

Mucogingival therapy

Free grafts and sliding flaps for root coverage

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Improved techniques in chemical root conditioning, flap design and wound closure have led to increased predictability in mucogingival surgery. Areas of exposed root surfaces can be covered with tightly adherent masticatory mucosal grafts which remain stable for years following therapy.

Gingival recession and root exposure pose a significant therapeutic challenge for the clinician. In the past, it was sufficient to increase the width of attached gingiva in order to prevent further recession. This was accomplished by repositioning unfavourable muscle and frenum pulls (1). The criteria for deciding whether the attached gingiva needed to be increased have been described by Hall (1977):

- (1) teeth involved;
- (2) age of patient;
- (3) patient's oral hygiene practices;
- (4) existing or potential aesthetic problems;
- (5) patient's dental needs;
- (6) previous dental treatment.

Presently, stronger emphasis is placed on root coverage as an important goal in successful mucogingival therapy (2). Benefits include: (a) improved esthetics, (b) decreased root hypersensitivity, and (c) decreased potential for root caries and erosion.

Available techniques

The techniques which allow for improved predictability of root coverage include:

- (1) Free gingival grafting (3,4,5)(FGG);
- (2) Lateral positioned pedicle sliding flap (6,7,8)(LPF);
- (3) Coronally positioned flap (9,10,11)(CPF).

These techniques will be reviewed with clinical examples. Other meth-

ods of therapy include the double-papillae repositioned flap (12) and the subepithelial connective tissue graft (13), and are mentioned only for completeness.

Classification of recession

Different types of gingival recession and root exposure problems are associated with varying success of root coverage after treatment. A useful classification system has been proposed by Miller (1985) which includes four categories in order of increasing severity.

Class I: Marginal tissue recession which does not extend to the mucogingival junction. There is no loss of periodontium (bone or soft tissue) in the interdental area, and 100% root coverage can be anticipated (Case I) (Figure 3).

Class II: Marginal tissue recession which extends to or beyond the mucogingival junction. There is no loss of periodontium (bone or soft tissue) in the interdental area, and 100% root coverage can be attempted (Cases I & II). (Figures 4,5).

Class III: Marginal tissue recession which extends to or beyond the mucogingival junction. Bone or soft

tissue loss in the interdental area is present, or there is malpositioning of the teeth which prevents attempting 100% root coverage (Figure 1). Partial root coverage can be anticipated provided the patient satisfies criteria for surgery stated in the introduction.

Class IV: Marginal tissue recession which extends to or beyond the mucogingival junction. The bone or soft tissue loss in the interdental area and/or malpositioning of teeth is so severe that root coverage cannot be anticipated (Figure 2). The case examples in Figures 1 & 2 demonstrate the potential recession problems in the absence of mucogingival therapy. All predisposing and precipitating factors are present, including poor plaque control.

In general, the best results for root coverage are achievable with mucogingival surgery when the gingival recession is characterized by:

- (1) thin, short area of root exposure;
- (2) isolated and localized;
- (3) minimal frenum involvement;
- (4) healthy interdental bone and attached gingiva support;
- (5) absence of root prominence (which usually is associated with a thin labial bony plate);
- (6) absence of facial dehiscence or fenestrations which may be exposed during surgery.

Etiology of gingival recession

Predisposing factors(1)

- (1) Inadequate attached gingiva, a

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Fig. 1 Severe Class III gingival recession and root exposure. Predisposing and precipitating factors include non-existent attached gingiva with strong frenum pull, severe root exposure, significant tooth malposition and poor plaque control. Patient's attitude and lack of motivation for plaque control precluded surgical correction.



Fig. 2 Severe Class IV gingival recession and root exposure. Risk factors are similar to those stated in Figure 1. Bone loss is so severe, that tooth #33 is supra-erupting. The severe nature of this periodontal condition precludes therapy. Both Figures 1 and 2 demonstrate the potential for advanced recession and root exposure problems.

- “high” frenum attachment;
- (2) malposition of teeth (prominent roots);
- (3) osseous dehiscence.

Of the predisposing factors, the most critical is absence of an adequate band of attached gingiva. Teeth may be malposed with prominent roots and dehiscences, but recession is unlikely to occur if attached gingiva is adequate (1). If inadequate attached gingiva is present over a thin labial plate of bone or dehiscence,

minor wounding may lead to dramatic recession. By the same token, a “high” frenum attachment will further encourage recession, only if the attached gingiva is already compromised.

Precipitating factors(1)

- (1) vigorous tooth brushing, especially with stiffer brushes;
- (2) laceration;
- (3) recurrent inflammation;
- (4) iatrogenic factors.

Of the precipitating factors, the most common is faulty toothbrushing (tooth brush abrasion). This results from repeated minor laceration of the narrow predisposed band of attached gingiva. Laceration on a larger scale is caused by hard foods such as toast and crusty bread which can sever right through narrow bands of attached gingiva with resultant recession.

If the gingival tissues are inflamed, such as occurs with poor oral hygiene practices, then they are more easily lacerated. Poor oral hygiene also leads to gingivitis and periodontitis which also have a direct effect on destruction of periodontal supporting tissues.

Iatrogenic factors include:

- (1) restorative procedures extending subgingivally in areas of inadequate attached gingiva;
- (2) vigorous subgingival placement of rubber dam clamps;
- (3) close apposition of partial denture clasps and RPD acrylic to the gingival margin resulting in a “gum stripping” effect;
- (4) orthodontic banding coupled with vigorous brushing efforts can precipitate recession. Also, labial tooth movement of predisposed teeth with fragile gingiva, thin bone and frenum pull will lead to recession and root exposure during the tooth movement.

It is well known that root surfaces become contaminated once they are exposed in the oral environment during the pathogenesis of periodontitis. If the roots are conditioned with citric acid (pH 1 for 3 minutes), the root surface can be conducive to a more favourable connective tissue response during healing (15). This is achieved both by encouraging fibro-



Fig. 3 Case 1: Treatment of Class I gingival recession and root exposure with the FGG. (a) presurgical appearance demonstrating minimal attached gingiva, frenum pull and 1/2 root exposure in a 15 year old girl. (b) The recipient site is prepared such that the existing marginal gingiva was removed from both central incisors. The roots of both central incisors were thoroughly scaled and planed. The graft is secured to the cemento-enamel junction with interrupted 5-0 gut sutures on a periosteal bed free of muscle fibres. The graft is immobilized by the extension of the partial thickness dissection into the vestibular fornix. 2 minutes of pressure with a moist gauze ensures removal of an undesirable blood clot between the graft and recipient site. A periodontal Coe-pak® dressing protects the donor and recipient sites for 1 week. (c) 3 month post-operative healing demonstrates 100% correction of the attached gingiva-frenum-pull-root exposure problem.

blast attachment to the demineralized dentine surface, as well as inhibition of epithelial migration between the connective tissue and the exposed root surface during the

healing phase (15). Both factors would favour a new connective tissue attachment which "may take place in an environment lacking periodontal progenitor cell populations (15)", i.e.: in areas of gingival recession. Positive results have been reported (4,5,11,13). There are other articles which conclude no difference in new connective tissue attachment when citric acid-treated roots are compared with conventionally-prepared root surfaces (16).

Free gingival graft (FGG)

The free gingival autograft was introduced in the mid 1960's (17,18). The principles of successful grafting were discussed by Sullivan and Atkins (19,20). The advantage of the FGG was in predictably increasing the width of attached gingiva, increasing vestibular depth and eliminating tension of muscle (frenum) pull (2). These grafts were reported to shrink an average of 25% over the first 12 months (21) which was subsequently maintained over a four year period (22). Clinicians could therefore enlarge grafts by one third in anticipation of the shrinkage and thus obtain the desired coverage during surgical therapy (23).

Recession characterized by deep and wide root exposure is least amenable to root coverage by grafting since graft survival depends on circulation from the recipient site in order to bridge the vascular denuded root surface (19,20). The phenomenon of "creeping attachment" however, can provide up to 3mm of root coverage after grafting, when assessed over five years (24). Thicker, 1.5mm grafts were shown to provide up to 80% coverage of root recessions ranging from 3-5mm when critical attention was given to suturing (3). Also, 2mm thick grafts in combination with citric acid root demineralization, were shown to provide complete coverage of root recession ranging from 2-7mm (4,5). Thicker grafts however, can appear unaesthetic and there is the possibility of residual labial pocketing.

Case I (Figure 3) demonstrates the FGG technique in the treatment of a mild case (Class I) of gingival recession and root exposure. The technique of Pennel et al. (1969)(26) was used in which the existing marginal

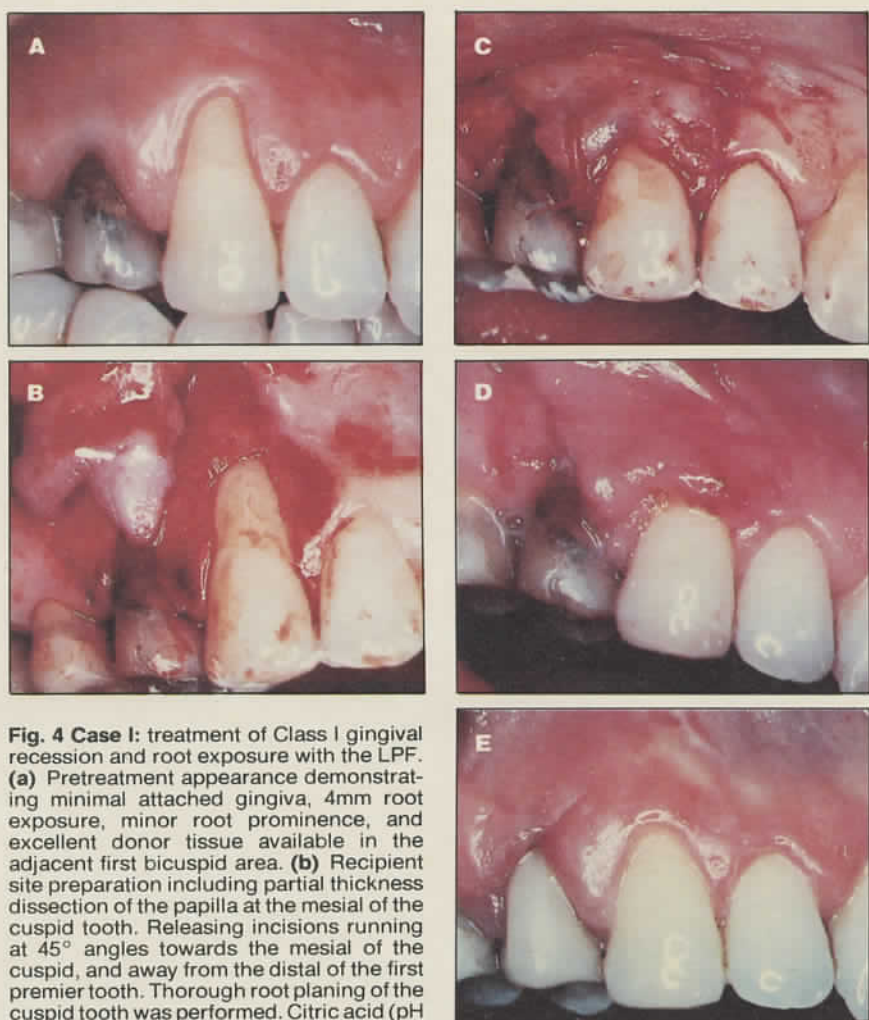


Fig. 4 Case I: treatment of Class I gingival recession and root exposure with the LPF. (a) Pretreatment appearance demonstrating minimal attached gingiva, 4mm root exposure, minor root prominence, and excellent donor tissue available in the adjacent first bicuspid area. (b) Recipient site preparation including partial thickness dissection of the papilla at the mesial of the cuspid tooth. Releasing incisions running at 45° angles towards the mesial of the cuspid, and away from the distal of the first premier tooth. Thorough root planing of the cuspid tooth was performed. Citric acid (pH for 3 minutes) root conditioning complemented the root preparation procedure. (c) The partial thickness pedicle flap is laterally positioned over the periosteal bed of the recipient site and secured with interrupted 4-0 gut sutures both at the mid-papillary regions, as well as the inferior margin of the releasing incisions. Tight apposition of the pedicle flap is facilitated by pressure with a warm moist gauze, which also squeezes out unfavourable clot fragments beneath the flap. The Coe-pak® periodontal dressing protects the surgical site for 1 week. (d) 1 week post-operative healing photograph. The attached gingiva of the pedicle flap is blending in with adjacent tissues. Root coverage looks promising at this early stage. The periodontal dressing is no longer necessary, but gingival massage is strongly encouraged. (e) 1 year post-operative appearance demonstrating 80% root coverage and favourable healing in the donor site as well.

gingiva is removed and the graft is placed at the cemento-enamel junction. The 3 month post-operative photograph indicates that 100% root coverage was achieved (Figure 3c).

Laterally positioned pedicle sliding flap (LPF)

The LPF was first described by Grupe and Warren in 1956 (25). The benefits include a single operative site for management of recession and root exposure, as well as favourable aesthetics of labial attached gingiva. It is critical however, that thick donor

tissue is available for transplantation since thin, friable gingiva may not survive the procedure, and is difficult to manage. Mean gains of root coverage from this procedure range from 2.51mm (7,8), to 2.7mm (6). Approximately 1mm of keratinized gingiva is likely to be lost at the donor tooth (6,7), unless this area is covered by an FGG at the time of surgery (8). Case I (Figure 4) demonstrates the LPF technique and the results of the treatment of gingival recession (Class I) and root exposure. Citric acid root conditioning was used in order to encourage a more favourable con-

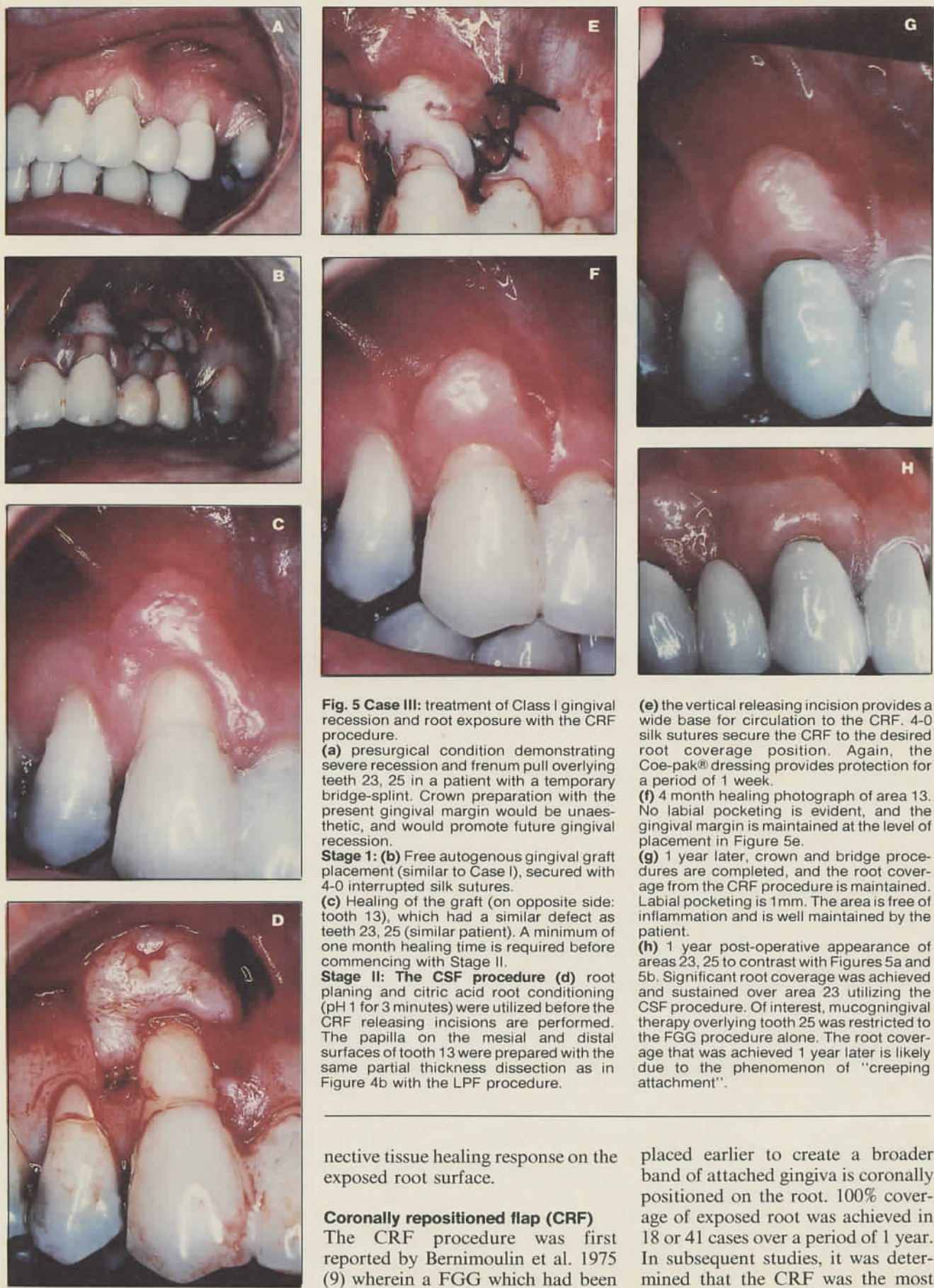


Fig. 5 Case III: treatment of Class I gingival recession and root exposure with the CRF procedure. (a) presurgical condition demonstrating severe recession and frenum pull overlying teeth 23, 25 in a patient with a temporary bridge-splint. Crown preparation with the present gingival margin would be unaesthetic, and would promote future gingival recession. **Stage 1:** (b) Free autogenous gingival graft placement (similar to Case I), secured with 4-0 interrupted silk sutures. (c) Healing of the graft (on opposite side: tooth 13), which had a similar defect as teeth 23, 25 (similar patient). A minimum of one month healing time is required before commencing with Stage II. **Stage II: The CSF procedure** (d) root planing and citric acid root conditioning (pH 1 for 3 minutes) were utilized before the CRF releasing incisions are performed. The papilla on the mesial and distal surfaces of tooth 13 were prepared with the same partial thickness dissection as in Figure 4b with the LPF procedure.

(e) the vertical releasing incision provides a wide base for circulation to the CRF. 4-0 silk sutures secure the CRF to the desired root coverage position. Again, the Coe-pak® dressing provides protection for a period of 1 week. (f) 4 month healing photograph of area 13. No labial pocketing is evident, and the gingival margin is maintained at the level of placement in Figure 5e. (g) 1 year later, crown and bridge procedures are completed, and the root coverage from the CRF procedure is maintained. Labial pocketing is 1mm. The area is free of inflammation and is well maintained by the patient. (h) 1 year post-operative appearance of areas 23, 25 to contrast with Figures 5a and 5b. Significant root coverage was achieved and sustained over area 23 utilizing the CSF procedure. Of interest, mucogingival therapy overlying tooth 25 was restricted to the FG procedure alone. The root coverage that was achieved 1 year later is likely due to the phenomenon of "creeping attachment".

nective tissue healing response on the exposed root surface.

Coronally repositioned flap (CRF)
The CRF procedure was first reported by Bernimoulin et al. 1975 (9) wherein a FG which had been

placed earlier to create a broader band of attached gingiva is coronally positioned on the root. 100% coverage of exposed root was achieved in 18 or 41 cases over a period of 1 year. In subsequent studies, it was determined that the CRF was the most

predictable method for covering a denuded root. Up to 59-75% coverage may be anticipated (10,11). The disadvantage of the CRF is that two surgical procedures must be performed at least 1 month apart. Case II (Figure 5) demonstrates the CRF technique and the results after treatment of a moderate case (Class I) of gingival recession and root exposure.

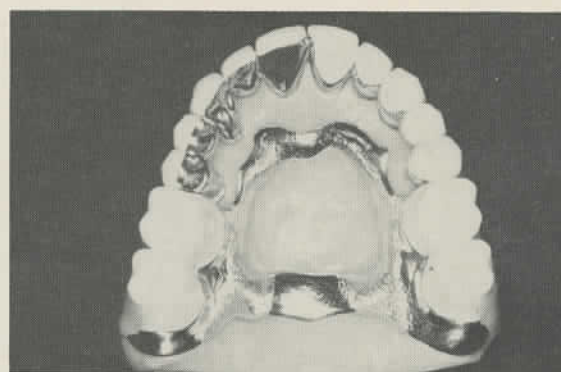
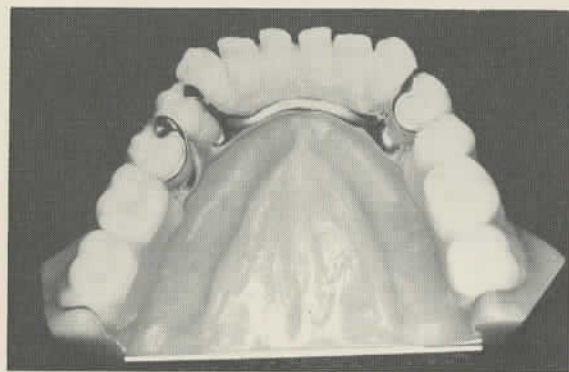
Conclusion

A variety of mucogingival procedures are available for the management of gingival recession and root exposure. Although 100% root coverage can be attempted, success depends on careful case selection. For minor defects, the autogenous free gingival graft procedure may be the most appropriate and predictable. For more complicated situations, the lateral sliding pedicle flap, or coronally repositioned flap with free graft may be more predictable. When interdental bone loss and tooth malposition accompany severe recession and root exposure, then the prospect of 100% root coverage diminishes.

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