CLINICAL ATTEMPTS AT PERIODONTAL REGENERATION

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Clinical Attempts at Periodontal Regeneration

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The ultimate goal of periodontal therapy is the regeneration of supporting tissue lost as a result of periodontal disease with the formation of new bone, new cementum and a functionally oriented periodontal ligament.

In the past, this goal (regeneration) was thought to be unattainable and periodontal surgical treatment was therefore primarily aimed at preventing further attachment loss by pocket reduction and improvement of patient access for homecare procedures. This, it was reasoned, would prevent further attachment loss.

Over the past 10 to 15 years, techniques have demonstrated that gain in new attachment is possible.[1,2] This article describes and evaluates techniques currently in use.

Measurement Parameters

Unfortunately, clinical observations make it impossible to determine the biology of the gain in clinical closure (regeneration or repair). Current clinical evaluation parameters only measure clinical closure which is defined as "a decrease in probing pocket depth at a site previously exposed to the oral environment." Repair, new attachment and regeneration may only be determined histologically. Repair occurs when "the continuity of the disrupted tissues is restored by new tissues which do not replicate the structure and function of the lost tissue."

New attachment is defined as "evidence of new cementum into which functionally oriented fibers are inserted at a root surface previously exposed to the oral environment." Regeneration occurs when new bone with inserting ligament fibers is present as part of the new attachment. Therefore, the clinical studies and techniques that will be described can only be evaluated in terms of clinical closure and bone fill. Where available studies providing human histological case reports will also be mentioned to determine if repair or regeneration occurs with the specific surgical procedure. Currently used techniques aimed at periodontal regeneration include:

1. *Open flap surgical debridement*

Clinical studies over the past 30 years have presented evidence using radiographs, probing bone levels, and reentry procedures to evaluate pocket closure and osseous fill which may occur following surgical debridement.[3,4]

The technique always includes reflection of a full thickness mucoperiostal flap, thorough defect and root debridement, usually with intramarrow penetrations, and suturing the flap at or close to presurgical levels. The exception to this is Prichard's intrabony technique which is mainly applicable in three wall osseous defects and which calls for a suture technique that leaves the interproximal areas "open."[5,6]

Monitoring results from six months to eight years indicates an average gain in new clinical attachment (pocket closure) of approximately 1.0 - 1.5mm. Most researchers agree that with deeper initial pockets, greater pocket reduction and closure follow and that a close correlation exists between post surgical plaque control and gain in clinical attachment.[3]

Although clinical results utilizing open flap debridement are encouraging, histological data in human studies have shown that pocket closure occurs by means of long junction epithelum (repair) with limited (if any) regeneration of a new periodontal ligament.[7,8]

2. *Bone Grafts*

A variety of bone graft materials have been used in attempt to gain new attachment and fill. Studies which utilized a control group comparing bone grafts to open debridement have demonstrated greater fill with bone grafts than with open debridement.[9,10] Mean bone fill with bone grafts varied from 2.0 to 4.5mm with autogenous grafts, allografts and ceramic alloplastic grafts, compared to open debridement results which range from 0.5 to 1.5mm. To date only autogenous grafts and allografts have shown the potential for histological regeneration,[7,11,12] while ceramic materials only act as fillers.[13-16]

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A recent six month clinical study showed a potential for closure and furcation fill using porous hydroxylpatite, that exceeds the open debridement controls by approximately 2 mm.[17]

3. *Root Conditioning*

Although animal studies showed encouraging results, to date human material has not demonstrated that citric acid root conditioning significantly enhanced clinical closure when used in combination with open debridement.[18-22] Other root conditioning agents such as fibronectin, tetracycline, etc. must be considered experimental at the present time.

4. *Membrane Barriers*

Studies demonstrated that placing a barrier between the instrumented root (over the defect) and the gingival flap resulted in delayed epithelial adherence to the root, thereby allowing periodontal ligament cells to repopulate the root surface.[23-25] Periodontal ligament cells have the potential to form new connective attachment.

Histological studies in five human block sections have demonstrated new attachment of as much as 5 mm.[23,25] Clinical studies using a teflon membrane (Goretex periodontal material) in Class II and Class III furcations showed impressive results in Class II furcations (over 90 percent showed clinical closure) but limited results in Class III furcations.[26-28]

Results from our own research demonstrated clinical closure and histological new attachment using three different membrane barriers (Figures I-IV.)[29] However, this technique using the nonresorbable teflon membrane does require two surgical procedures; the first to place the membrane and four to six weeks later to remove the barrier. To date clinical and histological results have been encouraging.

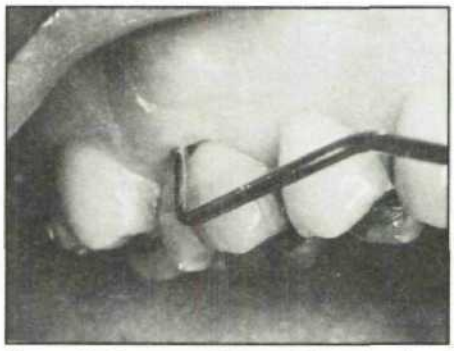

Figure I - Preoperative probing depth of 13mm. on the buccal aspect of tooth #3. This tooth tested vital and the pocket depth had been present for three weeks following root planing and 14 days of tetracycline (1GM per day) therapy.

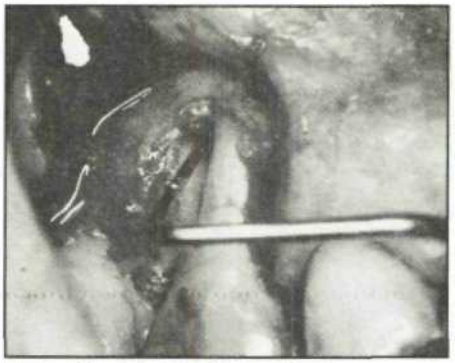

Figure II - A full thickness flap exposes a Class II furcation defect with 10mm. of the buccal alveolar bone destroyed.

Figure III - Following root debridement placement of a Goretex membrane barrier positioned to extend several millimeters apical to the remaining bone and covering the furcation.

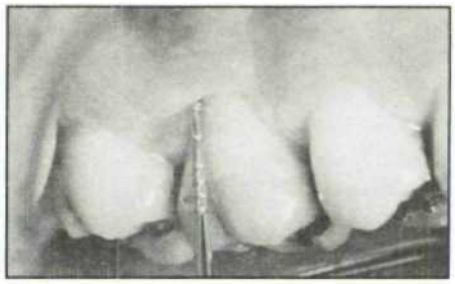

Figure IV - Three month healing following removal of the Goretex material (five months post initial surgery) probing depth is reduced to 2mm. A gain in clinical closure measured 8mm.

Combination Techniques

Coronally repositioned flap with citric acid root conditioning

A clinical study of human Class II furcations has shown promising results when, following open debridement, the root surface was conditioned with citric acid pH=1 for three minutes and the flap coronally repositioned. The latter was accomplished by suturing the flap with crown attached sutures using a resin to bond the sutures coronally. A 12-month reentry showed an approximate 70 percent volumetric fill of the furcations and a clinical closure of a about 1.5mm.[30,31]

Epithelial retardation and decalcified freeze dried bone allografts

A well controlled human clinical and histological study used decalcified freeze dried bone allografts to fill intrabony defects and then covered these sites with free soft tissue grafts. Clinical and histological evidence showed clinical closure and regeneration in the sites treated with the decalcified freeze dried bone allografts. A comparison of these results to open debridement controls showed no new attachment with the control treated defects.[10]

In conclusion, clinical closure has been shown to be predictable with a variety of new attachment techniques. Several of these techniques result in periodontal regeneration or new attachment. With refinement of these procedures we may soon be capable of diagnosing a specific lesion and predictably planning regeneration of lost periodontal attachment. This will bring us closer to our goal in dentistry - the preservation of natural dentition in health, function and esthetics for the life of the individual. □

The references used in the production of this manuscript may be obtained by written request to the Journal.