Periodontal Healing Following Open Debridement Flap Procedures

I. Clinical Assessment of Soft Tissue and Osseous Repair

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THE HEALING RESPONSE of the periodontium was evaluated after periodontal flap and debridement procedures in patients with different levels of postsurgical plaque control. Thirty-one sites in 19 patients were included. Measurements were performed from a fixed reference point presurgically and before reentry surgery. All reentries were performed 24 to 28 weeks after surgery. Surgery consisted of elevating an inverse bevel mucoperiosteal flap, debriding root accretions and osseous defects, penetrating into the marrow, and suturing with interrupted sutures at or near the presurgical level. All patients were recalled at least once every 4 weeks after surgery for professional maintenance. The number of postsurgical maintenance visits and plaque scores (NPI) before reentry were recorded for each surgical site. Average pocket depth at the 31 sites was 7.4 mm initially and 4.1 mm at the time of reentry. This reduction in pocket depth consisted of gingival recession, which averaged 2.0 mm, and a gain in attachment level, which averaged 1.4 mm. At no site was there a loss in attachment level. Average osseous depth of the 31 defects was 3.7 mm presurgically and 1.7 mm at reentry. In addition, there was an average crestal resorption of 0.8 mm and an average osseous fill of 1.2 mm. A significant positive correlation ($P < 0.001$) was found between gain in attachment, osseous fill and number of postsurgical maintenance visits. A significant negative correlation was found between the amount of plaque (NPI) at the study site and both gain in soft tissue attachment and osseous fill. Multiple measurements at various points within several osseous defects revealed that osseous remodeling and fill varied significantly at different locations within the same defect.

Restoration of diseased human periodontal supporting structures takes place with or without the use of grafts.[1-10] Although only limited human histological data are available, a somewhat more favorable healing potential has been demonstrated when grafts have been used.[6] However, recent clinical reports have indicated that under conditions of optimum plaque control maintained by "professional tooth cleaning," predictable levels of osseous as well as soft tissue repair are attained following periodontal flap and open debridement procedures.[1-4] In fact, clinical studies suggest that the level of plaque control may be the most significant factor affecting levels of repair.[3, 7-10]

The present study was undertaken to monitor levels of soft tissue and osseous repair with different levels of plaque control after periodontal flap and open debridement procedures.

MATERIALS AND METHODS

Thirty-one sites in 19 patients (18 males and 1 female) 20 to 62 years of age (average 48.5 years) were included in our study. The 19 patients were those remaining from a patient pool selected on a first-come basis from those being seen for routine periodontal therapy at the Dental Service, Veterans Administration Medical Center, New York, N.Y. The only criterion for initial inclusion in the study was that the patient be medically cleared and willing to participate. Each patient was given a complete explanation of the study before signing a consent form. Initial therapy for the patient pool consisted of oral hygiene instruction, scaling and root planing and occlusal adjustment for gross interferences. After initial therapy, a Navy Plaque Index was recorded. Only when the index approached 0 were patients identified for subse-

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quent surgical therapy.[11] The index was reduced to surgically acceptable levels by frequent (in some cases three or four times a week) prophylaxes by a hygienist with oral hygiene reinforcement at every session.

Sites for the study were chosen at random from all sites requiring periodontal surgery. Only osseous defects at least 2 mm deep were included.

Measurements

Measurements were made with a stent, boley gauge, endodontic silver point, and locking pliers. Using the base of the stent as a fixed point of reference, measurements were recorded before surgery from: a) the stent to the gingival margin; b) the stent to the deepest part of the pocket; and c) the stent to the cementoenamel junction.

Pocket depths (the distance from the gingival margin to the base of the pocket) were calculated as (b-a) and were obtained to the nearest 0.1 mm. At the time of surgical exposure of the osseous defect, the stent was regrooved and measurements were made from stent to osseous crest and stent to the deepest part of the osseous defect. The measurement from the stent to the cementoenamel junction was repeated at each site to test for seating of the stent. The same investigator performed all measurements to eliminate interexaminer discrepancies.

Six to seven months after initial surgery, all sites were reentered. At the time of reentry, each measurement was repeated. Measurements were made to the osseous crest at the same point as in the original defect and to the deepest part of the residual osseous defect (where one existed). In most cases, the latter point was not identical with the original deepest point of the defect. At all times, however, the deepest point of the defect was used for the measurement recorded.

Also, in four lesions of three patients, multiple measurements were made at several sites within the original defect. At the time of reentry, these measurements were repeated at the identical sites to record osseous remodeling at various points within the same defect. These values were recorded separately (Table VI) but averaged when calculating "initial osseous depth" and "osseous fill" (Table II).

Surgical Techniques

Surgery consisted of an inverse bevel flap procedure, retaining as much of the marginal gingiva as possible; debridement of root accretions and osseous defect; mul-

Table I
Soft Tissue Response to Open Debridement Flap Procedures With 24-28 Week Reentries

Number of sites	Presurgical pocket depth	Reentry	Maintenance visits	Postsurgical pocket depth	NPI x/18	Gingival recession	Change in attachment
	mm	*weeks*		*mm*		*mm*	*mm*
31	7.4 ±1.93	24.8 ±1.42	11.2 ±3.44	4.1 ±1.67	0.6 ±0.26	2.0 ±1.24	+1.4 ±0.98

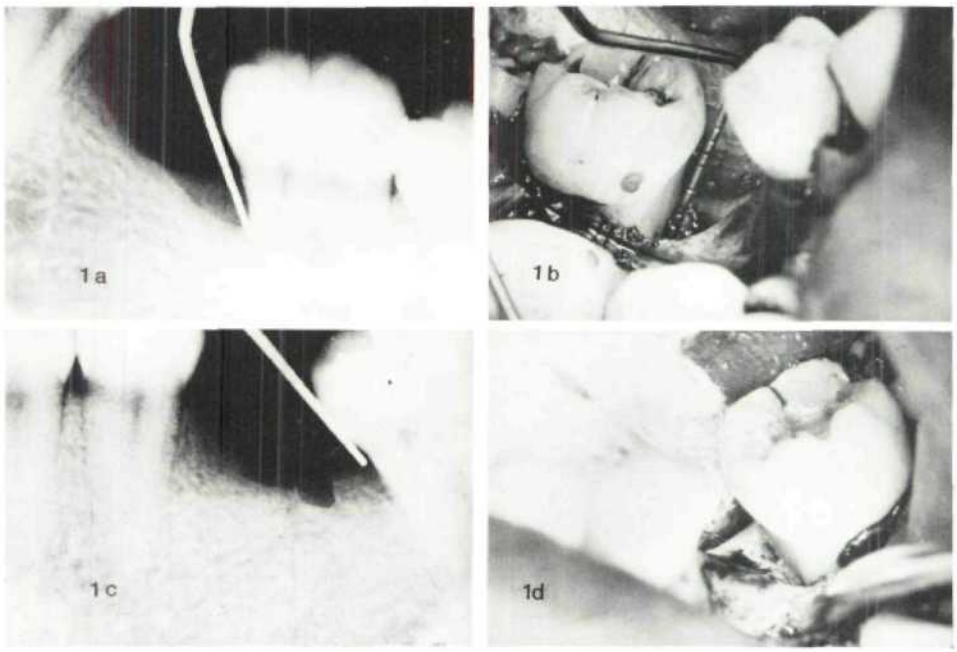

Figure 1a. *Radiographic appearance of the osseous defect on the mesial of the mandibular left 2nd molar immediately before surgery.* **b.** *Clinical appearance following debridement of the wide 3-wall infraosseous defect, which measured 5.0 mm at its deepest point (mirror photograph).* **c.** *Radiographic appearance of the surgical site, 24 weeks postsurgically, just before reentry.* **d.** *Clinical appearance of the surgical site, at the 24-week reentry, with a residual defect which measured 1.7 mm in depth and a fill which measured 3.3 mm.*

tiple intramarrow penetrations of the defect wall with an explorer or curette; and suturing of the flap with interrupted sutures at or close to presurgical levels. All patients were placed on antibiotic coverage (penicillin or erythromycin, 1 gm day) for 1 week and a dressing was applied. Penicillin or erythromycin was chosen to standardize the antibiotic therapy being used, since these were the drugs of choice for several patients requiring prophylactic antibiotic coverage for preexisting medical conditions.

Postsurgical Treatment

One week after surgery, sutures and dressings were removed. At this appointment and at intervals of no more than 4 weeks, the periodontist performing the initial surgery debrided the site. Each debridement visit consisted of an oral hygiene review and scaling and flossing of the surgical sites. Each patient was maintained in this manner until the reentry appointment.

The four surgical sites with multiple measurement recordings within the osseous defect were also professionally cleaned at least once every 4 weeks between the time of initial surgery and reentry.

For all sites, reentries were performed 24 to 48 weeks after initial surgery (average reentry time 24.8 weeks). Before reentry, a modified Navy Plaque Index of the tooth at the surgical site was recorded and all measurements were repeated. Radiographs (with probes inserted) and photographs were taken before, during, and after the initial and reentry procedures.

OBSERVATIONS

Tissue Response of 31 Sites Treated With Open Debridement Flap Procedures

The pertinent pocket measurement data are presented in Table I. There was no loss of attachment at any site evaluated.

As stated previously, a modified Navy Plaque Index was recorded for each surgical site at the time of reentry. Most patients were unable to maintain optimum levels of plaque control even when professionally maintained with "cleanings" at least once every 4 weeks postsurgically. The average NPI at reentry was 0.6 (SD ± 0.26) and ranged from 2/18 to 18/18 (Fig. 1).

Table II records the osseous response of the 31 study sites as measured during the initial surgical procedure and at reentry. Clinical responses are demonstrated in Figure 1.

Table III classifies the soft tissue response of the sites according to the type of osseous defect present at the time of initial surgery. Since most infrabony lesions were combination type defects, classifications were made according to predominant morphology.

Table IV classifies the osseous response of the 31 sites according to the type of osseous defect present at the time of initial surgery.

Table II
Osseous Response to Open Debridement Flap Procedures With 24-28 Week Reentries

Number of sites	Initial Osseous depth	Reentry	Maintenance visits	Osseous depth at reentry	NPI x/18	Osseous fill	Crestal resorption
	mm	*weeks*		*mm*		*mm*	*mm*
31	3.7 ±1.56	24.8 ±1.42	11.2 ±3.44	1.7 ±1.57	0.6 ±0.26	1.2 ±1.04	0.8 ±0.63

Table III
Soft Tissue Response to Open Debridement According to Type of Defect

Type of defect	*N*	Presurgical pocket depth	Postsurgical visits	NPI x/18	Postsurgical pocket depth	Gingival recession	Change in attachment
		mm			*mm*	*mm*	*mm*
Combined 1 and 1–2 wall	14	8.0 ± 1.96	12.1 ± 3.35	0.6 ± 0.28	3.7 ± 2.08	2.5 ± 1.29	+1.7 ± 0.88
2 Wall	10	7.6 ± 1.55	9.7 ± 2.67	0.7 ± 0.22	5.0 ± 0.89	1.7 ± 1.04	+1.2 ± 0.85
Combined 2–3 and 3 wall	7	6.1 ± 1.98	11.9 ± 3.98	0.5 ± 0.34	3.5 ± 1.39	1.2 ± 0.99	+1.5 ± 1.27

Table IV
Osseous Tissue Response to Open Debridement According to Type of Defect

Type of defect	*N*	Initial osseous depth	Postoperative visits	NPI x/18	Residual osseous depth	Osseous fill	Crestal resorption
		mm			*mm*	*mm*	*mm*
Combined 1 and 1–2 wall	14	4.2 ± 1.90	12.1 ± 3.3	0.6 ± 0.3	2.0 ± 2.10	1.3 ± 1.21	1.0 ± 0.60
2 Wall	10	3.2 ± 0.72	9.7 ± 2.7	0.7 ± 0.2	1.6 ± 1.05	0.8 ± 0.75	0.8 ± 0.79
Combined 2–3 and 3 wall	7	3.4 ± 1.29	11.9 ± 4.0	0.4 ± 0.3	1.3 ± 0.93	1.5 ± 1.01	0.7 ± 0.58

In summary, our measurements indicate that flap debridement procedures in our patient pool universally led to gingival recession (average 2.0 mm) and limited pocket closure (average 1.4 mm). Loss of attachment was not observed at any treated site during our observation period. The infraosseous portion of the lesions mirrored the soft tissue (supracrestal) responses to debridement. We recorded crestal resorption (average 0.8 mm) coupled with apical fill (average 1.2 mm).

When the gain in soft tissue attachment was compared to the number of postsurgical maintenance visits, a statistically significant correlation was found ($r = 0.89$, $P < 0.001$). Comparing the gain in attachment with the amount of plaque at the surgical site (NPI) resulted in a negative correlation ($r = -0.70$, $P < 0.001$). A similar negative correlation was found when the amount of osseous fill was compared with the NPI ($r = -0.60$, $P < 0.001$). No significant correlation could be established between the amount of crestal resorption and the number of postoperative visits or NPI. When the number of postoperative visits were compared to the NPI, a statistically significant negative correlation was found $r = -0.84$, $P < 0.001$ (Table V).

Table V
Correlation of Gain in Attachment Level, Crestal Resorption, Osseous fill, and Number of Postsurgical Visits and NPI

	Postsurgical visits	NPI at reentry
Gain in attachment	0.89*	−0.70*
Osseous fill	0.59*	−0.60*
Crestal resorption	−0.04†	−0.00**
Number of postsurgical visits		−0.84*

* All values significant $P < 0.001$.
† Not significant.

Multiple measurements of sites within the osseous defect of three patients (Table VI) indicated varying levels of remodeling within each defect. In our samples, the deepest part of the defect was different at reentry from what it was at the time of initial surgery. This discrepancy in osseous fill can be seen with patient No. 1 (Fig. 2) where the osseous fill at two points within the same defect measured 3.3 mm and 0.4. mm. At the deepest part, this defect measured 3.8 mm at the time of initial surgery (Fig. 2c). At reentry a 3.3 mm "osseous

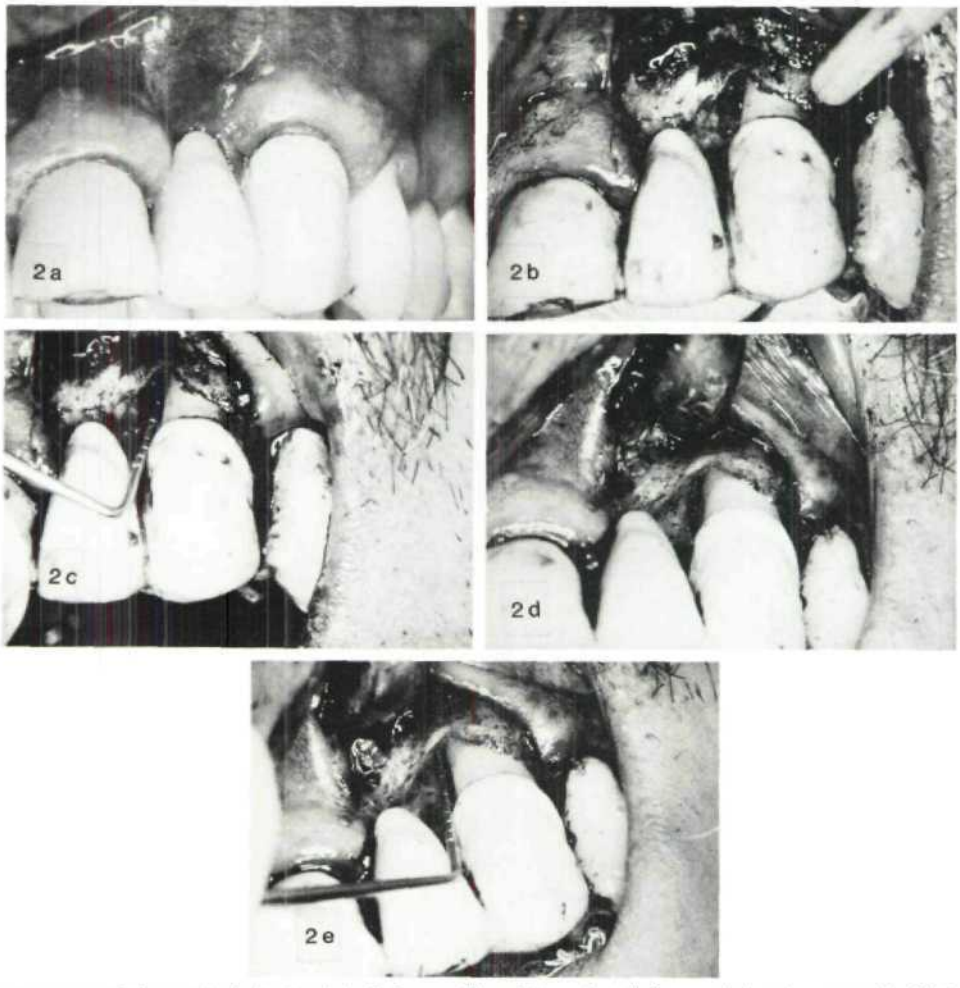

Figure 2a. *Clinical appearance of the surgical site (mesial of the maxillary left canine) before periodontal surgery.* **b.** *Clinical appearance of the intraosseous lesion immediately after debridement.* **c.** *Osseous defect with probe inserted measured 3.7 mm in depth.* **d.** *Clinical appearance, at 24-week reentry surgery, of the residual osseous defect measuring 1.1 mm. Fill and remodeling are evident.* **e.** *Surgical site, at time of reentry, with a fill which varied from 0.4 to 3.3 mm at two separate points of measurement.*

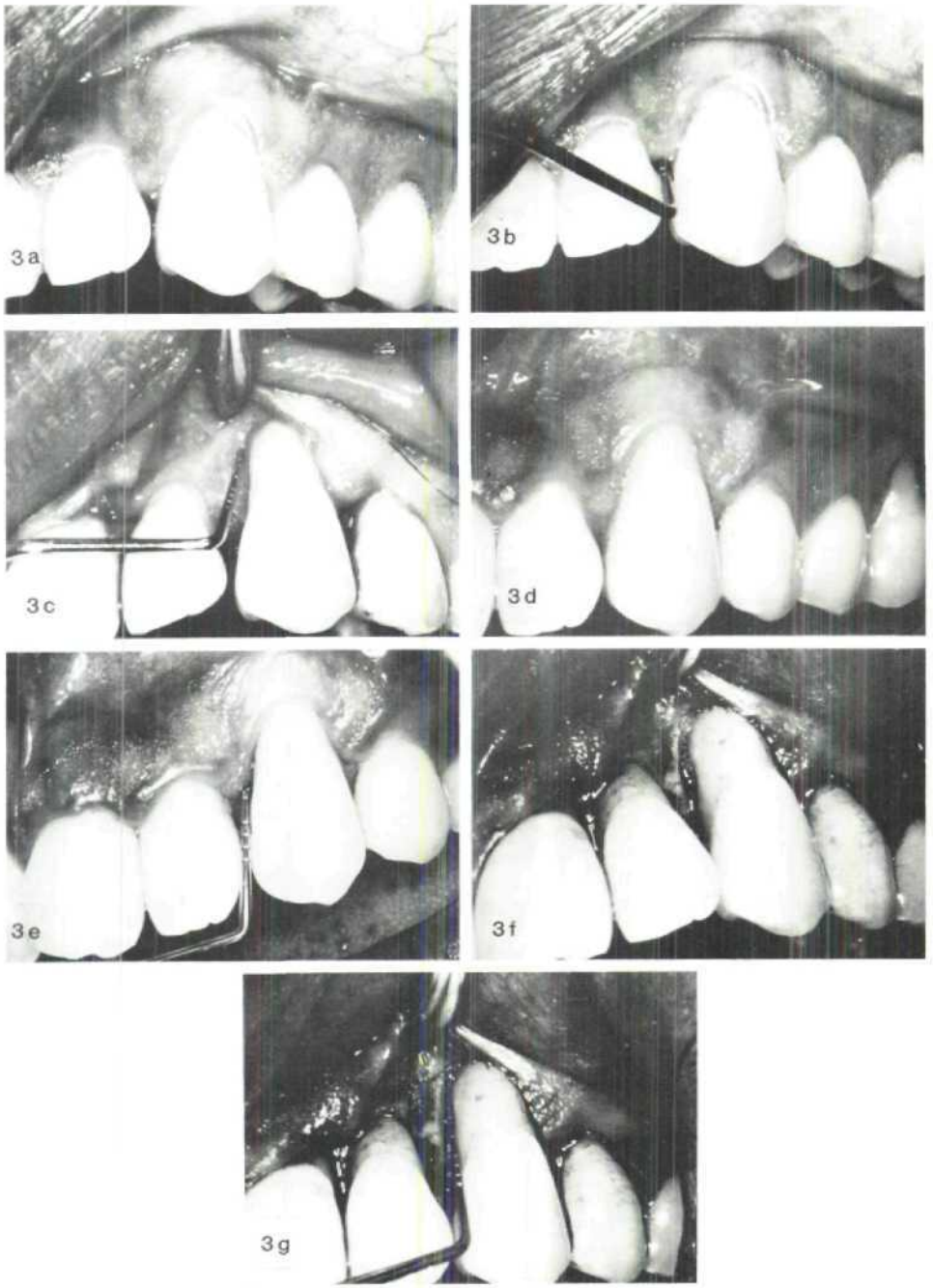

Figure 3a. *Clinical appearance of the surgical site, mesial of the maxillary left canine, before periodontal surgery.* ***b.*** *Clinical appearance of the site probed with an 8.4 mm soft tissue pocket depth.* ***c.*** *Appearance of the osseous defect immediately following debridement. The defect measured 4.1 mm in depth.* ***d.*** *Clinical appearance of the surgical site, 24 weeks postsurgically, just before reentry.* ***e.*** *Soft tissue probing before reentry, reveals a residual soft tissue pocket depth of 4.5 mm, with 2.7 mm gingival marginal recession and 1.2 mm of "new attachment."* ***f.*** *Osseous site at time of reentry. Crestal resorption measured 0.7 mm, while the residual osseous defect varied from 0.4 mm to 3.6 mm at two different study points.* ***g.*** *Probing the residual osseous defect at time of reentry reveals an osseous fill of 0.6 mm. At the 2nd study point, 1 mm mesial to the deepest point, the osseous fill measured 2.2 mm.*

fill" was measured (Fig. 2d). However, at a second site within the same defect which measured 3.7 mm in depth at initial surgery, "osseous fill" measured 0.4 mm at reentry (Fig. 2e). Although an average fill for the entire defect was calculated to be 1.9 mm, the greatest fill occurred at the deepest part of the defect and along the osseous walls. A similar type of remodeling took place on tooth No. 11 on patient No. 2 (Fig. 3). Comparing the initial osseous defect with the defect at reentry showed considerable remodeling. The deepest part of the defect at initial surgery was 4.1 mm (Fig. 3c). At reentry the osseous fill was 0.6 mm. However, at a point just 1 mm mesial to this point osseous fill measured 2.2 mm (Figs. 3f, 3g). A gain in soft tissue attachment occurred at all four sites in all three patients, ranging from 1.2 mm to 2.7 mm (Table VI).

Table VII depicts tooth mobility patterns at the 31 surgically treated sites. These values were observed using

Table VI
Osseous Response at Multiple Points in Four Sites Treated With Open Debridement Flap Procedures

Patient No.	Age	Site	Reentry	Initial osseous depth	Maintenance visits	NPI x/18	Residual osseous depth	Osseous fill	Crestal resorption	Change in attachment
			weeks	*mm*			*mm*	*mm*	*mm*	*mm*
1	54	M11	24	3.7, 3.7, 3.6, 3.8 (3.7)	16	6	0.0, 2.2, 2.1, 0.1 (1.1)	3.3, 0.4, 0.4, 3.3 (1.9)	0.7	+2.2
2	29	M11	24	4.1, 4.1	13	6	0.4, 3.6 (2.0)	2.2, 0.6 (1.4)	0.7	+1.2
		M22	24	3.0, 3.0	12	6	1.3, 0.3 (0.8)	0.4, 2.4 (1.4)	0.8	+1.3
3	53	M31	28	5.0, 5.0	17	2	3.0, 2.0 (2.5)	2.5, 1.5 (2.0)	0.5	+2.7

Table VII
Mobility Patterns for Various Types of Defects

Type of Defect	*N*	Average initial mobility	Average 24–48 week postsurgical mobility
Combined 1 and 1–2 wall	14	1.1 ± 0.46	0.6 ± 0.51
2 wall	10	1.3 ± 0.59	1.1 ± 0.57
Combined 2–3 and 3 wall	7	0.9 ± 0.69	0.6 ± 0.69

the Miller Index,[12] which has been reported to be highly subjective.[13] Within these limits, our findings showed no significant effect of flap debridement on mobility patterns.

COMMENT

Responses of diseased periodontal tissues to debridement long have been described as ranging from limited healing, caused by a reduction in inflammation, to the formation of new coronal attachment.[14] In early reports, debridement of infrabony lesions caused fill in many of the treated cases.[15, 16] With increasing experience, various modalities for treating the infrabony lesion have been evaluated over time. The data at hand show that many lesions exhibit repair regardless of treatment modality used.[17] However, levels of repair seem to be related to: (a) depth of lesion, (b) configuration of lesion, (c) plaque control at surgical site, and (d) modality of treatment.

Results of the current investigation show a significantly high correlation between gain in attachment level-osseous fill and level of plaque control at the surgical sites. A similar correlation exists between frequency of postsurgical maintenance visits and reduction of plaque index at the surgical site. These findings underscore the importance of plaque control following periodontal surgery.[1-3] Thus variations in clinical responses when similar surgical techniques are used may relate to varying levels of plaque control achieved during the healing phase of the studies.

Our results compare favorably with those of published studies showing a reduction in pocket depth after debridement and careful oral hygiene measures. For example, new coronal soft tissue adhesion to previously exposed root surfaces has been reported to be 1.5 mm for a 5-year evaluation period.[18] Our net gain in soft tissue attachment averaged 1.4 mm.

The response of fill after use of the procedures outlined showed crestal resorption of 0.8 mm (SD ± 0.63), which is similar to that described by Moghaddas and Stahl,[19] using identical measurement techniques. This resorption took place regardless of the level of plaque control at the surgical sites. A mean osseous fill of 1.2 mm (SD ± 1.04) in the present study compares favorably with our previously reported responses of 0.66 mm fill following debridement, but is less than the 2.98 mm fill we reported with the use of bone blend grafts.[7] Since the present number of sites was limited, the topography of defects variable, and the conditions responsible for these lesions not clearly understood, comparison of healing responses must be evaluated with caution. In the current study, such caution is underscored by the demonstration that fill may vary considerably within each defect. Thus extreme accuracy in finding the same spot along the fill, both pre- and postoperatively, becomes a necessity for accurate comparisons. However, such a degree of precision is not available in clinical practice. Nor can we be sure of the prognostic implications of such pinpoint response within the total repair of an infrabony defect. Clinically, then, we must recognize the limited repair potential of infrabony lesions and further evaluate the role of the various etiologic and therapeutic factors which influence the repair potential. However, the present data, albeit limited, demonstrate the ability of periodontal tissue to repair and even regenerate, a concept questioned by a previous generation of periodontists.[20]

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