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EVALUATION OF THE PERIODONTAL STATUS OF THE SECOND MOLAR AFTER THE SURGICAL REMOVAL OF THE MANDIBULAR IMPACTED THIRD MOLAR – A PROSPECTIVE STUDY

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ABSTRACT

Background: Impacted mandibular third molars are commonly associated with periodontal changes affecting the distal surface of the adjacent mandibular second molar because of plaque retention, inflammation, and difficulty in maintaining oral hygiene. Surgical removal may influence the periodontal status of the second molar.

Methods: This prospective observational study included 100 patients with mandibular impacted third molars. Periodontal probing depth was recorded at mesiobuccal, distobuccal, mesiolingual, and distolingual sites of the adjacent second molar. Clinical attachment level and radiographic alveolar bone level were also assessed. Measurements were obtained preoperatively, on postoperative day 7, and at 3 months. Data were analyzed using repeated-measures analysis of variance with Bonferroni post-hoc testing and one-way analysis of variance with Tukey HSD testing for subgroup comparisons.

Results: Mesiobuccal and mesiolingual probing depths did not change significantly over time. Significant overall changes were observed for distobuccal probing depth ($p=0.009$), distolingual probing depth ($p=0.023$), clinical attachment level ($p<0.001$), and alveolar bone level ($p<0.001$). Distobuccal probing depth improved significantly between day 7 and 3 months ($p=0.048$). Deeper Position C impactions showed significantly worse alveolar bone levels than shallower positions, including mean differences of 2.56 mm for mesioangular C versus A and 2.29 mm for vertical C versus A (both $p<0.001$).

Conclusion: Surgical removal of impacted mandibular third molars was associated with overall favorable periodontal changes at the adjacent second molar, particularly at distal sites. Greater impaction depth was associated with greater periodontal compromise.

Keywords: Impacted mandibular third molar; Periodontal status; Second molar; Probing depth; Clinical attachment level; Alveolar bone level

1 INTRODUCTION

Impacted mandibular third molars are frequently encountered in oral and maxillofacial surgical practice. Failure of eruption may result from inadequate space, abnormal angulation, or developmental factors, and third molar removal is commonly undertaken to prevent or manage conditions including pericoronitis, caries, cystic changes, and other local problems.[1-3]

The periodontal status of the mandibular second molar is clinically important because the distal aspect of this tooth lies in close proximity to the impacted third molar. Plaque retention, food impaction, chronic inflammation, surgical flap manipulation, bone removal, and postoperative wound changes may influence probing depth, clinical attachment, and distal alveolar bone support.[4-10]

The evidence regarding periodontal changes after third molar removal is inconsistent. Some investigations have reported improvement or stabilization of the distal periodontal condition after removal, whereas others have described persistent or increased periodontal defects, particularly in patients with pre-existing disease or deeper impactions.[8-10,22,24]

Several factors may influence healing, including the angulation and depth of impaction, surgical difficulty, flap design, bone removal, duration of surgery, wound closure, and postoperative plaque control.[11-13,25,26] Therefore, prospective evaluation using standardized clinical and radiographic parameters is relevant for understanding the periodontal response of the adjacent second molar.

The present study was undertaken to evaluate changes in probing depth, clinical attachment level, and radiographic alveolar bone level of the mandibular second molar following surgical removal of an impacted mandibular third molar, and to assess the influence of impaction type and depth on these outcomes.

1.1 Aim and objectives

The aim was to evaluate the periodontal status of the mandibular second molar following surgical removal of an impacted mandibular third molar.

The objectives were: (1) to evaluate the effect of third molar removal on the periodontal status of the second molar; (2) to determine postoperative pocket depth, clinical attachment level, and radiographic distal alveolar bone status; and (3) to identify factors associated with worsening of the periodontal status of the second molar.

2 MATERIAL AND METHODS

2.1 Study design and setting

This prospective observational study was conducted among patients attending the Outpatient Department of Oral and Maxillofacial Surgery, H.K.E. Society's S. Nijalingappa Institute of Dental Sciences and Research, Kalaburagi, Karnataka, India. The study duration was 18 months. A total of 100 patients with mandibular impacted third molars were included.[file source]

2.2 Sample size

The sample size was calculated using an alpha significance level of <0.05 and 80% power. With p=0.433, q=0.567, d=0.15, $Z\alpha/2=1.96$ and $Z1-\beta=0.842$, the calculated sample size was 85.68; this was rounded to 100 participants.

2.3 Eligibility criteria

Inclusion criteria were patients with a mandibular impacted third molar, age >18 years, and medically fit status. Exclusion criteria were carious or decayed second or third molars, ongoing endodontic or surgical treatment involving the second or third molar, medically compromised status, tobacco chewing, smoking or alcoholism, and unwillingness to participate.

2.4 Ethical considerations and consent

Institutional review board and ethical committee approval was obtained before data collection. All patients were informed about the study and written informed consent was obtained before participation.

2.5 Clinical and radiographic assessment

Periodontal probing depth was measured to the nearest millimeter at mesiobuccal, distobuccal, mesiolingual, and distolingual sites of the mandibular second molar using a Williams periodontal probe. Clinical attachment level was recorded at the distal aspect of the second molar. Radiographic alveolar bone level was measured on an intraoral periapical radiograph as the distance from the cementoenamel junction to the alveolar crest at the distal aspect of the second molar.

2.6 Surgical procedure

Surgical removal was performed under local anesthesia using 2% lidocaine with 1:80,000 epinephrine. A Ward's incision was made using a No. 15 scalpel. A mucoperiosteal flap was reflected with a Molt elevator and retracted with an Austin retractor. Bone removal was performed with a No. 702 or 703 carbide bur, and the tooth was removed either intact or after sectioning. Socket debridement and curettage were performed, followed by root planing of the distal aspect of the second molar and saline irrigation. The flap was closed using 3-0 silk sutures. Patients were instructed to use 0.2% chlorhexidine rinse for 7 days.

2.7 Study variables and follow-up

The periodontal parameters were recorded preoperatively, on postoperative day 7, and at 3 months. Impaction was categorized according to angulation and Pell and Gregory depth position. The principal outcome variables were probing depth, clinical attachment level, and radiographic alveolar bone level.

2.8 Statistical analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 22.0. Descriptive statistics included mean, standard deviation, median, interquartile range, minimum and maximum values. Normality was assessed using the Shapiro–Wilk test. Repeated-measures ANOVA was used to evaluate changes across the three time points, followed by Bonferroni-corrected pairwise comparisons when appropriate. One-way ANOVA was used to compare impaction types and combined impaction type/depth subgroups, with Tukey HSD post-hoc testing for significant findings. Statistical significance was set at $p<0.05$ with 95% confidence intervals.

3 RESULTS

A total of 100 patients underwent surgical removal of mandibular impacted third molars. Age ranged from 19 to 39 years, with a mean age of 26.4±4.8 years. Forty-eight patients were male and 52 were female. Mesioangular impaction was most common (49%), followed by vertical (32%), distoangular (10%), and horizontal (9%).

Table 1: Demographic characteristics of the study participants (N=100).

Characteristic	Category	n (%)
Age	Mean±SD	26.4±4.8 years
Age	≤25 years	48 (48.0)
Age	26–30 years	38 (38.0)
Age	>30 years	14 (14.0)
Sex	Male	48 (48.0)
Sex	Female	52 (52.0)
Impaction	Mesioangular	49 (49.0)
Impaction	Vertical	32 (32.0)
Impaction	Distoangular	10 (10.0)
Impaction	Horizontal	9 (9.0)

Table 2: Periodontal parameters at the three assessment time points.

Parameter	Pre-op Mean±SD (mm)	Day 7 Mean±SD (mm)	3 months Mean±SD (mm)	Overall p
MB	2.34±0.48	2.38±0.51	2.36±0.49	0.291
DB	2.52±0.64	2.58±0.62	2.48±0.58	0.009
ML	2.24±0.48	2.20±0.45	2.22±0.44	0.244
DL	2.28±0.56	2.34±0.58	2.26±0.52	0.023
CAL	3.46±1.24	3.32±1.16	3.28±1.08	<0.001
ABL	3.84±1.36	3.58±1.28	3.62±1.32	<0.001

Mesiobuccal and mesiolingual probing depths remained stable, with no statistically significant changes over time. Distobuccal probing depth showed a small postoperative increase followed by reduction at 3 months; the overall repeated-measures ANOVA was significant (p=0.009), and the day-7 versus 3-month comparison was significant after Bonferroni correction (p=0.048). Distolingual probing depth also showed a significant overall time effect (p=0.023), although individual Bonferroni-adjusted comparisons were not significant.

Clinical attachment level decreased from 3.46±1.24 mm preoperatively to 3.32±1.16 mm at day 7 and 3.28±1.08 mm at 3 months, with a significant overall time effect (p<0.001). Alveolar bone level decreased from 3.84±1.36 mm preoperatively to 3.58±1.28 mm at day 7 and was 3.62±1.32 mm at 3 months, also showing a significant overall time effect (p<0.001). Bonferroni testing showed significant preoperative versus day-7 and preoperative versus 3-month differences for ABL (p=0.028 and p=0.048, respectively).

Table 3: Repeated-measures ANOVA across preoperative, day-7 and 3-month assessments.

Parameter	F-value	p-value
MB	1.24	0.291
DB	4.86	0.009
ML	1.42	0.244
DL	3.84	0.023
CAL	8.42	<0.001
ABL	14.28	<0.001

3.1 Influence of impaction type and depth

Table 4: Selected significant Tukey HSD comparisons for impaction depth.

Impaction type	Comparison	Outcome	Mean difference	p-value
Mesioangular	C vs A	ABL	2.56 mm	<0.001
Mesioangular	C vs B	ABL	1.63 mm	<0.001
Mesioangular	C vs A	CAL	0.91 mm	0.008
Vertical	C vs A	ABL	2.29 mm	<0.001
Vertical	C vs B	ABL	1.76 mm	<0.001
Vertical	C vs A	CAL	0.98 mm	0.042
Horizontal	C vs B	ABL	2.44 mm	0.008
Distoangular	C vs A	ABL	2.35 mm	0.018

At baseline, significant differences among impaction types were observed for distobuccal probing depth, distolingual probing depth, clinical attachment level, and alveolar bone level. At 3 months, significant differences were observed for

distolingual probing depth, clinical attachment level, and alveolar bone level. Horizontal impactions had the lowest DL and CAL values at 3 months, whereas mesioangular and distoangular groups demonstrated higher values for selected parameters.

When impaction type was combined with Pell and Gregory depth, one-way ANOVA demonstrated significant differences among the 11 subgroups for all periodontal parameters at all time points ($p \leq 0.002$). Tukey HSD testing showed that Position C was associated with significantly worse alveolar bone levels than shallower positions in several impaction types.

4 DISCUSSION

The periodontal consequences of mandibular third molar surgery remain clinically relevant because the distal surface of the second molar may already be affected by plaque retention and chronic inflammation before surgery. The present prospective study evaluated 100 patients at baseline, postoperative day 7, and 3 months, allowing the early inflammatory response to be distinguished from later periodontal healing.

The overall findings support a favorable periodontal response after third molar removal. The mesial probing sites remained stable, whereas the distal sites demonstrated significant changes over time. The small increase in distal probing depth at day 7 followed by reduction at 3 months is compatible with transient postoperative inflammation and tissue edema rather than progressive periodontal destruction. Similar postoperative variation has been described in previous literature.[8,10]

The clinical attachment level improved from 3.46 mm at baseline to 3.28 mm at 3 months, and the radiographic alveolar bone level improved from 3.84 mm to 3.62 mm. These findings are consistent with reports that removal of an impacted third molar may eliminate local plaque-retentive and inflammatory factors and permit spontaneous periodontal healing at the distal second molar.[8,22,24]

In contrast, Peng et al. reported greater probing depth, attachment loss, and radiographic bone loss at distal second-molar sites in a long-term extraction group, particularly in patients with periodontal disease.[9] Differences in study population, baseline periodontal condition, follow-up duration, and clinical management may explain the differing results. The present study excluded patients with medically compromising factors and adverse habits and used standardized postoperative hygiene instructions, which may have contributed to the favorable short-term outcome.

The influence of impaction depth was an important finding. Position C impactions consistently demonstrated greater alveolar bone defects than shallower positions. For mesioangular impactions, the 3-month ABL increased from 2.59±0.38 mm in Position A to 5.15±1.06 mm in Position C. A similar gradient was observed for vertical impactions. Horizontal Position C showed an ABL of 5.99±0.71 mm, the highest value among the reported subgroups. These observations suggest that deeper impactions are associated with greater pre-existing periodontal compromise and may require more extensive surgical manipulation.[25,26]

The present findings are also compatible with studies indicating that the distal periodontal condition of the second molar may improve following removal of the third molar, particularly when postoperative plaque control is maintained.[8,24] Conversely, deeper impactions and pre-existing defects may increase the risk of residual periodontal defects. Adjunctive regenerative procedures have been investigated for selected high-risk defects, although the present study did not evaluate regenerative interventions.[27]

The study has several limitations. Follow-up was limited to 3 months, so the persistence of the observed periodontal changes cannot be determined. The study was observational and did not include a non-extraction control group. The sample sizes of individual impaction type/depth subgroups were also small, particularly for some Position A and C categories. Therefore, the subgroup findings should be interpreted cautiously. Longer-term prospective controlled studies are needed to establish whether the observed improvements remain stable over 1–2 years.

5 CONCLUSION

Within the limitations of this prospective observational study, surgical removal of impacted mandibular third molars was associated with overall favorable periodontal changes at the adjacent mandibular second molar. The most relevant changes occurred at distal sites, with significant overall improvements in distobuccal probing depth, distolingual probing depth, clinical attachment level, and alveolar bone level. Deeper Position C impactions were associated with greater periodontal defects than shallower impactions. Careful surgical planning, atraumatic technique, appropriate wound management, and postoperative oral hygiene may contribute to favorable periodontal healing. Longer-term controlled studies are required to determine whether these changes are maintained.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The author declares that there are no financial or non-financial conflicts of interest.

Statement of ethical approval

Institutional review board and ethical committee approval was obtained before commencement of the study. The dissertation records ethical approval for the study and written informed consent from participants. The institutional ethics approval number/date was not specified in the manuscript source and should be inserted before submission if required by IJSRA.

Statement of informed consent

Written informed consent was obtained from all individual participants included in the study.

Data availability

The data generated and/or analyzed during the present study are contained within the study records and may be made available by the corresponding author subject to institutional and participant confidentiality requirements.

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