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ORIGINAL ARTICLE

Effects of lower third molar removal on attachment level and alveolar bone height of the adjacent second molar

Wong Soo Yee, Roselinda Ab. Rahman*, Haslina Taib

School of Dental Sciences, Universiti Sains Malaysia, 16150 Kota Bharu, Kelantan, Malaysia.

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Keywords

Adjacent second molar, alveolar bone height, periodontal status, third molar removal.

Abstract The purpose of this study was to evaluate the periodontal status distal to the adjacent second molar following the extraction of a partially or fully impacted mandibular third molar at Klinik Pergigian Pakar Hospital Universiti Sains Malaysia (KPPHUSM) from April of 2008 until June of 2008.This was a prospective study which involved the clinical and radiological study of patients. In this study, convenience sampling method had been used. The sample size was 22 patients aged 18-32 years old with inclusion criteria. The outcomes measured in this study were periodontal pocket depth (PPD), clinical attachment level (CAL) and alveolar bone height (ABH). Subjects were examined at distal surface (disto-buccal, mid-distal and disto-lingual) of second molar for PPD and CAL before and 3 months after the impacted adjacent lower third molar extraction. OPG was taken each before and after the third molar removal. These data were analyzed using SPSS version 16 and Wilcoxon-signed-ranks test was used to compare the PPD, CAL and ABH pre and post operatively. All the results were not significant with p >0.05. For PPD, median = 3mm pre and post extraction. CAL median= 2mm pre and post operatively and ABH median of 3.10mm (before) and 2.8mm (after) the third molar removal. From our study, we concluded that there were no significant changes of PPD, CAL and ABH at distal side of second molar after 3 months of the adjacent impacted lower third molar removal.

Introduction

Third molars have high incidence of impaction, and have been associated with the pericoronitis, caries of the distal surface of the second molar or of the third molar itself, certain types of cysts or odontogenic tumors, and primary or secondary dental crowding (Chaparro-Avendaño *et al*., 2005).

Complications in third molar eruption, particularly of the lower molars, are attributable to their late formation and to the phylogenetic evolution of the mandible, which results in a lack of available space for normal eruption (Chaparro-Avendaño *et al*., 2005).

Extraction of third molar is the most common surgical procedure performed in the oral cavity. Kaminishi *et al*. (2006) noted that between 1997 and 2002 there was an increase in patients over the age of 40 requiring third molar removal. Numerous indications and contraindications for surgical extraction of third molars have been outlined, one of which is the prevention and improvement of periodontal defects in adjacent second molars.

Several conflicting findings have been published in previous literature regarding the effects of impacted third molar extraction on the periodontal health of the adjacent second molar; some have suggested improvement of periodontal status distal to adjacent second molar (Ash, 1964; Zeigler, 1975; Kugelberg *et al*., 1985), contrarily, few studies demonstrated loss of attachment and reduction of alveolar bone height (Stephens *et al*., 1983; Knutsson *et al*., 1996).

If there are significant changes of attachment level and alveolar bone height distal to lower second molar following removal of impacted adjacent third molar, bone grafts or bone substitutes can be placed in the socket post-operatively to maintain the alveolar bone height.

The purposes of this study were to evaluate the periodontal status distal to the

* **Corresponding author:** Dr. Roselinda Ab. Rahman, Lecturer, School of Dental Sciences, Universiti Sains Malaysia, 16150 Kota Bharu, Kelantan, Malaysia. Tel: +609 7675815 (office), Fax +609-7642026. E-mail roselinda@kck.usm.my

adjacent second molar following the pre- and post-extraction of a partially or fully impacted mandibular third molar and to determine the periodontal pocket depth (PPD), clinical attachment level (CAL) and alveolar bone height (ABH) at the distal side of the lower second molar, and further aimed to compare the alveolar bone height at the distal side of the second molar.

Materials and methods

This was a prospective study which involved the clinical and radiological study of patients. It was designed to evaluate patient who underwent a lower third molar extraction at KPPHUSM from April of 2008 until June of 2008. The Research Ethics Committee (Human), Universiti Sains Malaysia had approved this study on 15 May 2008 (Ref.:USMKK/ PPP/JEPeM[202.3 (11)]. All the information of the patients' data was kept confidential**.**

In this study, convenience sampling method was used and the total of sample size obtained was 22 patients. All these patients had been given informed consents. Patients had been examined clinically and radiographically pre and post surgical removal of lower impacted third molar. The criteria for patient inclusion were age range between 18-32 years old; availability of a good-quality pre-operative panoramic radiograph; patients' good oral hygiene.

The criteria for exclusion were pregnancy during the extraction or during the final examination; periodontal surgery at the time interval between the extraction and the examination; systemic conditions that might have an effect on bone growth and/or periodontal healing (such as uncontrolled diabetes mellitus or on immunosuppressive medications); patients with chronic periodontal diseases.

Clinical measurements were performed at three sites (disto-buccal, mid-distal and disto-lingual aspects) of the second molar. Their scores were then averaged in mm. Clinical examinations were performed to check the corresponding variables such as periodontal pocket depth (PPD), gingival margin position (GMP), clinical attachment level (CAL), alveolar bone height (ABH); and were measured in mm pre and post operatively.

Good quality orthopantomogram radiographs (OPGs) were performed twice; first during routine procedure before third molar extraction and second was during the 3 months review after the third molar extraction. This was to assess the alveolar bone height at the distal of second molar using Machine-Orthoralix 9200 (Italy). All measurements were recorded by a single examiner. To test for reproducibility in measuring alveolar bone height, 10 OPGs were randomly selected with measurements recorded at two separate times, a week apart. For radiological examination, Vixwin 2000 software was used to measure the alveolar bone height at distal side of second molar from OPG on the computer pre and post operatively.

SPSS version 16 was used to analyze the data including patients' name, registration number, age, sex, type of impacted lower third molar, class of impacted lower third molar and all the variables that had been mentioned above. PPD and CAL of distal-buccal, mid-distal and distal-lingual of the distal side of the adjacent lower second molar were compared before and after the removal of impacted lower third molar using Wilcoxon signed-ranks test.

The difference between pre and post operative alveolar bone heights, on the distal aspect of the adjacent second molar was also compared using the same non-parametric test**.** The reliability of our radiographic measurements was tested. Initially the double measurements were compared using paired *t*-test for observation. The correlations between the two sets of measurements were evaluated (Pearson's correlation coefficient test) and found to be highly associated (R^2= 0.998) and statistically significant (p <0.001). These minute differences between repeated measurements validate the accuracy of the radiological measurements. In this study, Wilcoxon-signed-ranks test had been used to analyze the data due to small sample size. In this test, median and interquartile range (IQR) were calculated to determine the changes of PPD, CAL and ABH at distal side of second molar before and after the removal of impacted lower adjacent third molar.

Results

The study population consisted of 22 patients, with 18 (81.8%) females and 4 (18.2%) males. Their ages ranged from 18 to 32 years old. There were 17 (77.3%) Malays, 4 (18.2%) Chinese and 1 (4.5%) Indian involved in this study. From the study, 12 cases (54.5%) were impacted left lower mandibular third molars (38) while 10 cases (45.5%) were impacted right lower mandibular third molars (48). For the type of impaction, 10 teeth (45.5%) were impacted mesioangularly, 7 teeth (31.8%) were impacted horizontally and 5 teeth (22.7%) were impacted vertically. There was no distoangular impaction in this study. The extracted third molars were in contact with the adjacent second molars in 10 cases (45.5%). The overall plaque score of all the study subjects were fair (26%-75%) by using the plaque score charts.

Discussion

Recently, impacted third molars are very common in adult populations (Krausz *et al.*, 2005). The ability to accurately predict third molar impaction will allow clinicians to improve third molar treatment strategies especially the periodontal health at the distal side of the adjacent second molar as extraction of third molars have been cited as causing periodontal problem (Ganss *et al.*, 1993; Forsberg, 1988;

Table 1 Changes of Periodontal Pocket Depth in mm for 3 distal surfaces of adjacent second molar before and after the impacted lower third molar removal with 22 subjects in this study

Variable	Before extraction Median(IQR)	After extraction Median(IQR)	Z-statistic	*p* value
Distal-buccal	3.0(3.0)	3.0(3.0)	-1.282	0.200
Mid-distal	2.5(2.0)	2.0(1.0)	-1.289	0.197
Distal-lingual	3.0(1.0)	3.0(3.0)	-1.653	0.098

Wilcoxon signed-ranks test.
(*p* value $\leq$ 0.05 = Significant; *p* value > 0.05 = Insignificant)

Table 2 Changes of Clinical Attachment Level in mm for 3 distal surfaces of adjacent second molar before and after the impacted lower third molar removal with 22 subjects in this study

Variable	Before extraction Median(IQR)	After extraction Median(IQR)	Z-statistic	*p* value
Distal-buccal	2.0(2.0)	2.0(3.0)	-1.420	0.156
Mid-distal	1.5(2.00)	1.0(1.0)	-1.289	0.197
Distal-lingual	2.0(1.0)	1.0(1.0)	-1.897	0.058

Wilcoxon signed-ranks test.
(*p* value $\leq$ 0.05 = Significant; *p* value > 0.05 = Insignificant)

Table 3 Changes of alveolar bone height in mm distal to the adjacent second molar before and after the impacted lower third molar removal with 22 subjects in this study

Variable	Before extraction Median(IQR)	After extraction Median(IQR)	Z-statistic	*p* value
Alveolar bone height	3.1(3.0)	2.8(2.3)	-1.309	0.191

Wilcoxon signed-ranks test.
(*p* value $\leq$ 0.05 = Significant; *p* value > 0.05 = Insignificant)

Hattab and Alhaija, 1999). There were few articles published regarding the effects of lower third molar removal on periodontal health at the distal side of the adjacent second molar (Ash, 1964; Zeigler, 1975; Kugelberg *et al.*, 1985).

From our results, we found that there were no significant changes of periodontal pocket depth (PPD), clinical attachment level (CAL) and alveolar bone height (ABH) at the 3 distal surfaces which consisted of disto-buccal, mid-distal and disto-lingual of the adjacent second molar before and after impacted lower third molar removal. From Table 1, the median for disto-buccal and disto-lingual surfaces were the same before and after the extraction of impacted third molar and the different changes was statistically insignificant (p> 0.05). While for the mid-distal PPD, it reduced about 0.5mm post operatively; however the *p* value was still insignificant possibly due to small sample sizes.

From Table 2, there were no gross changes of CAL before and after the third molar extraction for distal-buccal surface. However, for mid-distal, there were slight reduction of CAL post operatively but the *p* value was still statistically insignificant. The *p* value for disto-lingual was 0.058 which was close to being significant.

While for alveolar bone height (ABH), the result was showed in Table 3. There was a difference of ABH pre and post operatively of about 0.3 mm. However the difference was also statistically not significant. Our findings were agreed with Gröndahl and Lekholm (1973) who demonstrated no significant changes in alveolar bone height distal to the second molar after impacted lower third molar extraction. In their study, the duration was 12 months while in our study the duration was only 3 months. Kugelberg (1990) showed similar results where there were no gross changes of ABH following third molar extraction. However, in their study, they compared the ABH at 2 and 4 years after extraction. Osborne *et al*. (1982) and Quee *et al*. (1985) had also shown that there were no significant changes in PPD following third molar extraction regardless of the age and sex of the patients. Besides that, our findings were further supported by Richardson and Dodson *(*2005) who conducted a review paper of eight articles about this topic. The inclusion criteria for this review paper were prospective cohort studies or

randomized clinical trials with follow-up periods of 6 months or more. They found that clinical attachment level and periodontal pocket depth on the distal side of second molar 6 months post removal of impacted eights were clinically insignificant. In conclusion, they reported that the second molar periodontal probing depth or attachment level either remained unchanged or had slight improvement after third molar extraction.

However, there were some previous studies that had different results when conducting similar studies. Peng *et al.* (2001) compared the periodontal status at distal and mesial sides of mandibular second molars between two groups, where the first group of third molar had been surgically extracted and the second group was the control group. In this study, the samples size was 57 and the subjects were examined after the lower impacted third molar had been extracted more than 5 years. They noted that there were significant probing depth, greater attachment loss and radiographic alveolar bone loss at the distal sides of the experimental group compared to control group.

Kan *et al.* (2002) had conducted a retrospective study with 158 patients. They investigated the periodontal conditions distal to mandibular second molars 6-36 months after routine surgical extraction of adjacent impacted third molars. Their results supported Peng *et al.* (2001) where they suggested that periodontal breakdown was established on the distal surface of a mandibular second molar in the vicinity of impacted third molar. Our study was different from Peng *et al.* (2001) and Kan *et al.* (2002) in which their studies were retrospective study that only checked the second molar more than 6 months after the impacted third molar extraction. In their study, they used contralateral teeth as the control group which might not represent the true changes of PPD, CAL and ABH. In our prospective study, we did the measurement pre and post surgical removal of impacted third molar which would give more reliable results compared to their study. Krausz *et al.* (2005) had conducted another retrospective study where the findings did not coincide with the findings of Peng *et al.* (2001) and Kan *et al.* (2002). In Krausz *et al.* (2005) study, only a group of patients was included in the sample and the control were the contralateral second lower molar. Their study also evaluated the long-term changes in periodontal health and alveolar bone 28-58 months post-operatively which was of a longer duration than Kan *et al.* (2002). Krausz *et al.* (2005) noted that there was a significant gain of alveolar bone height on the distal aspect of the adjacent second molar on the test side, whereas slight bone loss was noted on the control side. However, the sample size by Krausz *et al.* (2005) was smaller (n=25) compared to Peng *et al.* (2001) (n=57) and Kan *et al.* (2002) (n=283). Again we could not compare the results of Krausz *et al.* (2005) with our findings because their study was a retrospective study and they examined the subjects aged 20-60 years old after the lower third molar had been removed for more than two years compared to our study in which the assessment was done 3 months after the removal of the tooth. The age range of subjects in Krausz *et al.* (2005) study was wider than in our study (aged 18-32 years old) which may give different outcomes of the study. However, the samples size of their study (n=25) was quite similar with this present study (n=22).

In our study, there were multiple types of impactions (vertical, mesioangulated and horizontal) of lower third molar while other study (Dodson, 2005) only included the mesioangularly and horizontally impacted lower third molars. This study found that mesioangular impactions of lower third molars were more common followed by horizontal impactions and vertical impaction. Vertical impactions were also included in this study due to small sample size in this limited duration of research. However, there were no distoangular impactions of lower third molars in both our study and Dodson (2005).

Limitations

There were a few limitations in our study. One of it was small sample size due to the time frame given. In our study, only short term changes of PPD, CAL and ABH could be evaluated. Longer duration of time is needed in order to observe the long term changes of alveolar bone height. The other limitation was patients' compliance as many patients refused to come post operatively because they felt that the extraction side did not have any pain or signs and symptoms.

Conclusion

From our study, we concluded that there were no significant changes of periodontal pocket depth (PPD), clinical attachment level (CAL) and alveolar bone height (ABH) at the distal aspect of the adjacent second molar after surgical removal of partially or fully impacted lower third molars.

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