Influence of flap design on periodontal healing of second molars after extraction of impacted mandibular third molars

Adalberto Luiz Rosa, DDS, MSc, PhD,[a] Marilia Gomes Carneiro, DDS,[b] Marco Antonio Lavrador, PhD,[c] and Arthur Belém Novaes Jr, DDS, MSc, PhD[d], São Paulo, Brazil
UNIVERSITY OF SAO PAULO

Objective. The aim of this study was to compare the influence of two mucoperiosteal flaps on periodontal healing of adjacent second molars after extraction of impacted mandibular third molars.
Study design. An envelope incision with a releasing incision anterior to the second molar (3-cornered flap) was used on one side and a Szmyd flap on the other side in 14 patients with bilateral impaction of mandibular third molars. The periodontal health of the second molars was evaluated before surgery and at 3 and 6 months postoperatively. A William's periodontal probe was used to measure the pocket depth, clinical attachment level, and bone level of the buccal and mesial surfaces of the second molars. The postoperative measurements were analyzed by using analysis of covariance, with the covariables being the preoperative measurements and variation factors being the type of flap used, the surface measured, and the time since the procedure.
Results. No statistically significant differences were found in comparing measurements of probing depth, clinical attachment level, or bone level for the 2 types of flap used or the 2 surfaces measured. However, there was a statistically significant increase in all 3 measurements from the 3-month to the 6-month postoperative time.
Conclusion. Independent of the design of the mucoperiosteal flap used in extracting an impacted mandibular third molar, the periodontal condition of the adjacent second molar worsened from 3 to 6 months, although it remained within normal values.
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Third molars are present in 90% of the population, with 33% having at least one impacted third molar.[8] Because of this prevalence, extraction is a relatively common procedure. Extraction involves the manipulation of both soft and hard tissues, so the patient usually experiences pain, edema, and trismus in the immediate postoperative period. Some patients also have periodontal disease in the later postoperative period.

Periodontal evaluation after the extraction of impacted mandibular third molars has raised questions concerning the direct effect of extraction on the health of the adjacent second molar. There may be a periodontal pocket, loss of clinical attachment, or bone loss of the second molar.[3-7,9,10] However, several authors[7,9,10] have concluded that the type of flap used does not interfere with the periodontal health of these second molars.

Surgical extraction of mandibular third molars requires that a flap be created and an ostectomy be performed. A mucoperiosteal flap exposing the buccal bone of the adjacent second molar is most commonly used. Research has shown that such exposure, even without ostectomy or extraction, leads to bone resorption.[1,13-15] The type of flap described by Szmyd,[12] which preserves a strip of mucosa on the buccal surface of the second molars, could minimize this bone resorption.

The objective of this study was to compare the effects of two types of flap used during impacted mandibular third molar extraction on the periodontal health of adjacent second molars, evaluating periodontal health by probing pocket depth, clinical attachment level, and bone level.

MATERIAL AND METHODS

A total of 16 patients, 18 to 25 years of age, were selected for this study. All patients required bilateral extraction of similarly positioned impacted or semi-impacted mandibular third molars, which was confirmed with periapical radiographs according to the angulation classification. Data from only 14 patients, 19 to 23 years of age, were used in the statistical analysis because 2 patients did not complete the entire experimental period. All patients had a negative medical history, were not using any medication, and gave informed consent to participate in the study.

Evaluation of periodontal health

A plaster model of the mandible was made, on which 1.5-mm-thick polyethylene disks were placed to make a probing guide adapted for examination of the second

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[a]Professor, Department of Oral & Maxillofacial Surgery and Periodontology, School of Clinical Dentistry of Ribeirão Preto, University of Sao Paulo, Brazil.
[b]Professor, School of Pharmaceutical Sciences of Ribeirão Preto.
[c]Private practice.
[d]Professor, Department of Oral & Maxillofacial Surgery and Periodontology, School of Clinical Dentistry of Ribeirão Preto.
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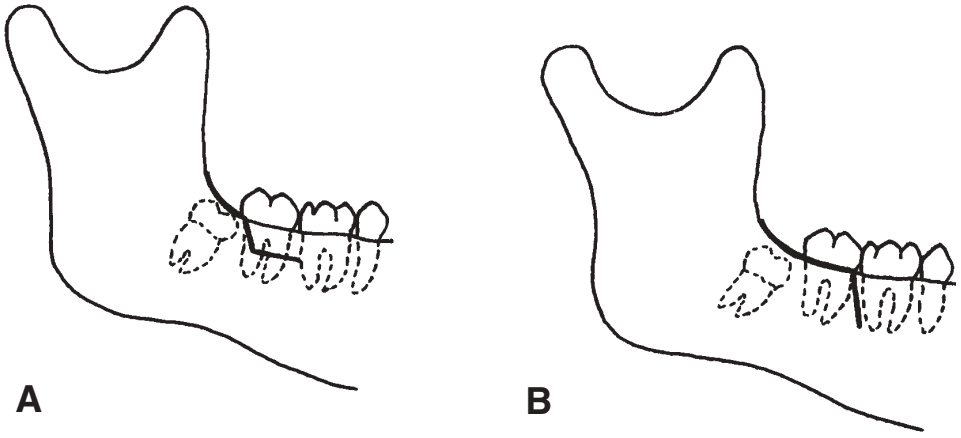

Fig 1. Flap designs used in study. **A,** Szmyd flap. **B,** Three-cornered flap.

molars. Markings of the same width as periodontal probes were made in this guide on the mesiobuccal and midbuccal surfaces of the mandibular second molars for use as probing guides preoperatively and at 3 and 6 months postoperatively.

Probing was done in the midbuccal surface and at the mesiobuccal line angles of the second molars, and the probing depth, clinical attachment level, and bone level were recorded. The probing depth is the distance from the gingival margin to the bottom of the gingival pocket. The clinical attachment level is the distance in millimeters from the cementoenamel junction to the bottom of the probable gingival pocket. Bone level is the distance from the cementoenamel junction to the alveolar bone crest. All sites were measured twice by 2 experienced examiners (A.B.N. and M.C.G.C.) using a William's periodontal probe (Hu-Friedy), and an average of the measurements was calculated. These measurements were made with the patient under local anesthesia because of the need for transgingival probing for the measurement of bone level.

Surgery

Extraction of teeth 38 and 48 was performed by only one surgeon (A.L.R.). A Szmyd flap (Fig 1, *A*) was made on one side (the selection of side was randomized) and an envelope incision with a releasing incision anterior to the second molar (3-cornered flap, Fig 1, *B*) was made on the other. By using local anesthesia (2% mepivacaine with noradrenaline, 1:100,000), the flap reflection, ostectomy, odontosection (if necessary), tooth extraction, cavity treatment, and suturing were carried out.

The patients were given sodium diclofenac (50 mg every 6 hours for 3 days, beginning 2 hours before surgery). Chlorhexidine gluconate (0.12%) rinsing was recommended for 7 days because of the difficulty of postoperative hygienic care. Sutures were removed 5 to 7 days postoperatively.

Statistical analysis

Analysis of covariance (ANCOVA) was used for statistical analysis, with the three variation factors being flap type, tooth surface measured, and postoperative time and the preoperative measurements being the covariable. Comparisons were made for flap design/tooth surface, flap design/time, time/tooth surface, and flap design/tooth surface/time. The threshold of statistical significance was set at 5%.

RESULTS

Table I shows patient data, angulation classification, surgical time, and flap type.

Table II shows the probing depth, clinical attachment, and bone level on the mesial and buccal surfaces of the second molars with both types of flap.

There was a statistically significant difference in probing depths between the 3-month and 6-month postoperative measurements (ANCOVA, $P = .002$). However, there were no statistically significant differences between the two types of flaps ($P > .05$), measurements of the mesial and buccal surfaces ($P > .05$), or for any interaction of these variables ($P > .05$).

There was a statistically significant difference between 3- and 6-month postoperative measurements of clinical attachment (ANCOVA, $P = .017$). However, there were no statistically significant differences in clinical attachment level for the two types of flaps ($P > .05$), measurements of the mesial and buccal surfaces ($P > .05$), or any interaction of these variables ($P > .05$).

ANCOVA showed that there was a statistically significant difference between 3- and 6-month postop-

Table I. Patient data and type of flap used for removal of impacted mandibular third molars

Patient	*Sex*	*Age (y)*	*Tooth*	*Angulation*	*Surgical Time (min)**	*Flap Type*
1	F	22	38	Mesioangular	28	Szmyd
			48	Mesial	36	3-Cornered
2	F	22	38	Horizontal	71	3-Cornered
			48	Horizontal	64	Szmyd
3	F	20	38	Mesioangular	23	3-Cornered
			48	Mesioangular	19	Szmyd
4	F	21	38	Vertical	12	Szmyd
			48	Vertical	19	3-Cornered
5	M	19	38	Mesioangular	27	3-Cornered
			48	Horizontal	30	Szmyd
6	M	22	38	Mesioangular	14	Szmyd
			48	Vertical	28	3-Cornered
7	M	19	38	Mesioangular	40	3-Cornered
			48	Distoangular	35	Szmyd
8	F	19	38	Vertical	18	Szmyd
			48	Vertical	40	3-Cornered
9	F	22	38	Vertical	14	Szmyd
			48	Vertical	11	3-Cornered
10	F	19	38	Mesioangular	25	3-Cornered
			48	Mesioangular	27	Szmyd
11	F	20	38	Mesioangular	25	Szmyd
			48	Vertical	23	3-Cornered
12	M	22	38	Vertical	22	3-Cornered
			48	Horizontal	50	Szmyd
13	M	19	38	Vertical	35	3-Cornered
			48	Vertical	45	Szmyd
14	F	21	38	Mesioangular	25	Szmyd
			48	Mesioangular	25	3-Cornered

*Surgical time was measured from incision until suture

Table II. Mean probing depth, clinical attachment, and bone level (mm) measured on the mesial and buccal surfaces of second molars in 14 patients before extraction of third molars (B) and at 3 months (3) and 6 months (6) after extraction using a 3-cornered flap or a Szmyd flap

	3 Cornered						*Szmyd*					
	Mesial			*Buccal*			*Mesial*			*Buccal*		
Periodontal parameters	B	3	6	B	3	6	B	3	6	B	3	6
Probing depth	1.96	2.18	2.82	2.0	2.29	2.79	2.04	2.11	2.46	1.96	2.11	2.29
Clinical attachment	5.75	6.11	6.57	5.93	6.39	6.86	5.89	6.36	6.50	6.04	6.14	6.57
Bone level	6.86	7.07	7.54	6.64	7.39	7.82	6.75	7.21	7.29	6.86	6.93	7.29

erative measurements of bone level ($P = .031$), but there were no statistically significant differences in bone level measurements between the 2 types of flaps ($P > .05$), measurements of the mesial and buccal surfaces ($P > .05$), or any interaction of these variables ($P > .05$).

DISCUSSION

This study evaluated the effects of 2 types of flaps used for the removal of impacted mandibular third molars and the postoperative time period on the periodontal health of adjacent second molars. Independent of the type of flap used or the measurement site, the periodontal health of second molars worsened with time but remained within acceptable levels.

Patient age has been reported to be an important factor for periodontal complications after extraction of impacted third molars, with younger patients healing better than older patients.[4,5] There can also be more complications when there is generalized inflammation.[6] Because the patients in this study were between 19 and 23 years of age and had no periodontal disease before surgery, these two variables did not interfere in the results.

Comparison of the 3-cornered flap and the Szmyd flap showed that both flaps caused periodontal compli-

cations of adjacent second molars, with an increase in probing depth, clinical attachment level, and bone level seen at 3 and 6 months postoperatively.

However, there were no differences related to flap design. These results are in agreement with those of Quee et al[7] and Schofield et al,[9] who also reported no differences in periodontal healing related to flap design. Other studies have reported that exposure of the alveolar bone to the buccal cavity, even without surgical procedures, causes bone resorption.[1,13-15] Considering this, it would be expected that the Szmyd flap would provide better results, at least for bone level, because this flap preserves a strip of mucosa on the buccal surface of the second molars. There are 2 possible explanations for why this did not happen.

First, it is possible that bone resorption is more intense and clinically important in areas where the alveolar bone is thinner, such as in the anterior region of the mandible and all of the maxilla, but not at the buccal region of the mandibular second molars. Second, during the extraction of teeth with a great mesiodistal or horizontal angulation, which were the majority, we observed that both the ostectomy as well as the application of dental elevators traumatized the strip of mucosa preserved by the Szmyd flap. It is possible that this contributed to delayed periodontal healing and explains, at least partially, the results observed with the flap. In keeping with this, the Szmyd flap would be recommended and would give better results when used for extraction of teeth in the vertical position.

Measurements of probing depth, clinical attachment level and bone level were greater at 6 months after the procedure compared with 3 months, suggesting that the periodontal health of second molars tends to deteriorate with time. These results do not agree with those of Stephens et al,[10] who reported an improvement in probing depth on three surfaces of second molars after 3 months. However, our results are in agreement with those of Quee et al,[7] who reported greater probing depth on the distal surface at 6 months postoperatively. These differences may be due to the methods used to evaluate periodontal health. For example, Stephens et al[10] used estimated values taken from other measurements rather than direct measurement of probing depth. Observations over 1 to 4 years showed that after 1 year, there was no difference in relation to preoperative bone level of second molars[2] and after 4 years there was an improvement in bone defects compared with 2 years postoperatively.[4] It is also possible that the observations of the present study were made during a period in which periodontal healing was not yet complete and that better results would occur after a longer observation period.

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Reprint requests:

Adalberto L. Rosa, DDS, MSc, PhD
School of Clinical Dentistry of Ribeirão Preto – University of Sao Paulo
Av do Cafe S/N
14040-904 – Ribeirão Preto, SP
Brazil
adalrosa@forp.usp.br