Repair of the Alveolar Process Following Osseous Surgery

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ALTERATIONS to the crestal portion of the vestibular alveolar process following a gingival mucoperiosteal flap operation and osseous surgery was studied in humans.

This clinical investigation was concerned with changes in the level of the alveolar crest over facial root surfaces determined from standardized intraoral photographs. Measurements, determined by microscopic methods, and the histologic repair of this area will be reported separately.1

REVIEW OF LITERATURE

Lobene and Glickman studied alterations to the buccal alveolar bone over root surfaces following a marginal gingivectomy and mucoperiosteal flap with and without osteoplasty. The mucoperiosteal flap was repositioned and sutured to cover the alveolar process. The four dogs used in this study were sacrificed after 7, 14, 21, and 28 days. Little, if any, reduction in crestal height was noted in the 7 and 14-day specimens with or without osseous surgery. In the 21- and 28-day specimens without osseous surgery, the loss of buccal alveolar bone height was 0.2 mm, as compared to 0.3 mm, crestal loss in specimens where the buccal surface of the alveolar process was reduced with a rotary diamond stone.

Friedman and Levine gave a preliminary report of a human study where the apically repositioned flap operation was performed with and without osseous surgery. The report was concerned with three specimens from two patients. No crestal bone loss occurred over the root of a mandibular first premolar where the specimen was removed 84 days following an apically repositioned flap operation without osseous surgery. On the adjacent mandibular canine, an osteectomy was performed by removing 2 mm of crestal bone. The 84-day postoperative specimen of this tooth showed a crestal bone loss of 0.25 mm.

In a second patient a mucoperiosteal flap operation and osteoplasty was performed in the area of a maxillary premolar. The osteoplasty procedure entailed reducing the thickness of the buccal alveolar process with a burr. A 70-day postoperative specimen demonstrated a 0.3 mm loss of crestal bone. The authors considered the permanent bone loss in the cases which they studied to be negligible.

Matherson was concerned with the extent of alveolar process maintenance following a gingivectomy, mucoperiosteal flap and osseous surgery. One of the three monkeys used in the study was sacrificed after one week and two after six months. After six months the alveolar bone was reported to have apparently maintained the experimentally produced reduction and contour. These findings were based on microscopic and macroscopic studies.

Felts and McKensie used various periodontal surgical procedures on humans and then measured the amount of bone lost which occurred approximately three months postoperatively. The surgical techniques were performed with and without osseous surgery. The authors concluded that some bone loss occurred from the buccal and labial crest height regardless of the type of surgery. Slightly more bone loss occurred if osseous surgery was performed.

A number of wound healing wound osseous reduction that the degree of and alterations to vary considerably depend upon the type of surgical procedures.

Surgical techniques marginal portion of the have been shown to cause the bone to. Wildermuth's study on dogs showed complete resorption of the alveolar process with obliteration of the resorbed bone. The permanent reduction height was equivalent to half of the amount of bone lost only to the through the alveolar process with dent alteration to the interproximal and interdental spaces.

Studies of surgical techniques perimetreum and various connective tissues revealed a marked reduct activity and crestal bone loss with bone exposure technique of crestal resorption thickness of the retained and the width and histology, process. With the periodontal procedures, the overlying mucosa excised or managed healed in an apical position.

Staffel, Wents and other techniques utilized a complete resorption crest after healing even the osteoelastic resorption occurs in postsurgical stages. In a similar study, a flap procedure in dogs reported very little or no if an adequate thickness was retained over the bone. In both studies the osteoelastic resorption was considered to be significant.
A number of wound healing studies not entailing osseous reduction have demonstrated that the degree of osteoclastic activity and alterations to the alveolar process vary considerably depending on the management of the soft tissue. The degree of crestal alteration has been an influential factor in the modification of periodontal surgical procedures.

Surgical techniques which expose the marginal portion of the alveolar process have been shown to cause severe changes to the bone.1-8 Wilderman, Wentz and Orn's study on dogs showed an initial complete resorption of the exposed vestibular alveolar process with only a partial restabilization of the resorbed bone after healing. The permanent reduction in crestal bone height was equivalent to approximately one-half of the amount of bone exposed. This occurred only to the radiocaudal portion of the alveolar process with little if any permanent alteration to the bone height in the interproximal and interradicular areas.9

Studies of surgical techniques which retain peristeme and vary amounts of connective tissue over the alveolar process revealed a marked reduction in osteoclastic activity and crestal bone loss in comparison with bone exposure techniques.7-11 The pattern of crestal resorption varied with the thickness of the retained connective tissue and the width and histology of the alveolar process.11 With the peristeme retention procedures, the overlying or outer tissue is either excised or managed as a flap and sutured in an apical position.

Staffen, Wentz and Orn used a split thickness flap technique on dogs and demonstrated a complete restoration of alveolar crest after healing even though increased osteoclastic resorption occurred in the early postsurgical stages. In a study of the split thickness flap procedure in humans, Pfizer12 reported very little osteoclastic activity if an adequate thickness of connective tissue was retained over the alveolar process. In both studies the outer portion of the split flap was sutured in its original position covering the retained periosteum and connective tissue.

Kohler and Ramfjord,14 in a study concerned with the clinical and histological aspects of healing following the elevation and replacement of gingival mucoperiosteal flaps on humans, reported no significant difference in the position of the alveolar crest before and after the flap procedures. Wilderman15 also reported a minimal loss of alveolar crest at the 'root' if the gingival flap is replaced, completely covering the bone.

In a clinical study involving humans, Donnerfeld, Marks and Glickman16 recorded an average loss of 0.63 mm. of crestal bone over the radicular area. A mucogingival flap including peristeme was elevated, and although the flap was placed and sutured in a more apical position, the bucal alveolar bone over the tooth root was completely covered by the flap.

Pfeifer17 reported an active degree of osteoclastic activity in humans following the elevation of a mucoperiosteal flap, and considered the thickness of the alveolar process to be an important factor in determining the amount of damage which would follow the surgical operation.

MATERIAL AND METHODS

Thirty-four teeth from 20 patients scheduled for full mouth extractions were used for this study. The patients ages ranged from 32 to 68 years. Centrals, laterals, cingulums, premolars and a molar with slight to moderate periodontal involvement were selected for study.

A rotary diamond disc (4.4 mm. in diameter and 1 mm. thick) was used to place a reference notch (A) (Fig. 1) across the mesiodistal width of the tooth, or teeth, adjacent to the gingival margin. An internal, beveled incision, originating at the gingival margin, and two vertical incisions were utilized in the elevation of a gingival mucoperiosteal flap. The thickness of the vestibular...
lay process was estimated and classified as thin, medium or thick.

Using the described diamond disc under running water, a horizontal notch (D) (Fig. 1) was placed in bone approximately 5 mm. distal to the alveolar bone margin. Vertical (E) and cross notches (F) were made in bone as indicated in Figure 1. The horizontal and vertical notches served as boundaries for bone reduction. All notch depths were made as constant as possible in order to serve as guides for uniform bone removal. Osteous reduction was carried out under running water using a rotary diamond instrument (P-3 Star). In addition, approximately 1 mm. of crestal bone was removed using a surgical chisel with hand pressure. The root was marked with a B-P scalpel blade before and after the removal of the crestal bone. These reference notches, represented in Figure 1 by lines (B) and (C), were necessary only for the histological portion of the study, but provided a choice of studying the teeth by standardized photographs or histologic methods.

Following osteous surgery a standardized photograph was taken and the mucoperiosteal flap was replaced and sutured to cover the alveolar process plus 1.5 mm. of root surface. The sutures and periodontal dressing were retained for one week before removal. After selected healing intervals ranging from 14 to 545 days, a mucoperiosteal flap was again elevated and a second standardized photograph made.

Since the first and second photographs were made with the same camera distance and angulation, accurate comparisons of the area under study could be made. The serial transparencies were printed with a polaroid 35 mm. slide copying machine (model 235). Tracings on matte cellulose acetate were made of the print taken immediately after osteous surgery. These tracings were then used to transfer the level of the alveolar bone crest recorded immediately after osteous surgery to a print taken at a selected postoperative time. Any gain or loss in the level of the alveolar bone crest, evident at the selected postoperative time, was measured with a Beoley gauge to the nearest one tenth of a millimeter. The photographs used for measurements were enlarged 2.0 times. In addition a Polar Planimeter (4236 M) was used to measure the square area of bone loss over the tooth root.

RESULTS

Weekly clinical examinations and photographs indicated satisfactory postoperative healing. Measurements of 34 teeth from 27 patients are recorded in the chart (Fig. 2). The average reduction in the height of the alveolar bone crest following the gingival mucoperiosteal flap operation and osteous surgery was 24 mm. A total of 16 teeth, or 47%, demonstrated no measurable loss while a total of 28 teeth or 82% showed...
ALTERATIONS FOLLOWING OSSEOUS SURGERY

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**Average**

- Loss: 0.25 mm.
- Average Loss: 2.8 sq. mm.

**Figure 2**

Examinations and photomicrographs of 34 teeth showed satisfactory postoperative conditions. A total of 16 teeth showed no measurable loss, 17 teeth or 82% showed
less than 1 mm. Two teeth demonstrated significant losses of 3 mm. and 3.8 mm. The average square area of bone loss measured with the polar planimeter was 2.8 sq. mm. Figures 3, 4 and 5 demonstrate alterations to the crestal level which occurred in postoperative intervals of 50, 77, 116 days respectively.

**DISCUSSION**

In patients where the alveolar bone was initially classified as thin, osseous reduction rendered the bone far thinner than would be necessary or desirable in therapeutic procedures.

The reduction in the level of the alveolar bone crest, which occurred in association with a mucoperiosteal flap operation and osseous surgery, was not considered to be significant. This is emphasized by comparing the square area of bone loss with the total square area of root support. The average loss of 2.8 sq. mm. would represent only 1.7% of 152 sq. mm., which is the average number of sq. mm. of attachment apparatus for a maxillary central. This percentage would increase to only 1.8% even if one third of the attachment apparatus had been lost from periodontal disease prior to therapy.

**REFERENCES**

1. Widerman, M. N., Perre, Burren, J.: Repair of the alveolar osseous surgery, II. Histologic In
4.孟朋龙, Daniel: Response to osseous surgery. J. Amer. So

**SUMMARY AND CONCLUSIONS**

This study was performed to determine any alteration in alveolar crest following periosteal flap operation. Following osseous regenerative mucoperiosteal flap coverage the alveolar process the tooth root. The area is fixed to the vestibular side of the tooth. Me
teeth from 20 patients were treated, including standardized photomicrographs of bone healing intervals at 545 days. The average height of the alveolar bone in the average square measured with the polar

2.8 sq. mm.

**Have you heard**

"Education in the form of intellectual, education of perpetual self-discipline are important to one could be."
SUMMARY AND CONCLUSION

This study was performed to determine if any alteration occurred to the level of the alveolar crest following a gingival mucoperiosteal flap operation and osseous surgery. Following osseous reduction, the gingival mucoperiosteal flap was positioned to cover the alveolar process and 1-2 mm. of the tooth root. The area of study was confined to the vestibular alveolar process over the root of the tooth. Measurements of 34 teeth from 20 patients were made by utilizing standardized photographs with postoperative healing intervals ranging from 1 to 545 days. The average reduction in the height of the alveolar bone crest was .54 mm. The average square area of bone loss measured with the polar planimeter was 2.8 sq. mm.

REFERENCES

Have you heard...

"Education in the formal sense is only a part of the society's larger task of abetting the individual's intellectual, emotional and moral growth. What we must seek for is a conception of perpetual self-discovery, perpetual reshaping to realize one's best self, to be the person one could be."

JOHN W. GARDNER