A New Flap Design Compared with other Flap Designs on Postoperative Pocket Depth following Surgical Removal of Mandibular Third Molar

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Abstract

Introduction: Surgical removal of mandibular third molars is the most frequently performed minor oral surgical procedure. **Aims:** This study aims to evaluate its effect on periodontal status of second molars at 3 and 6 months' follow-up comparing extractions done by three different flap techniques. **Settings and Design:** Prospective randomized control clinical study. **Subjects and Methods:** Ninety medically healthy controls of both gender, aged between 18 and 50 years who underwent surgical removal of impacted mandibular third molars were divided into Group A, Group B and Group C wherein Bayonet flap, modified envelope flap and envelope flap was raised, respectively. Pocket depth at distobuccal and distolingual aspect of adjacent second molar was measured and compared for each group at preoperative as well as 3 and 6 months' follow-up. **Statistical Analysis Used:** ANOVA, paired *t*-test, and Tukey *post hoc* test using SPSS software. **Results:** There was no statistically significant difference found between pocket depths distal to second molars following impacted third molar extraction between three different flap groups. However, a significant reduction of pocket depth was noted from 3 to 6 months' follow-up for all three flap groups. **Conclusions:** Flap designs used for impacted third molar extractions do not contribute toward the alteration of periodontal health of second molars.

Keywords: *Impacted third molars, new flap design, periodontal health, pocket depth*

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Introduction

Surgical removal of mandibular third molars is the most frequently performed surgical procedure in oral surgery. Third molars are present in 90% of the population with 33% having at least one impacted third molar.[1] In most of the situations, it results in a diverse range of disorders, such as pericoronitis, periodontal defects in the distal aspect of the second molar. To avoid and minimize the postoperative complications such as pain, swelling, mouth opening and to improve periodontal health distal to second molars, various flap designs have been used in surgical removal of mandibular third molars.[2]

The extraction of an impacted third molar definitely causes destruction of the surrounding soft and bony tissues; therefore, various surgical approaches by the surgeon have been designed to minimize this detrimental effect on the adjacent second molar's periodontium, including various flap designs.[3]

Each flap has its own advantages and disadvantages. The bayonet flap is more conservative because a lesser amount of tissue is reflected to keep the flap tension free

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during handling. On the other hand, the envelope flap provides very good exposure of the surgical site and has adequate blood supply because of its broad base.[4]

Thus, all flap designs have one or more drawbacks either in the primary healing or in restoring the periodontal health of the adjacent tooth. Hence, it is extremely imperative to design a flap, which will optimally satisfy all the requisites of an ideal flap.

The purpose of this study was to compare postoperative complication in terms of periodontal health of second molars distally following surgical removal of impacted mandibular third molars with three different flap designs out of which two were standard, and one flap design was a new flap design that is a modified envelope flap.

Subjects and Methods

The prospective randomized control clinical study included 90 medically healthy controls of both gender, aged between 18 and 50 years, who visited the department of oral and maxillofacial surgery with impacted mandibular third molars indicated for surgical removal.

Inclusion criteria

1. Impacted mandibular third molar completely or partially impacted with the absence of acute inflammatory symptoms
2. Teeth posing score between 4 and 7 out of 10 scale surgical difficulty as per Pederson assessment index
3. Medically healthy controls with no systemic disease and who is not on any medication that could interfere with the healing process.

Exclusion criteria

1. Patients with impacted third molars associated with existing pathology and infection
2. Teeth posing score between 1–3 and 7–10 out of 10 scale surgical difficulty as per Pederson assessment index
3. Debilitated patients who were deemed unfit to undergo surgery and immunocompromised
4. Prophylactic removal of impacted third molar
5. The patient who has taken analgesics 12 h prior to surgery.

Preoperative assessment included the presence of signs of inflammation and infection. The radiographic investigation included intraoral periapical to determine the type and surgical difficulty of impaction. Preoperative pocket depth was checked with William's periodontal probe, from free gingival margin to bottom of pocket on distobuccal and distolingual aspect of the second molar.

After preoperative evaluation and obtaining written informed consent, all the patients included in the study were allocated into three groups as follows:

- Group A – Patients were those who underwent surgical removal of impacted mandibular third molar using bayonet flap
- Group B – Patients were those who had undergone surgical removal of impacted mandibular third molar using the New Design of Modified Envelope Flap
- Group C – Patients were those who underwent surgical removal of impacted mandibular third molar using envelope flap.

Third molar using envelope flap.

Surgical procedure

Group A, Group B, and Group C were operated for surgical removal of lower third molar.

Mouth disinfection was done using chlorhexidine solution. Local anesthesia was achieved through the administration of 2% lignocaine hydrochloride with adrenaline (1:80,000) using inferior alveolar nerve block, lingual nerve block, and long buccal nerve block. The duration of each operation and the interval between the initial flap incision and the final suturing was noted.

Bayonet flap

Incision

It has three parts – anterior, intermediate, or gingival and distal. Anteriorly, the incision extended into the buccal vestibule forming a triangle with the interdental papillae. Intermediately, it extended around the gingival margin of the second molar turning into the impacted tooth area including the distal papillae of second molar in the flap. Distally, the incision slope outward as well as backward, as the ascending ramus lies on the lateral side of the body of mandible [Figure 1].

Modified envelope flap (new flap design)

Incision

It began medial to the external oblique ridge and extended to distal lower angle of second molar followed by sulcular incision which was made from distofacial angle of second molar to the middle of the second molar allowing minimal flap retraction [Figure 2].

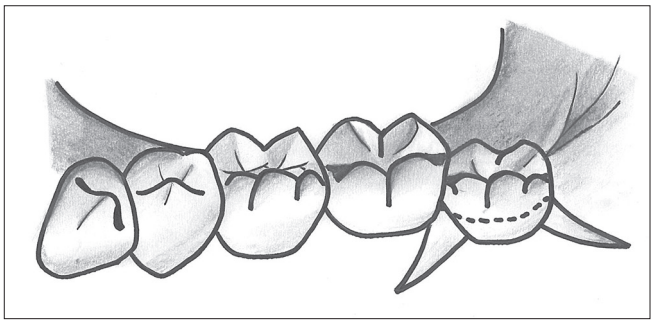

Figure 1: Bayonet flap

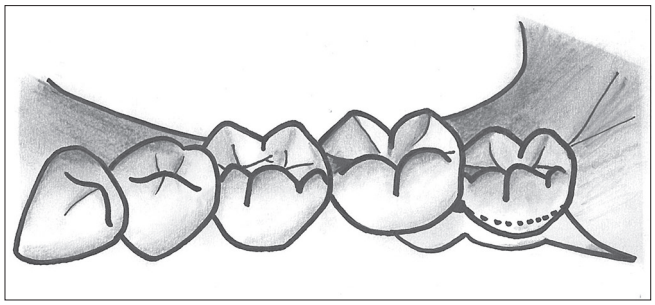

Figure 2: Modified envelope flap

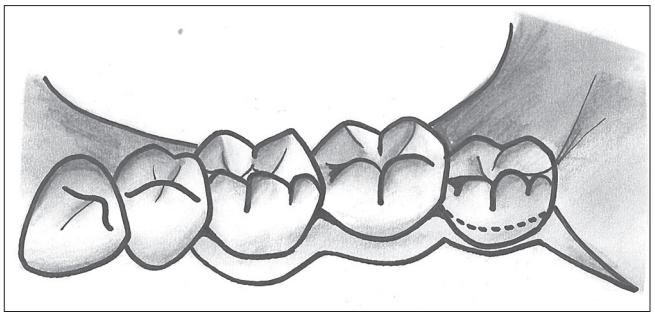

Figure 3: Envelope flap

Envelope flap

Incision

It began medial to the external oblique ridge and extended to the distal lower angle of second molar followed by sulcular incision which was made from distofacial angle of second molar to mesiofacial angle of the first molar [Figure 3].

For all the three groups, the incision was placed using a No. 15 BP blade. Bone osteotomy under copious saline irrigation was done using No. 703 stainless steel straight fissure bur using a micro motor handpiece with the speed of 24,000 rpm and the bone covering the buccal and distal side was removed. Tooth sectioning was carried out if necessary. The tooth was elevated and removed using a Coupland elevator/other suitable elevators. The socket was rinsed with saline and betadine solution, and hemostasis was achieved. The flap was being repositioned and wound closure was done using 3-0 black braided silk. Two sutures, one distal release incision and the other distal to second molars, were placed in all the three groups.

Intraoperative assessment

Intraoperative assessment included

1. Flap design
2. Operative time
3. Complications if any.

After the surgical procedure, all the patients were prescribed Amoxicillin 500 mg TID, Metronidazole 400 mg TID, Ibuprofen 400 mg TID all to be taken orally for 5 days. Postoperative instructions were given to the patient.

Postoperative follow-up

Postoperative follow-up was done for pocket depth on the 3rd and 6th month postoperatively and was compared.

It was checked with William's periodontal probe, from free gingival margin to bottom of pocket on distobuccal and distolingual aspect of the second molar.

Statistical analysis

Data were analyzed with ANOVA, paired *t*-test, and Tukey *post hoc* test using IBM SPSS Statistics software (Version 2015) (IBM Corp, Karnataka, India).

Results

In the present study, the pocket depth measured for all three groups preoperatively, at 3 months and at 6 months' follow-up were subjected to statistical analysis, and the results of the same have been tabulated [Tables 1-15].

The mean preoperative pocket depth at the distobuccal aspect of second molars in Group A was 3.566 ± 1.546, Group B was 3.566 ± 1.568 and in Group C was 3.600 ± 1.302. There was no statistically significant difference in the means and upon pairwise comparisons in preoperative pocket depth distobuccally between groups (i.e., $P = 0.995$) [Tables 1 and 2].

Preoperative pocket depth at the distolingual region of second molars in Group A was 3.133 ± 1.525, Group B was 3.400 ± 1.379, and in Group C was 3.500 ± 1.106, and hence no statistically significant difference was noted between the means and on pairwise comparison [Tables 3 and 4].

The mean postoperative pocket depth in distobuccal area at 3 months in Group A was 3.2000 ± 0.99655, Group B was 2.9667 ± 1.27261, and Group C was 3.0000 ± 0.94686 with no statistically significant difference between them [Table 5]. Pairwise comparison was done using Tukey *post hoc* test wherein no statistically significant difference between any groups was noted [Table 6].

The mean postoperative pocket depth in the distolingual area at 3 months in Group A was 2.9667 ± 1.29943, Group B was 2.7000 ± 1.11880, and Group C was 3.2000 ± 0.92476 with no statistically significant difference between them [Table 7]. Pairwise comparison was done using Tukey *post hoc* test wherein no statistically significant difference was found [Table 8].

The mean postoperative pocket depth in distobuccal area at 6 months was found to be 2.9667 ± 0.76489, 2.7000 ± 1.02217, and 2.5000 ± 0.77682 in Group A, B, and C, respectively, with no statistically significant difference [Tables 9 and 10].

Whereas, the mean postoperative pocket depth in distolingual area at 6 months was found to

Table 1: Preoperative pocket depth assessment at distobuccal aspect of second molar-ANOVA

One-way ANOVA		
Preoperative pocket dB	**Mean±SD**	***P***
Bayonet	3.566±1.546	0.995
Modified envelop	3.566±1.568	
Envelop	3.600±1.302	

SD=Standard deviation

Table 2: Preoperative pocket depth assessment at distobuccal aspect of second molar-Tukey honestly significant difference

Tukey HSD				
Dependent variable	**Reference group**	**Comparision group**	**Mean difference**	***P***
Preoperative pocket dB	Bayonet	Modified envelop	0.000	1.000
		Envelop	−0.033	0.996
	Modified envelop	Envelop	−0.033	0.996

HSD=Honestly significant difference

Table 3: Preoperative pocket depth assessment at distolingual aspect of second molar-ANOVA

One-way ANOVA		
Preoperative pocket dL	**Mean±SD**	***P***
Bayonet	3.133±1.525	0.555
Modified envelop	3.400±1.379	
Envelop	3.500±1.106	

SD=Standard deviation

Table 4: Preoperative pocket depth assessment at distolingual aspect of second molar-Tukey HSD

Tukey HSD				
Dependent variable	**Reference group**	**Comparision group**	**Mean difference**	***P***
Preoperative pocket dL	Bayonet	Modified envelop	−0.266	0.725
		Envelop	−0.366	0.546
	Modified envelop	Envelop	−0.100	0.956

HSD=Honestly significant difference

Table 5: Three months postoperative pocket depth assessment at distobuccal aspect of second molar-ANOVA

One-way ANOVA Postoperative pocket 3 months dB			
	n	**Mean±SD**	***P***
Bayonet	30	3.2000±0.99655	0.666
Modified envelop	30	2.9667±1.27261	
Envelop	30	3.0000±0.94686	

SD=Standard deviation

Table 6: Three months postoperative pocket depth assessment at distobuccal aspect of second molar-Tukey-*post hoc*

Tukey HSD *post hoc* test			
Reference group	**Comparison group**	**Mean difference**	***P***
Bayonet	Modified envelop	0.23333	0.682
	Envelop	0.20000	0.755
Modified envelop	Envelop	−0.03333	0.992

HSD=Honestly significant difference

Table 7: Three months' postoperative pocket depth assessment at distolingual aspect of second molar-ANOVA

One-way ANOVA Postoperative pocket 3 months' dL			
	n	**Mean±SD**	***P***
Bayonet	30	2.9667±1.29943	0.232
Modified envelop	30	2.7000±1.11880	
Envelop	30	3.2000±0.92476	

SD=Standard deviation

Table 8: Three months' postoperative pocket depth assessment at distolingual aspect of second molar-Tukey *post hoc*

Tukey HSD *post hoc* test			
Reference group	**Comparison group**	**Mean difference**	***P***
Bayonet	Modified envelop	0.26667	0.630
	Envelop	−0.23333	0.702
Modified envelop	Envelop	−0.50000	0.203

HSD=Honestly significant difference

Table 9: Six months' postoperative pocket depth assessment at distobuccal aspect of second molar-ANOVA

One-way ANOVA Postoperative pocket 6 months dB			
	n	**Mean±SD**	***P***
Bayonet	30	2.9667±0.76489	0.116
Modified envelop	30	2.7000±1.02217	
Envelop	30	2.5000±0.77682	

SD=Standard deviation

Table 10: Six months' postoperative pocket depth assessment at distobuccal aspect of second molar-Tukey *post hoc*

Tukey HSD *post hoc* test			
Reference group	**Comparison group**	**Mean difference**	***P***
Bayonet	Modified envelop	0.26667	0.458
	Envelop	0.46667	0.097
Modified envelop	Envelop	0.20000	0.643

HSD=Honestly significant difference

be 2.6333 ± 0.88992, 2.4000 ± 0.85501, and 2.5333 ± 0.89955 in Group A, B, and C, respectively, with no statistically significant difference between the means and on pairwise comparison [Tables 11 and 12].

In Group A, the mean postoperative pocket depth in 3 months was 3.2000 ± 0.99655 and 2.9667 ± 1.29943 distobuccally and distolingually respectively which reduced to 2.9667 ± 0.76489 and 2.6333 ± 0.88992

Table 11: Six months' postoperative pocket depth assessment at distolingual aspect of second molar-ANOVA

One-way ANOVA Postoperative pocket 6 months dL			
	n	Mean±SD	*P*
Bayonet	30	2.6333±0.88992	0.591
Modified envelop	30	2.4000±0.85501	
Envelop	30	2.5333±0.89955	

SD=Standard deviation

Table 12: Six months' postoperative pocket depth assessment at distolingual aspect of second molar-Tukey post hoc

Tukey HSD post hoc test			
Reference group	Comparison group	Mean difference	*P*
Bayonet	Modified envelop	0.23333	0.563
	Envelop	0.10000	0.899
Modified envelop	Envelop	−0.13333	0.828

HSD=Honestly significant difference

Table 13: Three and 6 months postoperative pocket depth assessment for Group A

Paired *t*-test			
Group A	*n*	Mean±SD	*P*
Pair 1			
Postoperative pocket 3 months dB	30	3.2000±0.99655	0.006
Postoperative pocket 6 months dB	30	2.9667±0.76489	
Pair 2			
Postoperative pocket 3 months dL	30	2.9667±1.29943	0.002
Postoperative pocket 6 months dL	30	2.6333±0.88992	

SD=Standard deviation

Table 14: Three and 6 months' postoperative pocket depth assessment for group B

Paired *t*-test		
Group B	Mean±SD	*P*
Pair 1		
Postoperative pocket 3 months' dB	2.9667±1.27261	0.003
Postoperative pocket 6 months' dB	2.7000±1.02217	
Pair 2		
Postoperative pocket 3 months' dL	2.7000±1.11880	0.001
Postoperative pocket 6 months' dL	2.4000±0.85501	

SD=Standard deviation

Table 15: Three and 6 months' postoperative pocket depth assessment for group C

Paired samples statistics		
Group C	Mean±SD	*P*
Pair 1		
Postoperative pocket 3 months' dB	3.0000±0.94686	<0.001
Postoperative pocket 6 months' dB	2.5000±0.77682	
Pair 2		
Postoperative pocket 3 months' dL	3.2000±0.92476	<0.001
Postoperative pocket 6 months' dL	2.5333±0.89955	

SD=Standard deviation

hence, showing a statistically significant difference in postoperative pocket between 3 and 6 months ($P = 0.006$) [Table 13].

In Group B, the mean postoperative pocket depth in 3 months was 2.9667 ± 1.27261 and 2.7000 ± 1.11880 distobuccally and distolingually, respectively, which reduced to 2.7000 ± 1.02217 and 2.4000 ± 0.85501 at 6 months thus showing a statistically significant difference in postoperative pocket depth between 3 and 6 months ($P = 0.003$) [Table 14].

In Group C, the mean postoperative pocket depth in 3 months was 3.0000 ± 0.94686 and 3.2000 ± 0.92476 distobuccally and distolingually, respectively, which reduced to 2.5000 ± 0.77682 and 2.5333 ± 0.89955 at 6 months thus showing a statistically significant difference in postoperative pocket depth between 3 and 6 months ($P < 0.001$) [Table 15].

Discussion

In our study, the mean postoperative pocket depth both distobuccally and distolingually at 3 and 6 months' follow-up had no statistically significant difference between the three flap design groups. Thus, flap design did not contribute to the alteration of periodontal health status of second molars. Similar results were obtained by Chen *et al*. wherein they concluded that different flap techniques had no significant impact on the probing depth reduction (WDPDR: −0.14 mm, 95% confidence interval: −0.44–0.17), or on the clinical attachment level (CAL) gain (WDCAG: 0.05 mm, 95% confidence interval: −0.84–0.94). However, a subgroup analysis revealed that the Szmyd and paramarginal flap designs may be the most effective in reducing the probing depth in impacted LM3 extraction, and the envelope flap may be the least effective.[3]

A study done by Laurito *et al*. also showed no significant differences in the periodontal parameters between two flap groups which were transposed versus repositioned flap ($P > 0.05$). Similarly, no difference was found at T2, T3, and T4 in wound dehiscence incidence ($P > 0.05$). However, they attributed this to less data on the use of transposed flaps in third molar surgery and suggested further studies with a larger population needed to investigate the potential advantages of this type of flap.[5]

On the contrary, Korkmaz *et al*., in their study, concluded that flap design in partially impacted third molar surgery considerably influenced the early periodontal health of the second molars and postoperative discomfort. However, although the three-cornered laterally rotated flap design might cause more pain and swelling, it could

be the method of choice for partially impacted third molar surgery because of the early periodontal healing.[6]

In addition to the above, a study done by Briguglio *et al*. also showed a correlation between flap design and periodontal health of second molars. They concluded that triangular flaps showed statistically significant reduction of pocket probing depth and increase of CAL compared to the envelope flap ($P < 0.05$) 24 months after surgery.[7]

More precisely, Monaco *et al*. observed statistically significant differences in probing depth between triangular and envelope flaps 7 days after the extraction of third molars with no root development, which was not important from a clinical perspective, because periodontal healing at 3 and 6 months was comparable. They believed this to be the case with the extraction of third molars with fully formed roots as well.[8]

Regardless of the type of flap raised, the pocket depth at 3 and 6 months' follow-up decreased in our study substantiating the fact that bone destruction is short-term adverse effect of a surgical procedure which regenerates by itself. Similar results were obtained by Montero and Mazzaglia in his study, where the periodontal health of the second molar was found to improve gradually after third molar surgery in all clinical parameters. Probing depth was gradually reduced by about 0.6 mm quarterly until a final depth of 2.6 ± 0.8 mm was attained. The relative risk of having a plaque index and gingival index coded as 0 (healthy) or 1 (minor problems) was about 10 times higher at the end of the follow-up than at baseline for both indices. The periodontal status of the four posterior sextants also improved gradually. Molar depth, according to the Pell and Gregory classes and types, seemed to be the main factor modulating both the baseline probing depth and the change in probing depth during follow-up.[9]

A study done by Martin *et al*. found that no patient had a gingival or plaque index >2 postsurgical extraction of third molars, and no gingival recession or periodontal pocket over 4 mm was found. Thus, they concluded that the extraction of impacted third molars in young healthy adults did not have any impact on the second molars periodontal environment.[10]

More precisely, a study done by Faria *et al*. observed that impacted third molars adjacent to second molars lead to periodontal defects that are deepest at the lingual side and almost recover at 12 months after extraction. The first 3 months is considered the cutoff for periodontal healing. Young adults with high-risk periodontal third molar impactions may benefit from early extraction, which increases spontaneous periodontal healing.[11]

On the contrary, Monaco *et al*. concluded 30% of the surgical extractions resulted in a debilitating postoperative period for the patients treated.[8]

Briguglio *et al*. even concluded that regardless of the flap design, the periodontal conditions of the adjacent second molar deteriorated after 12 and 24 months.[7]

Thus, literature attributes other factors relating to periodontal healing of second molars instead of the flap design used. Silva *et al*. in their study, found out that statistically significant difference was only showed only between immediate preoperative probing depth variables in any two techniques. In contrast, no statistical difference in probing depths between pre- and post-operative values, as well as no statistically significant difference regarding the type of incision alone was noted. Instead, the trauma caused by any technique by the surgeon impacted the postoperative complications to the largest extent.[12]

Conclusions

Periodontal destruction of second molars seen as a common postoperative complication of impacted third molar extractions is a short-term phenomenon which self-heals and regenerates independent of the flap design used. Hence, flap design choice by the surgeon should depend on other factors and instead as literature suggests surgical technique greatly influences the occurrence and the extent of periodontal sequelae. Thus, the emphasis must be laid upon the technique being minimally traumatic to have least postoperative complications. Future studies are required to relate other important factors such as age and gender with the healing capacity of the periodontium of second molars.

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Conflicts of interest

There are no conflicts of interest.

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