in angulation between the two sides was tested using the Wilcoxon test. The value of significance was set at p < 0.05.

3. Results
The differences in the angulation of the third molar relative to that of the second molar before and after treatment showed no correction in angulation. Both sides tended to have an increase in the degree of angulation, although this increase was not statistically significant (p > 0.05) (Table 1).
Table 1. Changes in the angulation of the third molar teeth relative to that of the second molars during fixed orthodontic treatment with premolar 1 or premolar 2 dental extraction.*

|                         | Minimum | Maximum | Average (SD) |
|-------------------------|---------|---------|--------------|
| Angulation T0 left (°)  | 6.00    | 59.00   | 32.24 (15.04) |
| Angulation T1 left (°)  | 4.00    | 93.00   | 34.80 (23.00) |
| Angulation T0 Right (°) | 4.00    | 54.00   | 28.80 (12.83) |
| Angulation T1 Right (°) | 3.50    | 79.00   | 32.04 (17.14) |

* The mean tooth angulation did not show a significant difference before and after orthodontic treatment on the left (p = 0.648) and right (p = 0.301) sides.

The age distribution was as follows: 13 children (10–14 years old), 7 adolescents (15–17 years old), and 5 young adults (17–21 years old). Based on the distribution of data for changes in the degree of angulation (Figure 2), the largest increase occurred in adults on the right side of the jaw. Changes in the degree of angulation of the third molars on both sides of the jaw tended to increase, with the left side showing an average increase of 2.56 ± 20.68, while an increase of 3.24 ± 15.34 was seen on the right side of the jaw. Based on statistical test results obtained, the comparison of changes of both sides had no significance differences (p = 0.920) (Table 2).

Figure 2. Relationship between changes in the degree of angulation of the mandibular third molar in the different age groups.

Table 2. Changes in the degree of angulation of the mandibular third molar on the left side and right side.

|               | Minimum | Maximum | Average (SD) |
|---------------|---------|---------|--------------|
| Left side (°) | −40.00  | 46.00   | 2.56 (20.68) |
| Right side (°)| −16.00  | 50.50   | 3.24 (15.34) |
4. Discussion

In orthodontic treatment, reducing crowding to add space occurs through extraction and non-extraction methods. First and second premolars are commonly extracted [12]. In the current study, it was thought that mesial movement of the second molar provides space on the retromolar pad to increase the probability of third molar eruption. According to Richardson (1977) and Poosti (2012), premolar extraction can accelerate uprighting and eruption into the oral cavity of the third molar [3, 11].

Data in the current study shows that one-half of the left and right third molars has undesirable changes of angulation (turning more horizontally) with increasing crowding; however, these angulation changes are not statistically significant. These results indicate that despite increased angulation or improvement in impacted mandibular third molars, whether the third molar teeth can be maintained or removed is dependent on other factors that influence angulation. Angulation of the right third molar in the mandible shows a larger increase than that of the left third molar. This study has findings similar to those conducted by Stagger (1992) and Russell (2012), which concluded that there were no significant changes in the angulation of the third molar before and after orthodontic treatment with extraction [4, 13]. The insignificant change in angulation suggests that there are other factors that play a role in the process of alteration of third molar angulation. Poosti (2012) showed that the process of uprighting third molar teeth occurred in the extraction and the non-extraction groups [11]. These results are in contrast to the results obtained by Jain (2009) and Poosti (2012), who concluded that the extraction of premolar teeth has a positive effect on the process of uprighting the mandibular third molars with a significant difference in results [6, 11]. The difference in outcomes may be due to differences in measurement methods and inclusion criteria. Poosti (2012) provided a relevant and accurate measurement method because it not only uses the reference plane of the second molar but also shows a change in the apical distance of the third molar to the lower mandibular inferior border [11]. The existence of two reference fields in Poosti’s method results in smaller bias than that obtained in other studies.

The current study also observed the relationship between changes in tooth angulation and age at initial treatment. Richardson (1978) stated that during the formation of the third molar, the angulation and position of the tooth is constantly changing. The root formation of the third molar at the lower jaw begins at an average age of 16 years and is completed at 18–25 years [7, 14, 15]. The data in the current study shows the largest changes in angulation occurring in the young adult age group (18–21 years) while the smallest change in angulation occurred in the adolescent age group (15–17 years). This result does not agree with the results obtained in Richardson’s (1978) study, which looked at the age at the initiation of root formation. However, this may be due to an imbalance in the number of samples from each age group. In addition, the rate of resorption of the anterior ramus influences the change in the position and angulation of the mandibular third molar [15].

Saysel (2005) and Ahmed (2011) agreed that even when uprighting occurred, the third molar does not necessarily erupt normally, requiring further observation until tooth development is completed [16, 17]. Gohilot (2012) also concluded that premolar extraction helps the uprighting of the third molar teeth. However, extraction cannot be the only factor because the study showed no significantly different results; therefore, it was concluded that premolar extraction does not have a significant effect on changes in third molar angulation [18].

Based on the review by Gohilot (2012) above, premolar extraction in orthodontic treatment does not significantly affect changes in the angulation of third molars. Even when the third molar experiences uprighting, it has not been confirmed that the third molar teeth erupt properly in the oral cavity until tooth development is completed. Movement of the third molar and uprighting with first or second premolar extraction is a secondary consideration in treatment because the initial purpose of extraction is to provide space for tooth movement.

The current study is not complete because there are some variables that cannot be grouped and specified, such as the use of anchoring, type of impaction, angulation of teeth, type of teeth extracted, length of treatment, and age. These variables may cause high variability in data as well as bias and thus affect the results of the research. A limitation of this study is the insufficient number of samples due to the limited samples available in the dental clinic.
However, the sample group used was a group of Indonesian people; therefore, it represents the Indonesian general population.

5. Conclusion
Although there is a tendency for increased angulation of the mesioangular impacted mandibular third molars on the left and right sides, this increase in angulation is not statistically significant between before and after orthodontic treatment with premolar extraction or between the right and left sides. The data show that young adults have the largest mean angulation change, with the largest change in the right third mandibular molar.

6. References
[1] ADA [Internet]. Tooth eruption: the permanent teeth: c2006 [cited 2013 Jun 19]; Available from: http://www.ada.org/sections/scienceAndResearch/pdfs/patient_58.pdf.
[2] Haavikko K, Altonen M and Mattila K 1978 Predicting angulational development and eruption of the lower third molar Angle Orthod. 48 39
[3] Richardson M E 1977 The etiology and prediction of mandibular third molar impaction. Angle Orthod. 47 165
[4] Russell B, Skvara M, Draper E, Proffit W R, Phillips C and White R P 2012 The association between orthodontic treatment with removal of premolars and the angulation of developing mandibular third molar over time Angle Orthod. 83 376
[5] Niedzielska I 2005 Third molar influence on dental arch crowding Eur J Orthod. 27 518
[6] Jain S and Valiathan A 2009 Influence of first premolar extraction on mandibular third molar angulation Angle Orthod. 79 1143
[7] Ness G M and Peterson L J 2004 Impacted teeth. Peterson’s Principles of Oral and Maxillofacial Surgery. 2nd ed. ed M Miloro (BC Decker) pp. 139–141
[8] Cobourne M T and DiBiase A T 2010 The orthodontic patient: treatment planning. Handbook of Orthodontics. 1st ed. ed M T Cobourne and A T DiBiase (Mosby Elsevier) pp. 191–196
[9] Nance P E, White R P Jr, Offenbacher S, Phillips C, Blakey, G H and Haug R H 2006 Change in third molar angulation and position in young adults and follow-up periodontal pathol J Oral Maxillofac Surg. 64 424
[10] Faubion B H 1968 Effect of extraction of premolars on eruption of mandibular third molars J Am Dent Assoc. 76 316
[11] Poosti M, Basafa M, Hosseini M and Parvizi F 2012 Changes in the position of mandibular third molars following extraction and non-extraction orthodontic treatments J. Dent. Mater. Tech. 1 47
[12] Ay S, Agar U, Bicakci A and Kosger H H 2006 Changes in mandibular third molar angle and position after unilateral mandibular first molar extraction Am. J. Orthod. Dentofacial Orthop. 129 36
[13] Stagger J A, Germane N and Fortson W M 1992 A comparison of the effects of first premolar extractions on third molar angulation Angle Orthod. 62 135
[14] Nelson S J and Ash M M 2010 Development and eruption of the teeth. Wheeler’s Dental Anatomy, Physiology, and Occlusion. 9th ed. ed S J Nelson and M M Ash (St. Louis: Saunders Elsevier) pp. 30–31
[15] Richardson M E 1978 Pre-eruptive movement of the mandibular third molar Angle Orthod. 48 187
[16] Ahmed I, Gul-e-Erum and Kumar N 2011 Mandibular third molar angulation in extraction and non-extraction orthodontic cases J. Ayub. Med. Coll. 23 32.
[17] Say sel Y M, Meral G D, Kocadereli I and Tasar F 2005 The effect of first premolar extractions on third molar angulations Angle Orthod. 75 719
[18] Gohilot A, Pradhan T and Keluskar K M 2012 Effects of first premolar extraction on maxillary and mandibular third molar angulation after orthodontic therapy J. Oral. Biol. Craniofac. Res. 2 97.