



## Soft Tissue Augmentation on Previously Restored Root Surfaces



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*Three cases are presented demonstrating that soft tissue augmentation procedures can be accomplished on previously restored root surfaces. Diagnostic techniques to help determine ideal tooth length are discussed, and clinical examples of how to surgically manage the previously restored root surfaces are presented. (Int J Periodont Rest Dent 1996;16:571-581.)*

The ultimate goal of periodontal therapy is not only the elimination of the disease but also the restoration of the anatomy of the periodontium to the pre-disease state. Great strides have been made in recent years in the regeneration of both the hard<sup>1-4</sup> and soft tissues<sup>5-9</sup> lost in the disease process. We can now routinely cover most denuded root surfaces and augment deficient ridges so that the mouth is prepared to receive ideal restorative dentistry with proper crown length and gingival contours.

The importance of these preprosthetic procedures has been well documented,<sup>10-15</sup> but there is another segment of our patient population that has not been offered these procedures because the root surfaces associated with the periodontal defect have been restored. It has been clinical wisdom that the prepared root surface, especially the subgingival margin of the preparation, would interfere with the grafting procedure. This

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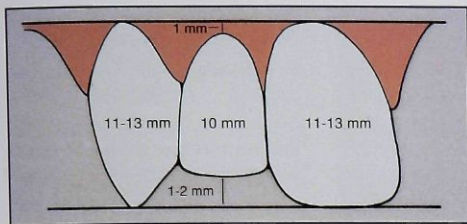
article will present a series of cases demonstrating that the periodontium adjacent to previously restored root surfaces can be rebuilt after the restorations are removed. These procedures ultimately create a more esthetic and hygienic environment for new restorations.

#### *Clinical guidelines for ideal tooth length*

Before any surgical augmentation procedures are undertaken, the clinician must first determine the particular patient's ideal tooth length. In very severe cases, where important landmarks such as incisal edge and soft tissue relationships have been destroyed, the determination is difficult. All three cases in this study present various problems in the creation of ideal tooth length.

In the author's opinion, the following guidelines are useful to clinicians who are considering changing the length of a maxillary anterior tooth—whether that change in length results from crown lengthening or root coverage grafts:

1. Incisal edge position must be established first. This is generally accomplished phonetically by having the patient say "55-55-55."<sup>16</sup> As that sound is made, the incisal edge of the maxillary central incisors should lightly touch the vermillion border of the mandibular lip. Once the incisal edge position is established, it then becomes the constant, and all measurements are made from it.
2. A knowledge of average tooth length is also useful (Fig 1). Although the particular tooth length will vary from individual to individual, the proportional relationship of one tooth to another usually remains a constant. The tooth's length-to-width ratio should also remain constant—the ideal ratio is approximately 10:8.<sup>17,18</sup>
3. The relationship of the maxillary anterior teeth to the maxillary and mandibular lip line is an important consideration. (This relationship assumes a "medium" smile line.) The following guidelines are useful in establishing proper tooth length and gingival contour. The free gingival margins of the maxillary central incisors and canines should lightly touch the vermillion border of the maxillary lip (Fig 2). Approximately 1 mm of gingiva should show between the lip and the gingival margin of the lateral incisors. The incisal edge of the central incisors and canines should touch the vermillion border of the mandibular lip, and the lateral incisor's incisal edge should be 1 to 2 mm above the vermillion border.



**Fig 1** Average tooth length of the maxillary anterior teeth.



**Fig 2** Ideal relationship between the maxillary anterior teeth and the vermilion border of the maxillary and mandibular lip.

The clinician, often required to change the length of the tooth incisally, gingivally, or both, will find these guidelines helpful. Any change in tooth length needs to be determined through careful analysis and consultation between the patient and all of the clinicians involved.

## Case reports

### Case 1

This case represents a young woman who desired to have a more natural and esthetic fixed partial denture made to replace the existing restoration of the maxillary right premolar, canine, and lateral incisor (Fig 3a). A large alveolar ridge deficiency was present in the region of the right canine, and

a tooth-length analysis demonstrated that both of the existing retainers were too long. The author's goal in this case was to rebuild the alveolar ridge deficiency, to eliminate the defect and create enough ridge width to allow for an ovate pontic, and to cover the previously restored root surface on the premolar and lateral incisor. The restorative dentist was asked to replace the existing fixed partial denture with an acrylic provisional restoration that had ideal tooth lengths and contours. In other words, the margin of the provisional restoration would end at the ideal tooth length even if the restoration did not cover the previously restored root surface. The provisional restoration could then be used as a surgical stint to help position the graft/ridge augmentation in

the most ideal relationship. The general dentist was reluctant, in this case, to make a new provisional prosthesis because he was able to remove the existing fixed partial denture and recement it provisionally. Consequently, the author recontoured the pontic and marginal relationship of the existing fixed partial denture to reflect the ideal tooth length. Under local anesthetic the author planed the previously restored roots with curettes and chisels in an effort to create a bio-compatible root surface, to flatten it as much as possible, and to eliminate any dead spaces (Fig 3b). Following root planing, the denuded root surface was burnished with a supersaturated solution of citric acid for 3 minutes with a cotton pellet. The restorative margin that would be covered on the



canine and lateral incisor was a chamfer, and it was easily removed during the root preparation. Other marginal relationships, such as a butt joint, are more difficult to manage (see case 2). A partial-thickness flap was raised facial to the teeth associated with the prosthesis. A subepithelial connective tissue graft was harvested from the palatal region in a similar fashion to that described by Langer and Calanga<sup>19</sup> and Langer and Langer.<sup>20</sup> The graft was adapted over the previously restored root surfaces and suspended over the void created by the alveolar ridge deficiency. It was then secured by interrupted gut suture at each papilla and on the mesial and distal extent of the graft. A suspensory sling suture was placed from the periosteum below the graft, around the neck of the tooth, and secured to ensure close adaptation of the graft to the prepared root surface. A wedge of tissue was taken from the tuberosity distal to the maxillary second molar. The epithelium was removed, and the remaining connective tissue was shaped so that it could be interposed between

the periosteum of the alveolar ridge defect and the connective tissue graft (Fig 3c). The original mucogingival flap was coronally repositioned with interrupted gut suture to cover the graft as much as possible (Fig 3d), and the recontoured bridge was provisionally re cemented. Excess cement was atraumatically removed, and the newly grafted tissue was checked for intimate contact to the margins of the crowns and the undersurface of the pontic. Appropriate postoperative medications were prescribed and the patient was advised to avoid chewing on or mechanically cleaning this area for the first week following surgery. The patient was seen at 7 days for the first postoperative evaluation, and the graft appeared to be maturing satisfactorily. Five weeks later the patient was seen again, and a gingivoplasty was performed to blend the graft into the adjacent tissue and refine the gingival contours. The patient returned for final restorative work at 8 weeks, and a new fixed partial denture that had an ideal relationship between tooth length, pontic, and soft tissue was constructed (Fig 3e).

**Fig 3a** (top left) Tooth length discrepancy of the maxillary right premolar and lateral incisor and the alveolar ridge deficiency in the region of the maxillary right canine.

**Fig 3b** (top right) Retainers on the ceramometal fixed partial denture are recontoured to create a more ideal tooth length. The exposed portion of the previously restored roots are planed and burnished with citric acid.

**Fig 3c** (left) Connective tissue wedge fills the deficiency and supports the graft. Note the connective tissue wedge extending above and below the graft.

**Fig 3d** (right) The original flap is sutured over the grafts and the fixed partial denture is seated. Note the intimate contact of the graft to the newly created margin on the lateral incisor. The ridge augmentation extends far enough facially to allow the pontic to form an ovate relationship.

**Fig 3e** Grafted area with the final restoration in place (restorative work courtesy of Dr Edgar James, Houston, Texas).





## Case 2

This patient presented a similar but more challenging situation than Case 1. This patient was also a young woman who had lost her maxillary right lateral incisor in an automobile accident 6 years earlier. The accident caused extensive bone and soft tissue loss in the area of the maxillary right canine and lateral and central incisors. A large alveolar ridge deficiency was encountered in the region of the lateral incisor, and both the canine and the central incisor lost 4 to 6 mm of bone and soft tissue on their facial and proximal aspects. A fixed partial denture was constructed shortly after the accident. The patient was never pleased with the esthetics of the fixed partial denture and was particularly concerned with the length of the crowns in relation to her natural teeth. She had seen several periodontists regarding her concerns, but had been told that while it might be possible to resolve the alveolar ridge deficiency if she was willing to have the prosthesis remade, there was nothing that could be done regarding the length of the adjacent teeth because of the marginal relationship of the existing fixed partial denture on the root surface.

After consultation, the patient was sent back to the restorative dentist with a request for him to remove the existing

fixed partial denture and replace it with an acrylic provisional restoration with an ideal tooth length and pontic relationship. After the provisional restoration had been constructed (Fig 4a), the hard and soft tissue loss was even more apparent. Under local anesthetic the exposed (previously restored) root surface was planed with curettes and chisels and burnished with citric acid as previously described (Fig 4b). A split-thickness flap was raised facial to the right canine and incisors to expose the subgingival butt joint marginal preparation (Fig 4c). The butt joint was removed through odontoplasty with high-speed finishing burs, and potential dead spaces were eliminated (Fig 4d). The rest of the soft tissue augmentation was performed as described in Case 1 (Figs 4e and 4f). At 6 weeks a gingivoplasty was performed to blend the graft into the adjacent tissue, and the patient was seen 1 month later, at which time the tooth length and soft tissue contour appeared greatly improved. The restorative dentist was asked to construct a new provisional restoration and adapt it as ideally as possible to the newly created environment so that the need for a secondary procedure could be determined (Fig 4g). A decision was made that further surgery would not be necessary, and the final restoration was constructed (Fig 4h).



**Fig 4a** The original restoration has been removed and the provisional restoration is now in place. Note the alveolar ridge defect associated with the region of the maxillary right lateral incisor and the exposed (previously restored) root surface on the canine and central incisor. (Unfortunately a photograph of the original bridge prior to its removal was not made.)



**Fig 4b** Pencil is used to trace the ideal tooth length created by the provisional restoration onto the root surface. (Note the previously restored root surface creates a Miller's Class IV recession.) The previously restored root surface between the soft tissue and the pencil line is planed and burnished with citric acid.



**Fig 4c** After reflection of a split-thickness flap, the butt joint restorative margin on the roots of both teeth can be visualized.



**Fig 4d** Ideal crown length is again marked on the teeth with a pencil, and the butt joint is removed with high-speed finishing burs, eliminating the potential dead space and creating a flat root surface from the pencil line to the alveolar ridge.



**Fig 4e** The graft is sutured with both interrupted and sling sutures, and a wedge of connective tissue is interposed between the alveolar ridge defect and the graft.



**Fig 4f** The split-thickness flap is sutured over the subepithelial graft and connective tissue wedge.



**Fig 4g (left)** Note the firm attachment of the grafted tissue to the root surface. The tissue is healthy and the sulcus depth should be easily maintained.

**Fig 4h (right)** Augmented area with the final restoration in place. (Restorative work courtesy of Dr Bill Boyd, Houston, Texas).





### Case 3

This patient presented with a strong desire to improve her maxillary anterior esthetics. Examination revealed generalized gingival recession resulting in excessive tooth length of the maxillary incisors and canines, complicated by existing composite Class V restorations and a provisional crown on the right lateral incisor (Fig 5a). The author had had some experience in grafting over localized areas of caries or previously restored Class V restorations, but never in such a generalized situation. The benefits and risks of the procedure were discussed with the patient, and she confirmed that she would willingly accept multiple surgical appointments to achieve her goal. The restorative dentist was requested to create a new provisional crown with ideal tooth length on the right lateral incisor, and the patient was scheduled for three separate

surgeries (for the right canine and right lateral incisor, the central incisors, and the left canine and left lateral incisor) at approximately 6-week intervals. A subepithelial connective tissue graft was performed at each surgery. Any portion of the existing Class V restoration that extended beyond the ideal tooth length was removed, and the root surface was planed as described in the previous cases. The previously restored and/or exposed root surface was covered with the graft, creating a more ideal tooth length and gingival contour (Figs 5b to 5e). A gingivoplasty was performed to blend the grafts into one another, but because of a propensity to scar, the grafts never blended as well as expected. Nevertheless, the procedures enabled the patient to achieve her goal of proper tooth length and gingival contour, and she is now in the process of having the teeth restored (Fig 5f).



**Fig 5a** Preoperative photograph of the maxillary anterior segment. Note that the margin of the provisional crown on the maxillary right lateral incisor has been left at the ideal tooth length. Also note the Class V restorations on the other anterior teeth.



**Fig 5b** A preoperative photograph of the maxillary right canine and lateral and central incisors.



**Fig 5c** Postoperative photograph of the right maxillary anterior segment. The portion of the Class V restoration that extended onto the crown of the tooth remains, but the portion of the restoration that extended apical to the ideal tooth length has been removed and the previously restored root has been covered with the graft. The denuded (previously restored) root surface of the lateral incisor was also covered, creating a more ideal tooth length.



**Fig 5d** Preoperative view of the maxillary left anterior segment.



**Fig 5e** Postoperative photograph of the maxillary left anterior segment. The portion of the Class V restoration that extended onto the crown of the tooth remains, but the portion of the restoration that extended apical to the ideal tooth length was removed and the previously restored root surface was covered with the graft. Note the more ideal tooth length and gingival contour.



**Fig 5f** Postoperative photograph of the patient's maxillary anterior segment following periodontal augmentation and new restorations. Note the more ideal tooth length and gingival contour resulting in a more esthetic outcome. (Restorative work courtesy of Dr Michael McCulloch, Houston, Texas.)



## Discussion

These cases demonstrate that previous restorations need not be a barrier to soft tissue augmentation procedures. Although these cases were treated with adaptations of fairly routine periodontal procedures, they do require thoughtful preoperative treatment planning and close attention to surgical technique.

One contraindication to this procedure may be the depth of the previous restoration. There is the possibility that when the restorations are removed, the restorative preparation may extend too far toward the pulp to be eliminated by aggressive root preparation. In such a case the large dead space would not be eliminated, and the procedure would have to be aborted. It has been the author's experience that small localized depressions (1 to 2 mm in dimension) that cannot be completely eliminated do not seem to adversely affect the success of the graft. Another potential contraindication would be the lack of adequate donor tissue in the palate or tuberosity region. The cases presented in this paper and others have been followed for up to 2 years, and all of them appear to retain dimensional stability. The type of soft tissue connection to the root surface

is unknown, but the grafts are firmly attached to the root surface, resulting in minimal sulcus depth (see Fig 4g).

Good communication is necessary between the periodontist, the restorative dentist, and the patient. Only through an effective partnership can miscommunication be reduced, the need for secondary procedures minimized, and superior results achieved. This article demonstrates that soft tissue augmentation is now possible for many patients, who, because of the location of their existing restorations, were denied that treatment.

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