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Comparison of Two Different Gingivectomy Techniques for Gingival Cleft Treatment

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ABSTRACT

Interdental clefts or invaginations contribute to orthodontic relapse and poor periodontal health in extraction cases. These clefts or invaginations can be removed both by electrosurgical or conventional surgical gingivectomy techniques. This study investigates and compares the efficacy of two different techniques to remove gingival clefts with respect to periodontal health and patient tolerance. Twenty-two patients (mean age, 15.7 years) with bilateral gingival clefts participated in this study. In each patient, the gingival invaginations were removed by gingivectomy using electrosurgery on one side and conventional surgery on the contralateral side. The length and depth of the invaginations, the gingival index of the adjacent teeth, and the changes in visual analogue scale scores were recorded before and after the operation for both groups. Mann-Whitney *U*-test and Wilcoxon tests were used to analyze the data statistically. The results showed significant improvement in invagination depth and length and gingival index scores for both techniques. There were no statistical differences between the two gingivectomy techniques with respect to gingival health and patient tolerance. Both techniques can be used to remove the gingival invaginations efficiently.

KEY WORDS: Gingival cleft, Invagination, Electrosurgery, Conventional surgery.

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INTRODUCTION Return to TOC

The extraction of teeth may be required in orthodontic treatment to satisfy the demands made by space deficiencies, function, esthetics, occlusion, and stability. Most commonly, first or second premolars are extracted in both the maxilla and the mandible.

During the orthodontic approximation of teeth adjacent to the extraction site, an infolding or invagination of gingival tissue commonly forms.[1,2] The clinical appearances range from a minor superficial crease in the attached gingiva to deep clefts extending across the interdental papilla from the buccal to the lingual alveolar surface.[3,4] The precise cause of these invaginations remains unclear. Because they occur commonly in patients undergoing orthodontic closure of extraction space, one reason may be the interruption of the continuity of the gingival fiber system and bone remodeling that occur with destruction of cortical plates, socket healing, and root movement.[3] Alternatively, the gingival fiber system may be displaced rather than remodeled during tooth movement, with the invagination forming as a result of a passive folding or pileup of gingival tissue.[5] Gingival invaginations may persist as long as five years after completion of orthodontic treatment.[6]

Histological and histochemical analyses of biopsies from invagination areas showed hyperplasia of the epithelium and the connective tissue in association with loss of collagen in the same regions.[7,8] The pressure of compressed gingiva on the bone when teeth are moved together has been discussed as a possible cause of these undesirable effects.[2,9] Compression of transseptal fibers has also been claimed to cause relapse after space closure.[2,9–13]

Periodontal health is directly related to the accumulation of bacterial plaque, the primary etiologic agent in gingivitis and periodontitis.[12] Factors that predispose toward an accumulation of bacterial plaque will increase the risk of marginal gingivitis.[14,15] If gingival invaginations predispose to plaque accumulation and gingivitis, their formation during and persistence after orthodontic tooth movement could have an adverse effect on future periodontal health.[3] In extraction cases where interdental clefts or invaginations contribute to orthodontic relapses and bad periodontal health, surgical excision might be indicated.[2,16]

Gingival invaginations can be treated by using either conventional surgical or electrosurgical gingivectomy techniques.[16–18] This study compares and investigates the efficacy of conventional surgery and electrosurgical gingivectomy techniques to remove gingival clefts with respect to periodontal health and patient tolerance.

MATERIALS AND METHODS Return to TOC

Twenty-two patients (12 girls and 10 boys) undergoing orthodontic treatment in Selçuk University Department of Orthodontics constituted the sample in this study. Their age ranges from 13.3 to 17.5 years (mean age, 15.7 years). No systemic medical problems and no record of periodontal diseases other than mild marginal gingivitis were recorded. All patients were treated with edgewise mechanics, and they all required the extraction of bilateral upper or lower premolar teeth as part of their orthodontic treatments.

The patients' molars were banded, and the remaining teeth were bonded and leveled. After the completion of canine distalization, patients were selected contingent upon the presence of an arch with bilateral and symmetrical gingival clefts in two or four quadrants. All together 44 gingival cleft areas were examined. The type of gingivectomy was randomly selected. In each patient, the gingival invaginations were removed by using electrosurgery on one side and a surgical blade on the contralateral side during the same visit under local anesthesia.

All patients received initial periodontal treatment before surgery, which included a supragingival scaling and polishing. Gingival invaginations were determined by clinical observation and probing with a Williams periodontal probe. The vertical (length) and horizontal (depth) extents of the buccal invaginations only were recorded to the nearest 0.5 mm. The scores were multiplied to give an estimate of the invaginated area. The gingival health in the extraction area was assessed by the method of Cowell et al.[19] All patients were examined and measured by the same operator (Dr Gursel).

Conventional surgical technique

Hyperplastic gingival tissue was resected with periodontal knives, a scalpel, and scissors. The incision was started apical to the points marking the course of the pockets and was directed coronally to a point between the base of the pocket and the bone crest. Exposure of bone is undesirable. The incision should be beveled at approximately 45° to the tooth surface and should recreate, as far as possible, the normal festooned pattern of the gingiva. The gingival margin was detached at the incision line with surgical hoes and scalers, and a periodontal pack was placed.

Electrosurgical technique

The electrosurgical removal of gingival clefts was performed with a needle electrode, supplemented by the small ovoid loop or the diamond-shaped electrodes for festooning. A blended cutting and coagulating current was used. In all reshaping procedures the electrode was activated and moved in a concise shaving motion. The incision edges were sealed by the current and left for primary healing. The vertical (length) and horizontal (depth) extents of the buccal invaginations and gingival index records were repeated after three weeks (Figure 1).

The visual analogue scale (VAS) was used to quantify pain levels and patients' discomfort. The subjects were instructed to mark an “X” on the scale corresponding to the pain that they were experiencing. The VAS score is defined as the distance in centimeters (up to one decimal place) from the left extreme of the line to the “X” marked by the subjects. Each patient was given the instructions to complete the VAS index cards two and 24 hours after the operation.

Mann-Whitney *U*-test was used to evaluate the significance of differences between the groups, and Wilcoxon test was used to determine the significance of the treatment results in both groups (Mann-Whitney *U*-test, with significance set at a *P* value of .01 for multiple comparisons).

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Table 1 shows the changes in the vertical (length) and horizontal (depth) extents of the buccal invaginations and gingival index scores at preoperative and postoperative periods for both procedures. In both groups, when preoperative and postoperative values were compared, the reduction in the vertical (length) and horizontal (depth) extents of the buccal invaginations and the gingival index scores were found to be statistically significant (Table 1). The differences between the electrosurgery and conventional gingivectomy groups, however, were not statistically significant (Table 1). Similarly, the differences in the discomfort and pain level associated with electrosurgery and conventional surgery at two and 24 hours in the gingivectomy area were not significant (Table 2).

DISCUSSION Return to TOC

The results of this study indicate that there was no significant difference between conventional surgery and electrosurgery in the vertical (length) and horizontal (depth) extents of the buccal invaginations or in the gingival index of the gingival clefts operated. Both techniques significantly reduced the depth and length of the gingival clefts and the gingival index scores. After both gingivectomy procedures, the healing period was eventless in all quadrants (Figures 2 and 3). We did not observe clinical healing differences between the sites operated with conventional surgery or electrosurgery.

Although the relapse data are inconclusive, the early forming of the invaginations and their persistence as late as five years after treatment[6] would appear to compromise the gingival health in that area and may increase the possibility of subsequent periodontal disease. Damage to the periodontal tissues may be severe enough to warrant surgical removal of these invaginations in selected patients.[3] Our selection criteria for cleft removal were therefore patients with poor oral hygiene, deep and long gingival clefts, and clefts with unpleasant gingival contours.

Electrosurgery provides homeostasis by coagulation, seals the capillary and lymphatic vessels, and permits an adequate contouring of the soft tissues.[20–22] The completed electromagnetic cycle of the instrument, electrode, patient, and dispersive plate sterilized the tip of the electrode, thus reducing the potential for infection.[23] An inherent problem with electrosurgery is the foul odor that is produced.[24] However, the use of a high-speed evacuator close to the operation area reduces the odor.

Studies of wound healing after electrosurgical excision of gingival tissue compared with conventional periodontal scalpels have yielded conflicting results. Some investigators reported no significant differences in gingival healing after electrosurgery and conventional surgery.[25] However, when used for deep resection close to the bone, electrosurgery may cause gingival recession, bone necrosis, and sequestration, loss of bone height, furcation exposure, and tooth mobility, which do not occur with the use of periodontal knives.[26,27] The use of electrosurgery should be limited to superficial procedures.[18] This variability between reports of electrosurgery healing has been attributed to differences in the current wave form, shape, and size, and in the speed of the electrode through the tissue.[26] Electrosurgery cannot be used in patients with a noncompatible or poorly shielded cardiac pacemaker.[27,28]

Often the term “electrocautery” is incorrectly used to describe electrosurgery. Electrocautery refers to direct current (electrons flowing in one direction), whereas electrosurgery uses alternating current. During electrocautery, current does not enter the patient's body. Only the heated wire comes in contact with tissue. In electrosurgery, the patient is included in the circuit, and current enters the patient's body. Cutting with the cut current will accomplish the task with less voltage. This is an important consideration during minimally invasive procedures.[18]

The removal of the gingival clefts was relatively easier to perform before space closure was complete, and the extraction space was still accessible. However, the risk of gingival cleft reoccurrence, which we have observed in some of our cases, should be considered. Therefore, the optimum time for gingival cleft removal seems to be right after complete closure of the extraction spaces.

The split-mouth design was an excellent method to determine the clinical relevance of comparison of the two gingivectomy techniques to remove gingival clefts. By comparing the techniques within a subject, it minimizes the influence of numerous intersubject factors, such as age, sex, anatomic factors, and bone metabolism, on any differences that may be present.

In this study, patients demonstrated minimal discomfort and edema during the first two days after the operation. The VAS is an established method for assessing pain or discomfort responses of patients. The VAS as a method of pain measurement has been reviewed extensively and was found to be a reliable method.[29]

There is only one controlled study that has been published on the relationship between the gingival cleft removal and a reduction in relapse. Edwards[2] reported a controlled study on a series of 10 patients, who were followed with bilateral gingival clefts after initial closure of extraction spaces. He claimed that if the excess gingiva between approximated teeth is removed by gingivectomy, relapse can be alleviated and gingival health can be maintained. Rivera Circuns and Tulloch[3] reported no correlation between the extraction space reopening and the presence or complexity of gingival invaginations. They suggested that their findings should not be interpreted as lack of effect because other unidentified etiologic factors for space reopening may overwhelm any effect of the gingival defect. By the same token, the presence and severity of gingival invaginations, regardless of the phase of treatment, were consistently related to a reduction in gingival health in that area. However, the infolding or invagination of gingival tissue that commonly forms during space closure[2,6] can be persistent, and altering the gingival contour may predispose toward subsequent periodontal disease[8] and a nonesthetic gingival appearance. This in turn would be inconsistent with the goals of orthodontic treatment.

CONCLUSIONS [Return to TOC]

This study indicates that there was no significant difference between the two gingivectomy techniques with respect to gingival health and patient tolerance. The results also showed significant improvement in invagination depth and length and in gingival index scores for both techniques.

Although electrosurgery is contraindicated in patients with cardiac pacemakers and may produce heat capable of causing change in adjacent tissues, sufficient tissue shaping ability and lack of hemorrhage in the operation field may be considered advantageous. With proper adhesion to safeguards, both techniques can be used to remove gingival invaginations efficiently.

Removal of gingival clefts can be considered a treatment modality to maintain the periodontal health and may help to avoid orthodontic relapses in extraction cases. It will be interesting to follow these patients for a long period and to investigate the effect of gingival cleft removal on extraction space reopening and on future periodontal health.

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TABLE 1. Comparison of Electrosurgery and Conventional Surgery Regarding Preoperative and Postoperative Periods

	Preoperative			Postoperative			*P*		
	Gingival Index, X ± Sx	Depth, X ± Sx	Length, X ± Sx	Gingival Index, X ± Sx	Depth, X ± Sx	Length, X ± Sx	*Gingival Index*	*Depth*	*Length*
Electrosurgery	1.81 ± 0.39	4.27 ± 2.05	4.77 ± 2.06	1 ± 0	0.22 ± 0.52	0.36 ± 0.84	.000***	.000***	.000***
Conventional surgery	1.59 ± 0.5	3.9 ± 1.26	4.68 ± 1.98	1.18 ± 0.85	0.45 ± 0.67	0.63 ± 0.95	.012*	.000***	.000***
P	.102	.834	.943	.317	.185	.219			

X = mean; Sx = standard error of the mean.
* $P < .05$, ** $P < .001$.

TABLE 2. Comparison of Electrosurgery and Conventional Sur gery Visual Analogue Scale (VAS) Values After Two and 24 Hours

	VAS	
	After Two h, X ± Sx	After 24 h, X ± Sx
Electrosurgery	1.22 ± 1.6	0.68 ± 1.17
Conventional surgery	0.86 ± 1.6	0.59 ± 0.95
P	.652	.808

X = mean, Sx = standard error of the mean.
P none were significant.

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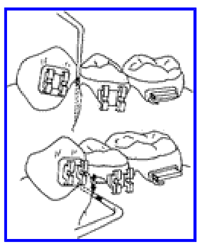
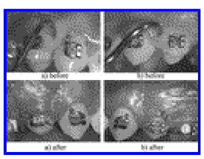


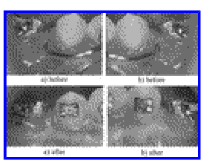
Click on thumbnail for full-sized image.

FIGURE 1. Method of measuring vertical and horizontal extents of invaginated area



Click on thumbnail for full-sized image.

FIGURE 2. Maxillary interdental clefts area before and after treatment



Click on thumbnail for full-sized image.

FIGURE 3. Mandibular interdental clefts area before and after (a) conventional surgery (b) electrosurgery

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