Human histologic responses to guided tissue regenerative techniques in intrabony lesions

Case reports on 9 sites

S. S. Stahl, S. Froum and D. Tarnow
Department of Periodontics, College of Dentistry, New York University, New York, New York, USA

Stahl, SS, Froum S and Tarnow D: Human histologic responses to guided tissue regenerative techniques in intrabony lesions. Case reports on 9 sites. J Clin Periodontol 1990; 17: 191–198.

Abstract. 9 sites of 8 teeth in 5 adults with severe periodontitis were treated by open surgical debridement followed by placement of 1 of 2 Teflon barrier membranes. Teeth were notched at both gingival margins and deepest visible calculus on the root. Barrier membranes were placed apical to alveolar crest and coronal to gingival notch. Flaps were sutured coronally and patients were placed on 1.2% chlorohexodine gluconate twice daily for 2 weeks, post-surgery. Subsequent to suture removal, patients returned for frequent plaque control until block removal. In order to observe early healing responses, 6 sites were harvested 5 to 8 weeks after surgical treatment. 3 additional sites were removed 14, 22 and 30 weeks respectively after surgical treatment. Histologically, new cementum was seen in a linear direction along root surfaces in 6 out of 9 sites (length of cementum = 0.5 to 1.7 mm). 3 sites showed no evidence of new attachment. At sites of cementogenesis, functionally-oriented fibers were inserted. The osseous seams opposite the new attachment often demonstrated osteogenesis. Regenerative responses were seen with both types of teflon membranes and were present as early as 5 weeks after surgery.

Key words: human histologic GTR responses.

Accepted for publication 20 March 1989

Periodontists have long hoped for a clinical approach restoring periodontal attachment destroyed by periodontal disease. In order to achieve new attachment (i.e., new functionally oriented attachment at root sites previously exposed to the oral environment), many procedures have been tried (Egelberg 1987). Current interest has focused on the human application of tissue guidance in periodontal defects (Nyman et al. 1982, Pontoriero et al. 1987), and histologically, new attachment responses have been reported in human cases with this technique (Nyman 1982, Gottlow et al. 1986, Becker et al. 1987).

Since new attachment, as described above, can only be demonstrated histologically, human block sections are the requisite for such studies. Obviously, this need significantly limits the overall sample pool. The present report therefore presents additional histologic healing responses in 6 sites in which barrier membranes were placed and blocks removed after a relatively short time period (5 to 8 weeks), and 3 sites in which barrier membranes were placed and blocks removed after 14, 22 and 30 weeks, respectively.

2 different teflon millipore filters were placed in different sites to observe if such variations affect the biologic principles activated by the use of barrier filters (Melcher 1976, Gould 1983).

Since the most significant healing responses take place in the early stages of wound repair (i.e., root epithelization), we focused on relatively early post-surgical responses (6 sites). Only 3 sites were used to observe 3 to 8 months responses. It should be underscored at the very outset that this collection of case presentations does not represent a controlled clinical study. However, results can be interpreted as human experiences, which either confirm or question published laboratory studies and clinical reports.

Material and Methods

9 periodontal lesions on 8 teeth in 5 adult (ages: 29 to 65 years) volunteer patients (2 female, 3 male) were treated by open debridment flap procedure followed by insertion of one of two types of membrane barriers.

All patients were in good health and each signed an informed consent following explanation of the study and providing freedom to withdraw at the patient's will. Surgery was performed as part of the overall periodontal treatment plan in the Department of Periodontics at New York University College of Dentistry. All 9 teeth selected were scheduled for extraction and diagnosed as being hopeless, for periodontal or prosthetic reasons, by at least two periodontists who were not part of the present study. Prior to surgery, cause related therapy was performed. However, root planing at these sites were performed after notching of root at time

of surgery. Root debridement was performed using ultrasonic scalers and hand instruments until all visible calculus was removed. Both magnifying lenses and fiberoptic light were employed to detect calculus, and 2 periodontists (SF and DT) checked the thoroughness of the procedure. Pre-treatment photographs and radiograms were taken at this time and photographs were obtained during surgery for clinical documentation.

Measurements

Prior to surgery, a horizontal notch was made at the level of the gingival margin using a 1/2 round bur. To insure reproducibility at subsequent measurements, a vertical notch was placed in the crown of each tooth to guide the silver point used for measurements. All measurements were made to the nearest 0.1 mm utilizing a number 50 silver point, a locking plier and a Boley gauge. The distance from the gingival notch to base of clinical pocket was recorded prior to surgery and 1 week prior to block section whereever possible. At the time of surgery, prior to root planing, a second notch was made through the most apical level of visible calculus and the following measurements made: (i) distance from calculus notch to the deepest point of the osseous defect; (ii) distance from calculus notch to the alveolar crest.

Following defect and root debridement, the defect was classified according to the number of osseous walls remaining or type of furcation involvement.

Surgical procedure

An intrasulcular incision was made to elevate a full thickness mucoperiostoal flap in order to retain as much marginal gingiva as possible. After root/calculus notching, the lesion and root were thoroughly debrided and above described measurements recorded. At random, 1 of 2 different teflon (PTFE) membranes was chosen to be used following debridment of the defect. In all cases where the Emflon* membrane was used, it was placed to extend coronally to the gingival notch and at least 5 mm apical to the crest of the alveolar defect. Thus, following suturing all Emflon membranes were exposed (Nyman et al. 1982 Gottlow et al. 1986). In all cases where the Goretex** periodontal material was used, it was placed at least 5 mm apical to the crest of the alveolar defect and positioned to remain subgingival following suturing of the flaps (Becker et al. 1987).

Membranes was secured with resorbable sutures placed circumferentially around the tooth using a sling technique. The flaps were readopted without sutures to allow adjustment of the position of the membranes and then sutured coronally in these positions with interrupted sutures of 4–0 silk or Dexon. No dressing was placed. Patients were instructed to rinse with 1.2% chlorhexidine gluconate twice a day for 2 weeks. Flap sutures were removed 10–14 days following surgery. Patients returned for plaque removal once a week for 1 month, then every 2 to 3 weeks until block section was performed.

Teflon membranes barriers, (5 Emflon, and 4 Goretex) were removed during a second surgical procedure following membrane placement*. Block sections were removed 5 to 30 weeks after membrane placement. At the time of block removal, clinical records, measurements, photographs and radiographs similar to those described at initial surgery were taken, whereever possible. (At the 6 sites removed 5 to 8 weeks after initial surgery, the soft tissue configuration at the sites still reflected membrane retention. Therefore, accurate pocket depth and recession measurements could not be obtained.)

* Emflon manufactured by Pall Fileter Co., Long Island, NY, USA.

** Gortex manufactured by W. L. Gore Assoc. Inc., Flagstaff, AZ, USA.

* Gore-Tex Guided Tissue Regeneration Workshop Manual, W. L. Gore and Assoc. Inc. Flagstaff, AZ 1988. Presented orally, 1986.

Table 1. Pre-surgical clinical data and post-surgical histologic findings (5 to 8 weeks post-surgery)

Patient no.	Age (years)	Tooth site	Type of defect (walls)	Barrier membrane	Observation period (weeks)	Initial PD (mm)	Initial osseous depth (mm)	Length of JE (mm)	Length of cementum (mm)
1	41	15m	2	E*	5	6.0	3.0	1.0	0.5
		15d	2	E*	5	5.0	3.0	0.5	1.0
		16m	1	E*	5	7.0	9.0	1.3	0.0
		25d	2	E*	8	5.0	3.0	1.1	1.7
2	50	46d	2	G**	8	10.0	7.0	0.7	1.1
3	52	34m	1	G**	8	8.4	3.5	0.6	0.5

* Emflon; ** Gortex.

Table 2. Pre-surgical clinical data and post-surgical histologic findings (14 to 30 weeks post-surgery)

Patient no.	Age (years)	Tooth site	Type of defect (walls)	Barrier membrane	Observation period (weeks)	Initial PD (mm)	Initial osseous depth (mm)	Length of JE (mm)	Length of cementum (mm)
4	29	34d	2	E*	14	10.9	5.1	1.9	1.1
		46d	furcation	G**	22	11.5	4.7	2.0	0.0
5	65	23d	1	G**	30	9.5	4.5	2.0	0.0

* Emflon; ** Gortex.

Histologic process and measurements

At time of block removal, teeth were fixed in 10% buffered formalin, decalcified in EDTA and embedded in paraffin.

Step serial sections 8 μ thick were cut and stained for routine histologic evaluations. The length of new cementum and junctional epithelium was measured microscopically in 3 centrally located step serial sections (60 μ apart). They were measured in a linear direction along the root surface. The junctional epithelium was measured from base of crevice to it's most apical extent. The new cementum was measured from it's most coronal to it's most apical root position, but never beyond the base of the osseous crater. The distances reported per site are the mean of the 3 measurements taken per block.

Observations

Clinical

Pertinent clinical and histologic findings at each site are presented in Tables 1 and 2. Summarizing these observations, we note that average initial pocket depth in sites removed 5 to 8 weeks after treatment was 6.9 mm and ranged from 5.0 mm to 10.0 mm. Osseous depth averaged 4.8 mm with a range of 3.0 to 9.0 mm. In the sites removed 14 to 30 weeks after treatment, the average initial pocket depth was 10.6 mm with a range from 9.5 mm to 11.5 mm. The average osseous depth was 3.8 mm and ranged from 4.5 to 5.1 mm.

At the sites removed 5 to 8 weeks after surgery, post-operative probing was exceedingly difficult since the presence of the barrier membranes was associated with red, inflamed and easily retractable gingival margins. The tissue retracted and appeared normal only after the membranes had been removed for a number of weeks. In the later blocks, post-surgical measurements were obtained and are cited in each case description.

Histologic

Patient no. 1, a 41-year-old male provided 4 sites for observation (15m, 15d, 16m, and 25m). The barrier membrane used was Emflon. 3 sites were removed at 5 weeks post-surgery and 1 site at 8 weeks post-surgery. (Fig. 1) Histologic evaluation of the blocks removed at the 5-week interval showed varying responses in closure. Site 15m showed recession of the gingival margin apical to the calculus notch (Fig. 2). However, apical to the JE, a thin line of new cementum was present (length = 0.5 mm) into which fibers were attached. (Fig. 3) Site 15d showed epithelial adhesion within the calculus notch. Immediately, apical to the notch, new cementum appeared to have been laid down into which functional fibers were inserted. (Figs. 4–6) Cementogenesis extended well below the adjacent crest. The linear distance of new cementum was 1.0 mm. The length of the JE was 0.5 mm. Significant inflammation was present within the gingival margin reflecting the clinical observation of highly inflamed gingival tissues at these sites.

The site at 16m showed marked gingival recession and the gingival marginal tissues were severely inflamed. Closure was by epithelial adhesion (junctional epithelial length = 1.3 mm). Significant root resorption was taking place apical to the JE (Fig. 7).

Site 25d was removed 8 weeks after surgery (Fig. 8). The calculus notch at this site showed partial epithelial adherance (length of JE = 1.1 mm). However,

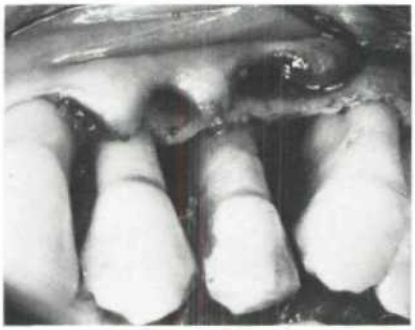

Fig. 1. Patient no. 1. Sites 15m, 15d and 16m debrided. These teeth were removed in block 5 weeks after surgery and membrane (Emflon) placement.

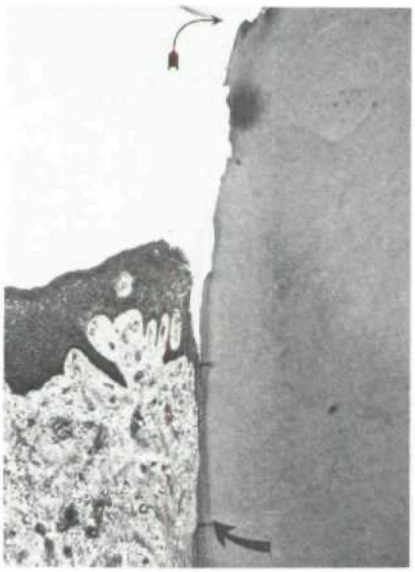

Fig. 2. Appearance of root surface at 15m. Note gingival margin has receded apical to calculus notch (arrow) and a thin line of new cementum is seen apical to the JE (arrow) (10×).

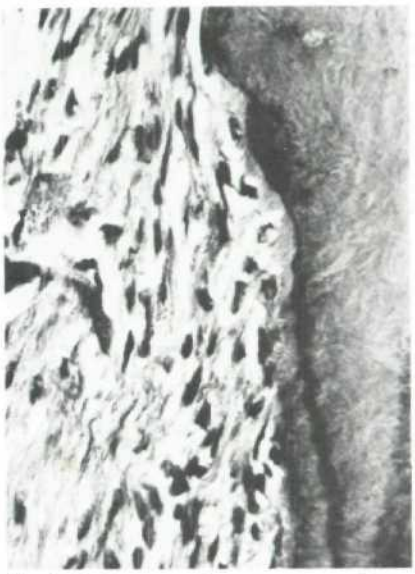

Fig. 3. Appearance of new cementum shown in Fig. 2 into which functionally oriented fibers are inserted (160×).

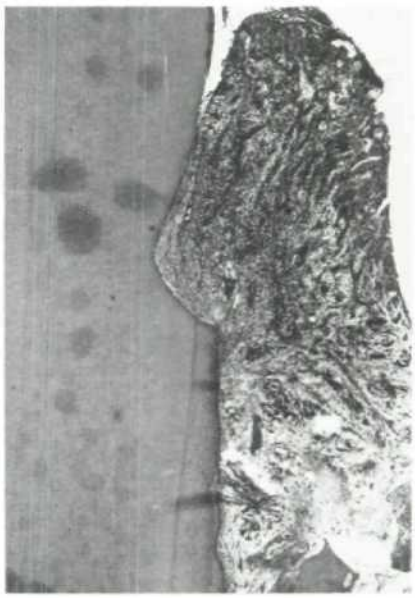

Fig. 4. Appearance of root surface at 15d. Note gingival margin is incisal to calculus notch and epithelial adhesion (JE) is seen in the notch. Immediately apical to notch, new cementum was laid down (10×).

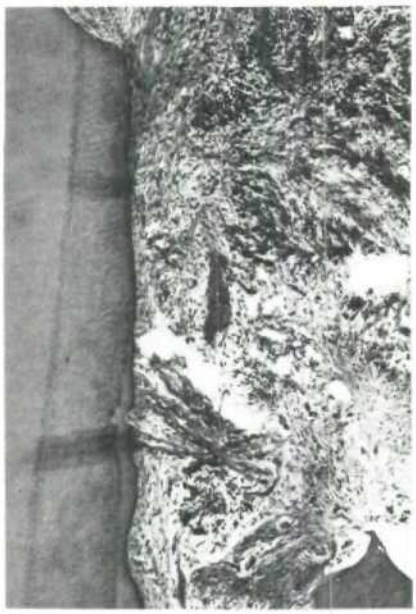

Fig. 5. Appearance of new cementum shown in Fig. 5 in relation to alveolar crest. Note functionally oriented fibers inserting supracrestally into new cementum (25×).

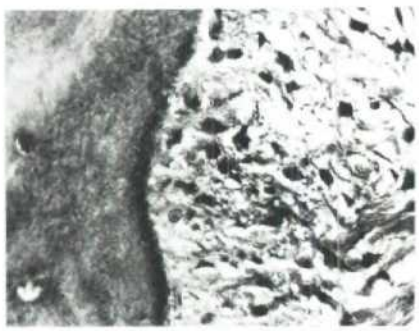

Fig. 6. Appearance of fiber insertion into new cementum shown in Fig. 5 (160×).

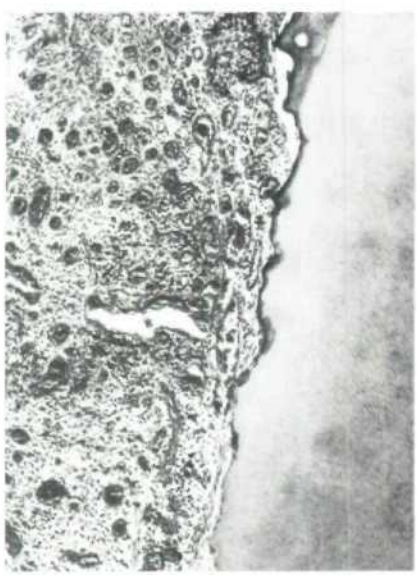

Fig. 7. Appearance of root surface at 16m. Note marked inflammation and vascularity within the gingival margin and active root resorption at this site (25×).

within this notch and immediately apical to the JE, new cementum was present which extended unto the root (length of new cementum = 1.7 mm). (Fig. 9). This cementum contained functionally oriented fibers (Fig. 10). Thus, new attachment was present at this site.

Patient no. 2 had one site (46d) which was removed 8 weeks after surgery. The membrane used was Gortex. (Fig. 11). Histologically, this lesion showed epithelial adherance within the notch. Immediately apical to the notch, cementogenesis (length of new cementum = 1.1 mm) was present into which functional fibers were inserted (Figs. 12, 13). The cementum appeared cellular and was deposited on cementum. While no new attachment was seen within the calculus notch, the presence of new cementum immediately apical to the notch is strongly suggestive of a regenerative process.

Patient no. 3 had one site (34m) which was removed 8 weeks after surgery. A Gortex membrane was placed in this site (Fig. 14). Histologically, the notch was exposed (recession) and closure by epithelium (long JE) was present apical to the notch (Fig. 15). Limited cementogenesis was noted apical to the JE which was not well defined.

Patient no. 4 had one site (34d) which was treated using an Emflon membrane. The block was removed 14 weeks after

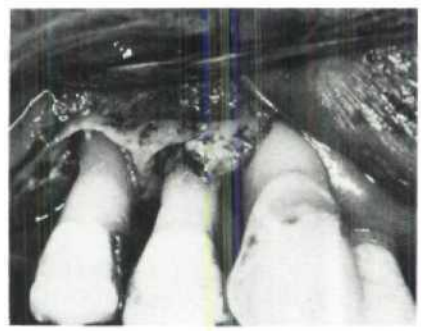

Fig. 8. Patient no. 1, site 25d debrided. The tooth was removed in block 8 weeks after surgery and membrane (Emflon) placement.

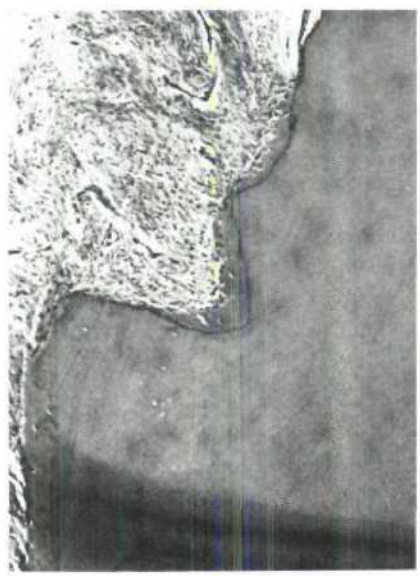

Fig. 9. Appearance of root surface at 25d. Note epithelial adhesion in the coronal part of the calculus notch while the more apical part and the contiguous root show active cementogenesis (10×).

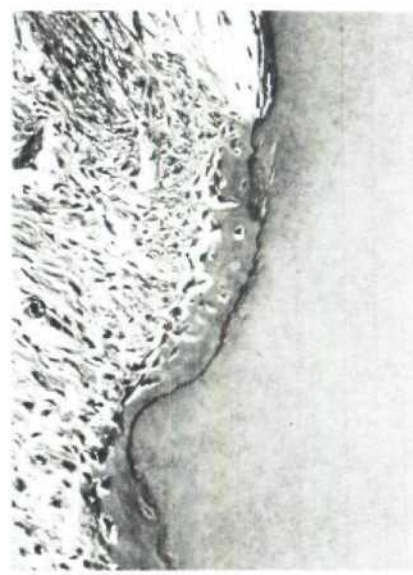

Fig. 10. Appearance of new cementum shown in Fig. 9, into which functionally oriented fibers insert (64×).

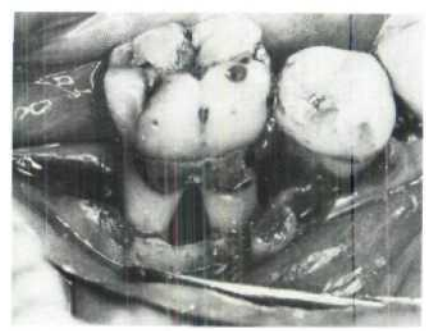

Fig. 11. Patient no. 2, site 46d debrided. This tooth was removed 8 weeks after surgery and membrane (Gortex) placement.

surgery (Fig. 16). Histologically, the calculus notch showed epithelial adhesion which extended unto the root apical to the notch. Cementogenesis (length of new cementum = 1.1 mm) was seen along the root with functional fiber insertion at supracrestal levels (Figs. 17, 18). This patient also furnished a second site (46d) which was removed at 22 weeks. It had been treated using a Gortex filter (Fig. 19). Histologically, the site showed the junctional epithelium at the level of the root apex in the presence of moderate inflammation. No cementogenesis was present (Fig. 20).

Patient no. 5 had one site (23d) which was treated using a Gortex membrane (Fig. 21). Histologically, this site showed no evidence of cementogenesis, but rather demonstrated closure by epithelial adhesion and recession (length of JE = 2.0 mm) (Fig. 22).

Fig. 12. Appearance of root surface at 46d. Note the calculus notch shows epithelial adhesion. Apical to the notch, new cellular cementum is present (25×).

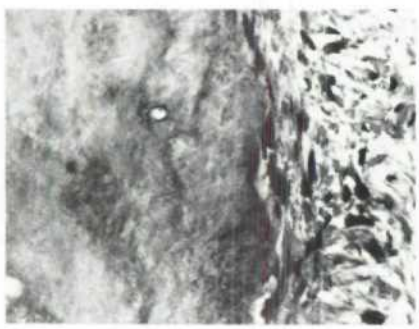

Fig. 13. Appearance of fiber insertion into new cementum shown in Fig. 12 (64×).

Fig. 14. Patient no. 3 site 34m debrided. This tooth was removed 8 weeks after surgery and membrane (Gortex) placement.

Fig. 15. Appearance of root surface site 34m. Note the gingival margin is at the apical edge of the calculus notch and closure is by epithelial adhesion (long JE) with limited and not well defined cementogenesis apical to the JE (10×).

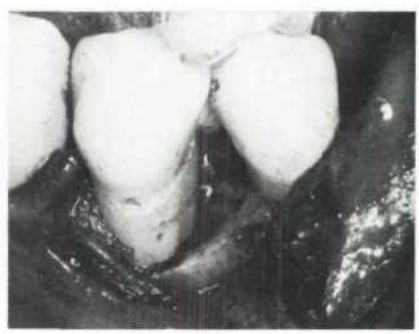

Fig. 16. Patient no. 4 site 34d debrided. This tooth was removed 14 weeks after surgery and membrane (Emflon) placement.

Comments

Pocket closure mechanisms

Evaluating the histologic responses found in our patients, it becomes obvious that gain in clinical closure reflected closure adhesion (long JE) or closure by a combination of new attachment (c.t.) and adhesion (epith.). However, the histologically observed contribution of connective tissue and epithelium to the gain in clinical closure varied per site.

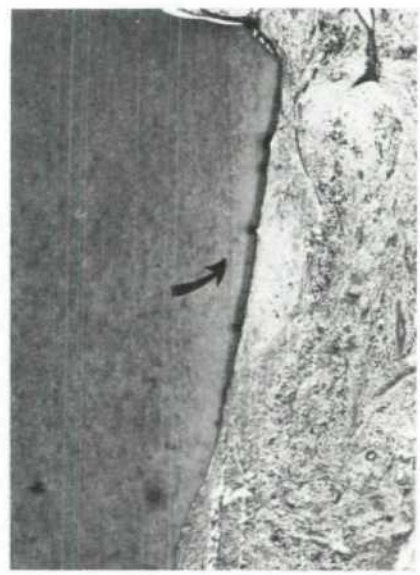

Fig. 17. Appearance of root surface of site 34d. Note epithelial adherence within the calculus notch which extended unto the root surface. Apical to the JE (arrow) new cementum is present (10×).

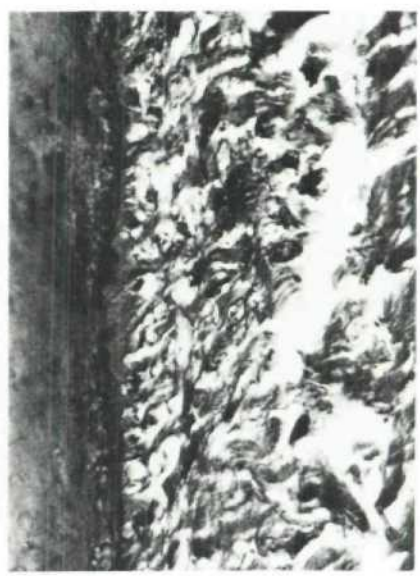

Fig. 18. Appearance of fiber insertion into new cementum shown in Fig. 17 (160×).

Furthermore, histologic responses indicated that membranes used at different sites led to varying degrees of regeneration of attachment or lack of it.

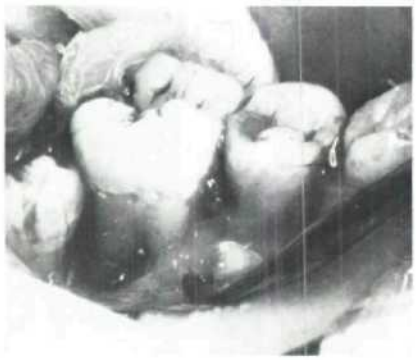

Fig. 19. Patient no. 4, site 46d debrided. This tooth was removed 22 weeks after surgery and membrane (Gortex) placement.

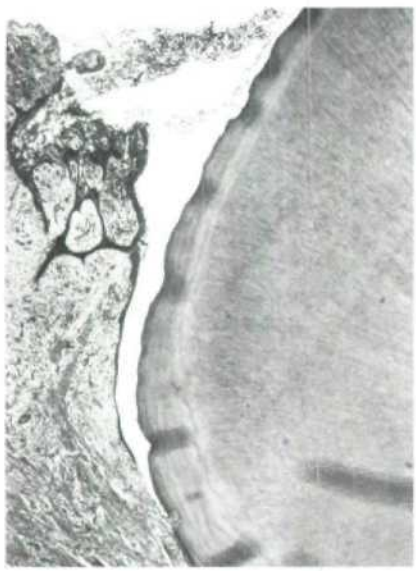

Fig. 20. Appearance of root surface at site 46d. Note closure is by epithelial adherence. The JE is at about the apical level of this tooth and new attachment was not present (10×).

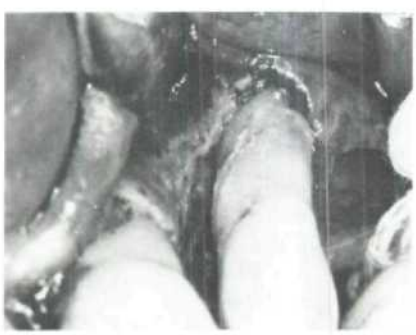

Fig. 21. Patient no. 5, site 23d. This tooth was removed 30 weeks after surgery and membrane (Gortex) placement.

Histologic evidence of new attachment

Ideally, new attachment can only be identified if new cementum with functionally oriented fibers is seen at a site previously exposed to the oral environment. However, since our calculus marker (notch) is relatively limited in size (1/2 round bur), it seems reasonable to assume that cementogenesis and new fiber attachment adjacent to the notch may well be part of a new attachment process. We therefore believe that evidence of fiber attachment into new cementum at linear distances on the root not exceeding 0.5 mm from the apical extent of the calculus notch should be considered part of the new attachment process.

With these limits in mind, evidence of new attachment in our cases is comparable to the trend demonstrated in human histologic samples treated by similar techniques (Nyman et al. 1982, Gottlow et al. 1986, Becker et al. 1987). The largest number of human sites examined histologically to date are those published by Gottlow et al. 1986. In those 5 cases, cementogenesis measured in a linear fashion varied from 2.8 mm to 4.5 mm and was seen in all cases. A comparison of our responses with the Gottlow et al. 1986 results is at variance at two levels: (i) Gottlow et al. reported that all 5 sites in which a barrier membrane was used showed histologic evidence of new attachment. In our cases, 3 out of 9 treated sites did not indicate histologic evidence of new attachment. (ii) The sites reported by Gottlow et al. showed new cementogenesis to vary from 2.8 to 4.5 mm, while our cases showed new cementum to vary from 0.5 mm to 1.7 mm. The causes for these differences are not known, but may reflect differences in site morphology and pathology as well as technical limitations and variations encountered at the specific sites.

Fig. 22. Appearance of root surface at site 23d. The calculus notch is covered by plaque which extends unto the root. Closure was by epithelial adhesion. No new attachment was present (10×).

Obviously, our histologic sample does not contribute to the identification of the "progenitor cell" necessary to stimulate the regenerative process. It does, however, suggest the specific role played by the interposed membrane, namely, delaying gingival epithelial and connective tissue cells from reaching the root surface in the early stages of healing. This delay may then allow progenitor cells to repopulate the previously exposed root surface. Yet, clinically observed "new attachment" has also been reported recently in response to different techniques. For example, treatment of periodontal furcation defects has been described using citric acid root conditioning and coronally positioned flaps in 14 mandibular molar, class II defects. Responses to citric acid root treatment, bone allografts and coronally positioned flaps were reported in additional 16 defects. The clinical results showed a 67% bone fill of all defects. Bone grafts did not augment these positive clinical results (Gantes et al. 1988). Such results compare favorably with clinical responses described in similar human sites using a porous hydroxylapatite implant (Interpore) (Kenney et al. 1988), and with clinical observations reported in similar human sites using barrier membranes (Pontoriero et al. 1987). In the latter report, 19 cut of 21 type II furcation defects in mandibular molars resulted in "resolution of the furcation defect."

The fact that enhancement procedures such as the use of (a) root conditioning, (b) hydroxylapatite grafts and (c) membrane barrier – guided tissue regeneration led to similar positive clinical results at specific sites, (i.e., molar furcations) may suggest that the topography of the lesion is a controlling factor, as the biologic rationale underlying these regenerative techniques is surely different. Of course, clinical fill does not speak to the histologic modes of

closure. In fact, the use of porous hydroxylapatite implant in human teeth did not lead to histologically demonstrable new attachment, but rather served as a filler in the presence of a long epithelial adhesion type of closure. But this study did not focus on Type II furcation lesions (Stahl & Froum 1987).

Furthermore, if we expand our literature citations in this area, we must include a recent study describing healing responses in 11 human intrabony defects *adjacent* to mandibular second molars. In this study, *no augmenting techniques* were used. Rather, the surgical approach left the "margins of flaps open adjacent to the defects". Such treatment led to 61% fill in these wide mouthed three wall intrabony lesions (Becker et al. 1986) (Could this positive response be related to the larger distance created between marginal gingival tissues and the root surface, thereby "delaying" epithelial contact with the root in a mechanical manner?).

And finally, how do we relate regenerative results attributed to use of either root conditioning, synthetic fillers, or mechanical barriers with those reported with the use of bone grafts. Bowers et al. (1988) recently reported on histologic responses in human intrabony lesion with or without the use of bone allografts at 57 sites. They indicated that control defects showed no new attachment. Grafted sites, on the other hand, showed a "mean new attachment apparatus of 1.21 mm." It should be noted that both control and grafted sites received "free gingival grafts to attempt retardation of epithelial migration". Yet, only grafted sites demonstrated new attachment.

What all the above-cited reports have in common is the morphology of the treated lesion, namely intrabony configuration or mandibular Type II furcation. As stated before, is the lesion morphology then crucial to regeneration, or are there additional biologic factors yet to be detailed?

In conclusion, while our cases do not indicate predictability of results, our observations support the concept that a physical barrier (s.a. teflon millipore filters) may delay epithelization of the root long enough to allow progenitor cells from the attachment tissues to colonize previously denuded root surfaces and form new attachment. Furthermore this process occurs in the early stages of healing (note our 5 week responses). Considering the complexity of processes involved in the initial healing of a periodontal wound, it is not surprising that new attachment responses vary with sites and technique (Tanner et al. 1988). Additional human histologic data is therefore necessary to further delineate the role of barrier membranes in enhancing new attachment.

Acknowledgements

This study was supported in part by a grant in aid from the Claire and Melvyn Kaufman Institute for Periodontal Research, New York University College of Dentistry. The author gratefully acknowledges the assistance of advanced education students in Periodontics, Drs. W. Bayne, G. Brenner, M. Perez-Mena, M. Shamiri, and M. Shambra, and the technical assistance of Ms. Gloria Turner in the preparation of this study.

Zusammenfassung

Histologische Reaktionen auf gesteuerte Gewebe-Regenerationsverfahren bei intraossalen Läsionen des Menschen. Fallberichte von 9 Stellen

Bei 5 Erwachsenen mit schwerer Parodontitis wurden an 8 Zähnen, 9 Stellen mit offener chirurgischer Belagentfernung behandelt und daran anschliessend eine von 2 verschiedenen Teflon-Barrieremembrantypen appliziert. An den Zähnen wurden, in Höhe der marginalen Gingiva und des am tiefsten liegenden, sichtbaren Zahnsteins der Wurzel, Kerben angebracht. Die Barrieremembrane wurden, von apikal der alveolaren Knochenleiste, bis koronal der Kerbe am Gingivalrand appliziert. Die Lappen wurden koronal vernäht und die Patienten postoperativ 2 Wochen lang, zweimal wöchentlich mit 1.2% Chlorhexidinglukonat behandelt. Nach der Nahtentfernung und bis zur Entnahme der Blockpräparate erschienen die Patienten zu häufiger Plaquekontrolle. Um frühe Heilungsvorgänge beobachten zu können, wurden 6 Stellen 5 bis 8 Wochen nach der chirurgischen Behandlung und 3 weitere Stellen, 14, 22 und 30 Wochen nach der chiurgischen Behandlung als Biopsien entnommen. Histologisch wurde an 6 der 9 Stellen neugebildetes Zement (Länge der Zementschicht = 0.5 bis 1.7 mm), linear entlang der Wurzeloberflächen verlaufend, gesehen. Bei 3 Stellen konnte kein Hinweis auf neugebildetes Attachment beobachtet werden. In Regionen mit Zementogenese inserierten funktionell orientierte Fasern. An knöchernen Regionen, gegenüber neugebildetem Attachment, wurde oft Osteogenese beobachtet. Bei beiden Teflonmembran-Typen wurden auf Regenerationsvorgänge deutende, histologische Reaktionen konstatiert, die bereits 5 Wochen nach dem chirurgischen Eingriff in Erscheinung traten.

Résumé

Réponses histologiques humaines aux techniques de régénération tissulaire guidée dans les lésions intraosseuses. Rapport sur 9 sites

Neuf sites présents au niveau de 8 dents chez 5 adultes avec parodontite sévère ont été traités par nettoyage chirurgical, suivi du placement d'une des deux membranes en Teflon. Les dents ont été marquées par des entailles au niveau de la gencive marginale ainsi que du tartre le plus apical. Les membranes ont été placées depuis la zone en apical de la crête alvéolaire jusqu'en coronaire de l'entaille gingivale. Les lambeaux ont été suturés coronairement et les patients se sont rinçés la bouche deux fois par jour pendant deux semaines avec une solution de 1.2% de digluconate de chlorhexidine. Suite à l'enlèvement des sutures, les patients sont revenus fréquemment pour un contrôle de plaque jusqu'à ce que leur dent soit prélevée pour l'analyse histologique. Afin d'observer les premiers signes de la guérison, six sites ont éte prélevés cinq à huit semaines après le traitement chirugical. Trois autres sites ont été enlevés après 14, 22 et 30 semaines. Histologiquement, du nouveau cément a été découvert linéairement le long des surfaces radiculaires dans six des neuf sites, d'une longueur variant de 0.5 à 1.7 mm. Trois sites n'ont montré aucune nouvelle attache. Aux endoits où la cémentogénèse avait été aperçue, des fibres orientées fonctionnellement ont été mises en évidence. La soudure osseuse en face de la nouvelle attache s'accompagnait souvent d'ostéogénèse. Des réponses de régénération ont été trouvées avec les deux types de membranes dès la cinquième semaine suivant la chirurgie.

References

Becker, W., Becker, B. E., Berg, L. & Samsam, C. (1986) Clinical and volumetric analysis of three – wall intrabony defects following open flap debridement. *Journal of Periodontology* **57**: 277–285.

Becker, W., Becker, B. E., Prichard, J. F., Caffesse, R., Rosenberg, E. & Gian-Grasso, J. (1987) Root isolation for new attachment procedures. *Journal of Periodontology* **58**: 819–826.

Bowers, G., Chadroff, B., Carvevale, R., Ronberg, E., Stevens, M., Emerson, J., Mellonig, J., Cario, R. & Hartman, K. (1988) Histologic evaluations of the regeneration of a new attachment apparatus in humans (III). *Abstract 1911, AADR Abstracts.*

Egelberg, J. (1987) Regeneration and repair of periodontal tissues. *Journal of Periodontal Research* **22**, 233–242.

Gantes, B., Garrett, S. & Egelberg, J. (1988) Treatment of periodontal furcation defects (II). Before regeneration in mandibular class II defects. *Journal of Clinical Periodontology* **15**, 232–239.

Gottlow, J., Nyman, S., Lindhe, J., Karring,

T. & Wernstrom, J. (1986) New attachment formation in the human periodontium by guided tissue regeneration. Case reports. *Journal of Clinical Periodontology* **13**, 604–616.

Gould, T. R. L. (1983) Ultrastructural characteristics of progenitor cell populations in the periodontal ligament. *Journal of Dental Research* **62**, 873–876.

Kenney, E. B., Lekovic, V., Elbaz, J. J., Kovacic, K., Carranza, F. A. & Takei, H. H. (1988) The use of a porous hydroxyapatite implant in periodontal defects (II). Treatment of class II furcation lesions in lower molars. *Journal of Periodontology* **59**, 67–72.

Melcher, A. H. (1976) On the repair potential of periodontal tissues. *Journal of Periodontology* **47**; 256–260.

Nyman, S., Lindhe, J., Karring, T. & Rylander, H. (1982) New attachment following surgical treatment of human periodontal disease. *Journal of Clinical Periodontology* **9**; 290–296.

Pontoriero, R., Nyman, S., Lindhe, J., Rosenberg, E. & Sanavi, F. (1987) Guided tissue regeneration in the treatment of furcation defects in man. *Journal of Clinical Periodontology* **14**; 618–620.

Stahl, S. S. & Froum, S. S. (1987) Histologic and clinical responses to porous hydroxapatite implants in human periodontal defects. *Journal of Periodontology* **58**; 689–695.

Tanner, M. G., Solt, C. W. & Vuddhakanuk, S. (1988) An evaluation of new attachment formation using microfibrillar collagen barrier. *Journal of Periodontology* **59**; 524–530.

Address:

S. Sigmund Stahl
New York University College of Dentistry
345 East 24th Street
New York, NY 10010
USA