



## EVALUATION OF HEIGHT OF THE INTERDENTAL PAPILLA BEFORE AND AFTER PAPILLA PRESERVATION FLAP SURGERY IN SUBJECTS WITH CHRONIC PERIODONTITIS - A CLINICAL & RADIOGRAPHIC STUDY

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### ABSTRACT

**Purpose:** The purpose of the present study was to evaluate and compare the height of the interdental papilla before and after periodontal flap surgery for pocket reduction using "Papilla Preservation Technique" in subjects with chronic periodontitis with horizontal bone loss.

**Method:** 10 subjects with generalized chronic periodontitis were included in the study. 20 sites from the maxillary anterior sextant were selected. Probing depth was recorded using a customized acrylic stent; changes in alveolar bone level and height of the interdental papilla were recorded noninvasively using an intraoral radiographic technique at baseline and six weeks after papilla preservation flap surgery.

**Results:** There was reduction of 3.02mm in probing depth, 0.53mm in alveolar bone level and 2.18 mm in height of the interdental papilla following papilla preservation flap surgery.

**Conclusion:** Interdental papilla heals without the formation of interdental clefts or craters following the papilla preservation flap technique, thus maintaining a good postoperative gingival contour. However, some loss of papillary height is evident.

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### INTRODUCTION

The goal of periodontal therapy is to restore the health and function of the periodontium and maintain the natural dentition for a lifetime. However, esthetic considerations pose therapeutic dilemmas in the selection of treatment modalities for periodontal pockets in the anterior regions. Horizontal pattern of bone resorption can lead to lengthening of the distance from the bone crest to the contact between adjacent teeth leading to the formation of black triangles [1]. Also, periodontitis is often associated with migration of teeth and opening of interdental spaces. The formation of pathological diastema without the presence of normal contact may lead to an apical shift of the papilla. Apical shift of the papilla can also be a sequel of periodontal therapy due to soft tissue contraction associated with wound healing, opening up the so called 'black triangles,' thus posing esthetic and functional problems.

The most commonly performed periodontal flap surgeries for pocket reduction include the conventional flap (the Kirkland flap), the Modified Widman flap etc. These surgeries involve splitting of the papilla just below the contact point. During healing, development of interdental soft tissue craters or clefts

is frequently observed with these flaps with a resultant loss of papillary height. [2, 3, 4]

The Papilla Preservation Technique proposed by H. H. Takei, is mainly carried out during regenerative procedures utilizing bone grafts and membranes [5]. It can also be used in order to improve postoperative soft tissue contour in the interproximal region.

A medline search was carried out with the key words "periodontal flap, papillary height, papilla healing, sulcular incision". Limited number of articles evaluating height of interdental papilla following sulcular incision in endodontic surgery were found. No studies have been reported with regards to **height** of the interdental papilla following periodontal flap surgery. The present study was planned to evaluate and compare the probing depth, alveolar bone level and height of the interdental papilla before and after periodontal flap surgery using "Papilla Preservation Technique" in cases with chronic periodontitis.

### MATERIALS AND METHODS

For this study, patients belonging to both sexes, age group 20-50 years were selected from the outpatient Department of

Peridontology. The inclusion criteria were probing depths of 5-7 mm in maxillary anterior sextant after Phase I therapy, interdental spaces in the range of 2 to 5 mm, no evidence of tooth mobility, no evidence of Endodontic-Periodontal problem and intraoral periapical radiograph showing horizontal bone loss not more than half the root length. Exclusion criteria were subjects with history of systemic diseases, subjects with oral habits like tobacco and betel nut chewing or smoking, subjects with high frenum attachment, teeth with restorations or crowns interdental papilla apical to facial CEJ of adjacent tooth (Class III Nordland and Tarnow Classification) [6]. All examinations were performed by one trained examiner. The study was approved by the Local Ethics Committee. All subjects were explained the need and design of the study. Written informed consent was obtained from the subjects included in the study.

A total of twenty sites (in the maxillary anterior sextant) with persistent probing depth of 5-7 mm after Phase I therapy were selected to be included in the study as per the criteria mentioned above. The clinical parameters at the selected sites recorded were Plaque Index (PI), Papillary Bleeding Index (PBI) and Probing depth (PD) using a customized fabricated stent [7,8]. These parameters were recorded at baseline and six weeks post surgery. The length of the interdental papilla was calculated noninvasively using digital periapical radiographs [9]. Digital periapical radiographs were taken (Satellac, 70 KVp, 8 mA, 0.5 sec) using Paralleling Cone Technique with an Extended Cone Paralleling (XCP) device (Figure 1).



Figure 1 IOPA x-ray taken using paralleling cone technique and XCP device

To standardise the radiographic assessment, radiographs were obtained in a constant and reproducible plane and a soft putty material was used to record the bite at the time of the preoperative radiograph (Figure 2).



Figure 2 Bite registered using soft putty material

For measurement of the length of the interdental papilla, a radiopaque material consisting of a 2:1 mixture of zinc oxide-

eugenol and barium sulphate was placed at the tip of the papilla with a probe (Figure.3).



Figure 3 Zinc oxide and barium sulphate paste placed at the tip of papilla

All the measurements were recorded using the Kodak digital software (KODAK RVG 5000/6000 Digital Radiography System). The length of the papilla was calculated by measuring the distance from alveolar bone crest to the radio-opaque mark at the tip of the papilla (BC-PT) (Fig.4). The distance from the alveolar bone crest to the root apex (BC-RA) was measured and used as a reference to evaluate the change, if any, in the level of alveolar bone crest, post surgery (Fig.4). The interdental distance between the teeth (at the level of CEJ), at the site selected for the papilla preservation flap was also recorded (Figure 4). These measurements were repeated 6 weeks post surgery, (with the preoperative bite record used as a guide for the post operative placement of the XCP device) to determine the changes in the height of the papilla (BC-PT) and the level of the alveolar crest (BC-RA).



Figure 4 Radiographic measurements

Local anesthesia at the surgical site was achieved by administering a field block labially and nasopalatine nerve block palatally. Local anesthetic solution consisting of Lidocaine hydrochloride 2% and Adrenaline (1:200,000) was used. Papilla preservation flap was performed at selected sites according to the study protocol (Figures 5, 6).



Figure 5 Semilunar incision made on palatal side in 11, 12 region



Figure 6 Intact papilla reflected with buccal flap

Thorough debridement was carried out. Care was taken to avoid excessive trimming of the interproximal tissue on the underside. The flap was replaced and the interdental papilla was secured with an interrupted suture using 3-0 Mersilk (Figure 7).



Figure 7 Thorough debridement done, flap replaced and sutures given

All patients were prescribed a course of antibiotic (Cap Amoxicillin 500 mg thrice a day for 5 days) and analgesic (Tab Diclofenac sodium 50mg + Paracetamol 500 mg twice a day for 3 days). The subjects were recalled for check up on the next day of surgery and for suture removal after 1 week. Oral hygiene instructions were repeated.

After six weeks the subjects were recalled and the clinical (PD, PI, PBI) and radiographic parameters (BC-PT, BC-RA) were reassessed and noted as per the study design. Figure 8 shows the healing at the operated site after 6 weeks.



Figure 8 Healing at 6 weeks

**Statistical analysis**

Data on periodontal parameters (probing depth, height of the papilla, distance from bone crest to root apex) is shown using Mean ± Standard deviation. The entire data was entered and cleaned in MS Excel before it was statistically analyzed in Statistical Package for Social Sciences (SPSS ver 11.5) for MS Windows (SPSS). The statistical significance of post-operative

improvement in each parameter is tested using paired 't' test, after confirming the underlying normality assumption of difference of respective parameter. The p-value less than 0.05 were considered to be statistically significant. All the hypotheses were formulated using two tailed alternatives against each null hypothesis. The entire data was analyzed using Statistical Package for Social Sciences (SPSS ver 11.5) for MS Windows.

**RESULTS**

The mean probing depth at baseline was  $5.37 \pm 0.67$  while the mean probing depth 6 weeks post surgery was  $2.35 \pm 0.43$ . There is a reduction of 3.02mm in probing depth.

The mean value of height of the papilla at baseline was  $6.57 \pm 0.68$  and 6 weeks post surgery was  $4.39 \pm 0.59$ . These results show that there is a slight reduction (2.18 mm) in the height of the papilla post operatively.

The mean value of preoperative BC-RA distance was  $10.03 \pm 1.07$ mm while the mean post operative distance was  $9.50 \pm 1.09$  mm. There was a mean reduction of 0.53 mm which is indicative of crestal bone resorption.

**DISCUSSION**

*Probing depth (PD)*

Table 1 Probing Depth (PD)

Mean Pre-operative PD (mm)	Mean post operative PD (mm)	t-value	P-value
$5.37 \pm 0.67$	$2.35 \pm 0.43$	23.611	0.001

The mean probing depth at baseline was  $5.37 \pm 0.67$  while the mean probing depth 6 weeks post surgery was  $2.35 \pm 0.43$ . There is a reduction of 3.02mm in probing depth. P-value is 0.001 and so is statistically significant.

Our results are comparable to numerous studies reported in literature comparing the effect of different periodontal treatment modalities for pocket reduction. Studies by **Ramfjord and Nissle (1974)**, **Lindhe et al (1982)**, **Philstrom et al (1983)** have all shown that periodontal flap surgery is more effective at achieving sustained pocket depth reduction as compared to scaling and root planning or gingival curettage [10,11,12]. In our study, the mean pocket depth reduction post surgery was 3.02 mm.

*Height of the interdental papilla (BC- PT)*

Table 2 Height of the interdental papilla (BC-PT)

Mean Pre-operative BC-PT(mm)	Mean Post operative BC-PT(mm)	t-value	P-value
$6.57 \pm 0.68$	$4.39 \pm 0.59$	22.24	0.001

The mean value of height of the papilla at baseline was  $6.57 \pm 0.68$  and 6 weeks post surgery was  $4.39 \pm 0.59$ . These results show that there is a slight reduction (2.18 mm) in the height of the papilla post operatively. The p value is 0.001 and so is statistically significant.

Periodontal flap surgery is one of the treatment modalities used for the reduction of pockets in patients with moderate to severe chronic periodontitis. Various flap surgical techniques like the Kirkland flap (conventional flap), modified Widman flap, undisplaced flap, papilla preservation flap etc. are used for treatment of periodontal pockets. The most commonly used

techniques like conventional flap and modified Widman flap basically involve splitting of the interdental papilla just below the contact point. Loss of papillary height is a known complication following conventional flap surgery. Reports of formation of soft tissue clefts and craters following conventional flaps have been documented by **Renvert et al (1985)**, **William Becker et al (1988)** [2,3]. These craters contribute to inadequate oral hygiene post operatively as they accumulate plaque and also lead to formation of black triangles.

**Zimmerman et al (2002)** investigated the shrinkage of the papilla (in endodontic surgery) after sulcular flaps in patients with healthy periodontal tissues [13]. The loss of height of the papilla increased gradually during healing. Postoperative loss of papilla height due to surgical manipulation resulted in 14 sites with a recession within one quarter of the original papilla height. In 3 sites between one quarter and one half of the original papilla height was lost. At suture removal 6 sites exhibited a loss of papilla height up to one half of its original height. None of the 17 sites remained at preoperative levels at any time. These data suggest that the conventional sulcular flap results in moderate retraction of the papilla.

**Velvart et al (2004)** compared the long-term loss of papilla height (in endodontic surgery) when using either the papilla base incision (PBI) or the standard papilla mobilization incision in marginal full thickness flap procedures in **periodontally healthy cases** [14]. They reported a loss of the papilla height of  $1.16 \pm 0.8$  mm at 1 month and  $1.3 \pm 0.9$  mm at 3 months and  $0.98 \pm 0.75$  mm at 12 months following marginal sulcular incision. The improvement in papillary height noticed at 12 months was attributed to the phenomenon of creeping attachment.

Our study was to evaluate the height of the papilla before and after papilla preservation surgery in maxillary anterior teeth with horizontal bone loss. This technique has been shown to improve the postoperative gingival contour in the interproximal areas as the intact papilla heals without the formation of interdental clefts/ craters (Takei et al, 1985) [5]. This procedure is indicated in teeth with open embrasures. As the teeth are not in contact, there is no question of the interdental papilla completely filling the gingival embrasure. There are no studies which have compared the pre operative and post operative height of the papilla following **conventional flap or papilla preservation flap in subjects with moderate to severe periodontitis**. In our study we have attempted to find this critical value in cases treated with papilla preservation flap surgery. In our study the mean loss of papillary height in the selected cases after papilla preservation flap surgery was found to be 2.18 mm.

#### Resorption of alveolar bone crest (BC-RA): (Table 3)

**Table 3** Resorption of alveolar bone crest (BC-RA)

Mean Preoperative BC-RA (mm)	Mean Postoperative BC-RA (mm)	t-value	P-value
10.03 ± 1.07	9.50 ± 1.09	25.67	0.001

The mean value of preoperative BC-RA distance was  $10.03 \pm 1.07$ mm while the mean post operative distance was  $9.50 \pm 1.09$  mm. There was a mean reduction of 0.53 mm which is indicative of crestal bone resorption. P-value is 0.001 and so is statistically significant.

Elevating any type of flap results in inflammation and bone resorption, with a risk of thinning of bone and reduction of bone height (**Wilderman et al, 1960**), (**Glickman et al, 1963**), (**Tavtigian R, 1970**) [15,16,17]. In our study, the mean reduction of alveolar crestal bone was 0.53mm. Comparable results have been reported by **Donnenfield et al (1964)** [18]. They studied loss of crestal alveolar bone after full thickness flaps and observed a mean loss of 0.63 mm, with five of the six patients they re-evaluated. Similar results have been reported by **Pennel et al (1964)** [19]. They studied the alveolar crest of 34 teeth in 20 patients and found an average loss of 0.54 mm of alveolar crest after mucoperiosteal flap. Our study showed a mean crestal bone loss of 0.53 mm. **Wood and Hoag (1973)** carried out a clinical study on nine patients to evaluate the difference in response of the crestal alveolar bone height to full thickness and partial thickness flaps[20]. After surgical re-evaluation, all of the patients lost crestal bone after both full thickness and partial thickness flaps. The mean bone loss after full thickness flaps was 0.6 mm and after partial thickness flaps was 0.98 mm. In our study, the alveolar crest reduction post surgery was 0.53 mm which is comparable to the results of **Wood and Hoag, 1973**.

The results of our study thus show that papilla preservation flap surgery helps in achieving significant reduction of probing depth in cases with moderate periodontitis. The post surgical reduction in papillary height in the treatment of cases with moderate pockets noticed in our study is comparable to the loss of papillary height noticed in periodontally healthy cases (**Zimmerman et al, 2002**) [13].

From the above observations it can be concluded that the papilla preservation surgery gives a good post operative gingival contour. However, some loss of papillary height is evident postoperatively. Since no studies have been reported in literature regarding the measurement of height of the papilla before and after the papilla preservation surgery, our study can be considered as one of its kind. Reduction in papillary height is a known complication following conventional flaps. So it can be expected that use of conventional flaps in cases of chronic periodontitis with open embrasures and horizontal bone loss may also follow the same pattern. The reduction in papillary height evident in our study appears to be comparable to the reduction in papillary height found in periodontally healthy subjects (**Zimmerman et al, 2002**) [13]. However, further long term studies with a larger sample size and carrying out a comparative evaluation of the conventional flaps and papilla preservation flaps in cases of moderate to severe chronic periodontitis with horizontal bone loss and open embrasures are required.

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