Gingival Augmentation Surgery for Specific Mucogingival Problems

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Introduction

Gingival augmentation surgery has been advocated for more than a half century to correct specific deficiencies in gingival tissues. The types of gingival augmentation procedures used today are based on biological principles applicable to all surgical interventions involving pedicle or free graft surgical approaches. The purpose of this chapter is to discuss the use of gingival augmentation surgery to manage three clinical problems affecting natural teeth and dental implants, specifically, gingival recession, the lack of an adequate zone of attached gingiva, and attachment of a frenum which compromises the function of the marginal tissue. Where appropriate, the preferred surgical approach and graft material will be identified. Emphasis will be given to the healing characteristics of the surgical wound as reinforcement of the type of surgical procedure selected. It is not the intent of this chapter to discuss the etiology, pathogenesis, or prevention of mucogingival problems. This chapter will also not address nonsurgical approaches or maintenance of mucogingival problems, nor will this chapter address considerations related to adjunctive procedures for correcting mucogingival problems, e.g., orthodontic tooth repositioning or odontoplasty.

Today, most practitioners utilize the free connective tissue graft (subepithelial connective tissue graft) procedures to provide root coverage where gingival deficiencies are esthetically problematic for the patient [1–7]. Donor tissue for free connective grafts is typically harvested from the palate (autograft) but may also utilize xenograft materials (such as Mucoderm) or allograft materials (such as Alloderm from human cadavers) [8]. The alternate donor tissue products reduce the surgical

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E. M. Ferneini, M. T. Goupil (eds.), *Office-Based Maxillofacial Surgical Procedures*, https://doi.org/10.1007/978-3-030-22371-7_10

time because harvesting palatal tissue is not required which reduces the likelihood for postsurgical morbidity at the donor site (severe bleeding) [9]. The use of alternative sources of connective tissue is particularly helpful with gingival recession that extends over several teeth and where harvesting a very large graft from the palate is not possible.

This chapter will also review the use of gingival augmentation procedures for the purpose of establishing an adequate zone of keratinized gingival tissue where other dental problems may exist such as a minimal depth of the vestibule or a specific mucogingival problem that has contributed to dental disease such as caries. For these specific mucogingival defect problems, the free gingival graft (epithelialized gingival graft) procedure has particular advantages in treating problem sites. When performed properly, the free gingival graft provides a predictable zone of immovable keratinized gingiva. This chapter describes the use of this procedure for managing dental problems associated with mucogingival deficiencies or problem areas.

The presurgical considerations for gingival augmentation surgery include the patient's age, tooth root prominence, orthodontic treatment options, the restorative treatment plan, the patient's compliance with home care instructions, and esthetic requirements. If the patient is primarily concerned about esthetic issues regarding a mucogingival deficiency, a free connective graft procedure is the preferred approach to manage a gingival deficiency (gingival recession) that is an esthetic concern. However, increasing vestibular depth [10], problematic frenum attachments or continued progression of recession can often be managed with a free gingival graft procedure with excellent treatment results [11]. The following cases provide examples of how these procedures can provide a satisfactory solution to specific issues with mucogingival deficiencies.

Types of Gingival Augmentation Procedures

Gingival augmentation procedures include the procedures listed in Table 10.1. Many of the pedicle graft procedures are not performed routinely today and are not considered to be mainstream gingival augmentation procedures. Of the procedures listed, this chapter will concentrate on free gingival graft, frenectomy/frenotomy procedures, and laterally positioned flaps. The specific examples described in this chapter are not intended to address only a deficiency of gingival tissue but rather to address specific dental problems associated with the mucogingival deficiencies.

Table 10.1 Classification of gingival augmentation surgical procedures

• Pedicle grafts
– Laterally positioned flap
– Rotated pedicle flap
– Double pedicle flaps
– Coronally positioned flap
• Free gingival graft
• Frenectomy/Frenotomy
• Free connective tissue graft

Currently, pedicle grafts are rarely used for treating mucogingival defects. However, as described later in this chapter, a laterally positioned pedicle flap can be used to manage keratinized tissue deficiencies in cases where the implant procedure includes the surgical uncovering of an implant or implants. The pedicle grafts retain attachment of the gingiva to the body whereas free grafts release the grafted tissue from the body so that positioning at a distant recipient site can occur. Free gingival grafts primarily augment gingiva at sites were minimal keratinized gingival tissue is present but are not intended to provide substantial coverage of denuded root surfaces.

The Free Gingival Graft Procedure to Augment Gingiva and Increase Vestibular Depth

Figure 10.1 shows the steps involved with the free gingival graft procedure. The free gingival graft survives initially by plasmatic support from the recipient site because the connective tissue side of the graft contacts the recipient bed, thereby providing vascular support for the overlying graft to survive. When placed directly

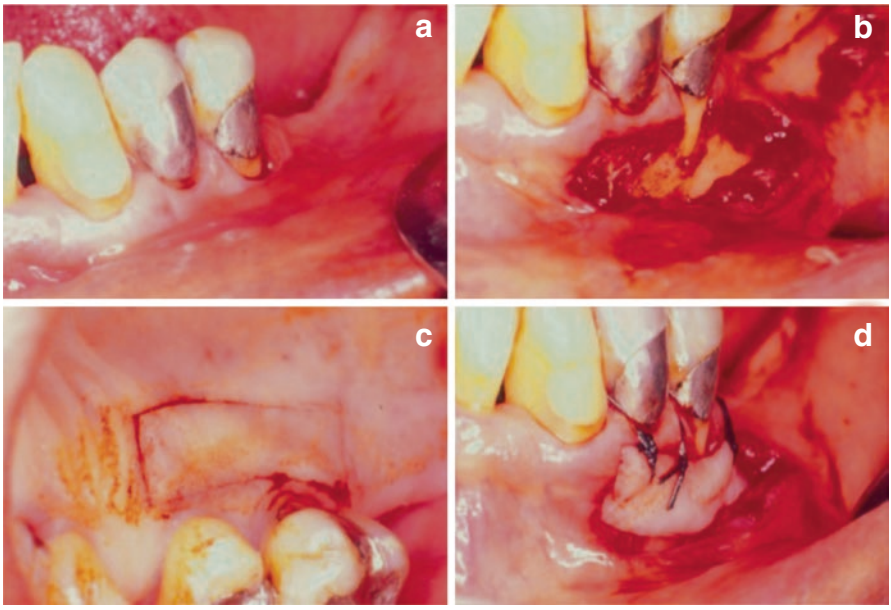

Fig. 10.1 Free gingival graft procedure. (**a**) Preoperative location of the free gingival margin shows a minimal zone of keratinized gingiva on the facial aspect of #21 and no keratinized gingiva on the facial aspect of #20. (**b**) Preparation of the graft recipient site. (**c**) Preparation of the donor site. (**d**) Placement of the free gingival graft on the recipient site. (**e**) Appearance of the donor site after the graft is removed from the palate. (**f**) Healing of the donor site after 1 week. Note the striations of epithelium extending from the edge of the donor excision site. (**g**) Appearance of the site before performing the graft procedure and the appearance of the site after 6 months of healing (**h**). Photographs courtesy of Dr. James Bussiere

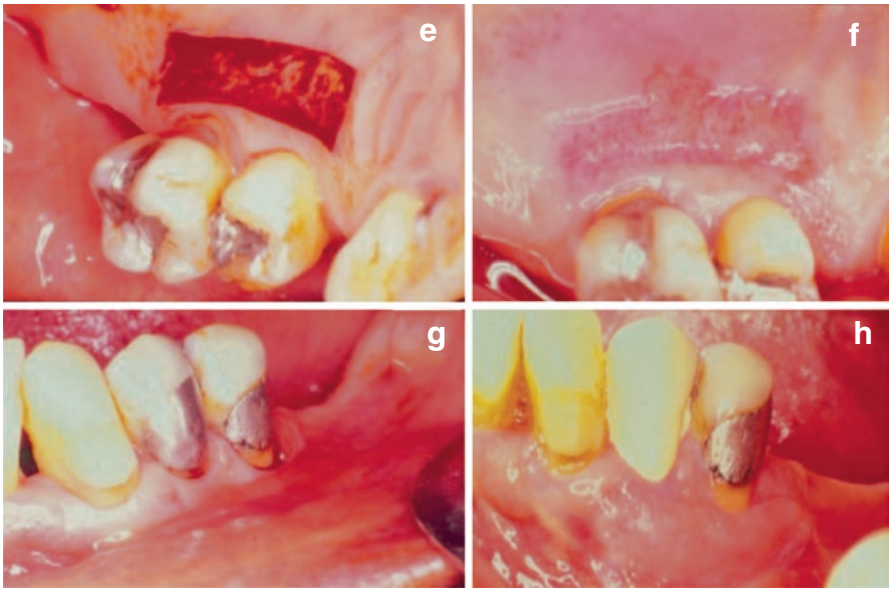

Fig. 10.1 (continued)

over an exposed root surface, the free gingival graft will likely not survive due to lack of vascular support to the graft from the tooth root. When the graft is placed on the recipient site, it is also important to ensure that the graft sits on a bed of immovable connective tissue. Preparation of the recipient site involves a beveled incision coronal to the mucogingival junction so that the bed separates the moveable oral mucosa from the underlying alveolar bone (Fig 10.1b). Only a thin layer of immovable connective tissue remains on the exposed alveolar bone. The tissue elements remaining on the alveolar bone are usually minimal in thickness or as an alternative, a fenestration through soft tissue to the alveolar bone is also acceptable. The recipient site must be extended mesially and distally to accommodate for secondary contraction (shrinkage) of the graft during healing (see below). Vertical incisions are made at the mesial and distal extent of the recipient bed. Care must be taken to avoid excising nerves or other critical structures in the area. The dimensions of the graft to be taken from the palate are determined by measuring the height and width of the recipient site and increasing these dimensions by 10–20%. The freed graft will shrink by about 10–20% in size when it is released from the palate (primary contraction). The graft size is outlined on the palatal donor site by making an incision to approximately the depth of the bevel of the Bard Parker blade (Fig. 10.1c). The graft is then released by using the scalpel to excise the tissue parallel with surface of the palate. Bleeding should be well controlled within a normal clotting time. If a particular area shows excessive bleeding, a stricture suture in the palatal soft tissue can be placed to control a local area of excessive bleeding. The graft is then placed on the recipient site with the epithelial surface of the graft contacting the cheek and

not the alveolar bone. Once the graft is positioned on the recipient site, a good way to test that the graft is resting on an immovable recipient site is to pull the cheek or lip mesially and distally in order to verify visually that the graft does not move. If movement of the graft is observed, the recipient site should be extended, or the graft trimmed in order to ensure that the graft rests on an immovable recipient bed. The graft is then attached coronally to the keratinized gingiva using suspensory sutures (Fig. 10.1d). Typically, a periodontal dressing (Coe-Pak dressing) is placed over the graft in order to maintain contact between the graft and the underlying recipient tissue. The dressing and sutures are removed in 7–10 days.

Revascularization of the connective tissue portion of the free gingival graft occurs from 30 h to 6 days after graft placement. The overlying graft epithelium will slough but will regenerate as the graft matures with additional healing. The graft will also shrink even more with the healing and maturation at the recipient site and is termed secondary contraction. Secondary contraction can be up to 50% of the graft size depending on the thickness of the graft. Thicker grafts tend to shrink less with healing and are generally much lighter in color than the surrounding keratinized tissue after healing. If an esthetic problem exists for the patient because it is too light in color after graft healing, the thickness of the healed graft can be reduced by dermabrasion using a high-speed handpiece and diamond bur. A better way to avoid the very light color of a healed gingival graft is to resect the graft with a minimal connective tissue layer. A guide for incision depth for excising an epithelialized graft is the width of the bevel on a #15 Bard Parker blade. The outline of the graft is made to the depth of the bevel and this depth is maintained during the surgical harvesting of the graft. Another helpful tip is to excise the graft to a depth where the side of the Bard Parker blade is barely visible through the keratinized tissue of the palate as the graft is released. A uniformly thin free gingival graft heals with a color approximately matching the usual gingival tissue coloration of the facial gingiva (Fig. 10.1h). Note the increased vestibular depth evident after healing of the graft. Increasing the depth of the vestibule allows better access for cleaning of the recession areas on the facial aspects of the bicuspid teeth and also provides greater depth for a denture flange along the lateral aspect of the alveolar process.

For this and all subsequent procedures described in this chapter, postoperative pain management rarely requires the use of opioid analgesics. Generally, use of a nonsteroidal anti-inflammatory (NSAID) medication such as ibuprofen (400–600 mg tid) is usually sufficient to manage postoperative discomfort. As with any NSAID, this medication also provides additional benefit by reducing postoperative inflammation. It is advisable to begin analgesic coverage 1 h prior to the surgical procedure in order to maximize the anti-inflammatory effect of this medication. Although these medications are known to increase bleeding times, use of NSAIDS rarely lead to significant postoperative bleeding unless it is combined with other well-known anticoagulant medications. Acetaminophen is an effective alternative to ibuprofen for those individuals who cannot take NSAID medications. Periodic topical anesthetic application (Benzocaine) to the palate will also help patients who experience significant pain at the graft donor site when oral function occurs, such as eating or speaking. Topical anesthetic application is rarely needed for extended periods.

The Free Gingival Graft Procedure to Manage Aberrant Frenum Attachment

Another example of how a free gingival graft can be used to correct a facial mucogingival problem is shown in Fig. 10.2 [12]. The facial aspect of the mandibular bicuspid is concealed by a buccal frenum; the buccal frenum prevents adequate cleaning of the facial aspect of this tooth. Retraction of the frenum with a periodontal probe revealed that the frenum is covering a class V carious lesion. Treatment of this problem area included excising the frenum followed by preparation of a free gingival graft recipient site (see free gingival graft procedure above). The sutured graft is sutured to an immovable bed of connective tissue verified by manipulating the cheek as described in Fig. 10.1. A Coe-Pack dressing can also be used to provide contact between the graft and the recipient site. After healing of the graft, the facial aspect of the tooth was accessible for oral hygiene measures and the facial class V carious lesion was restored with a composite restoration.

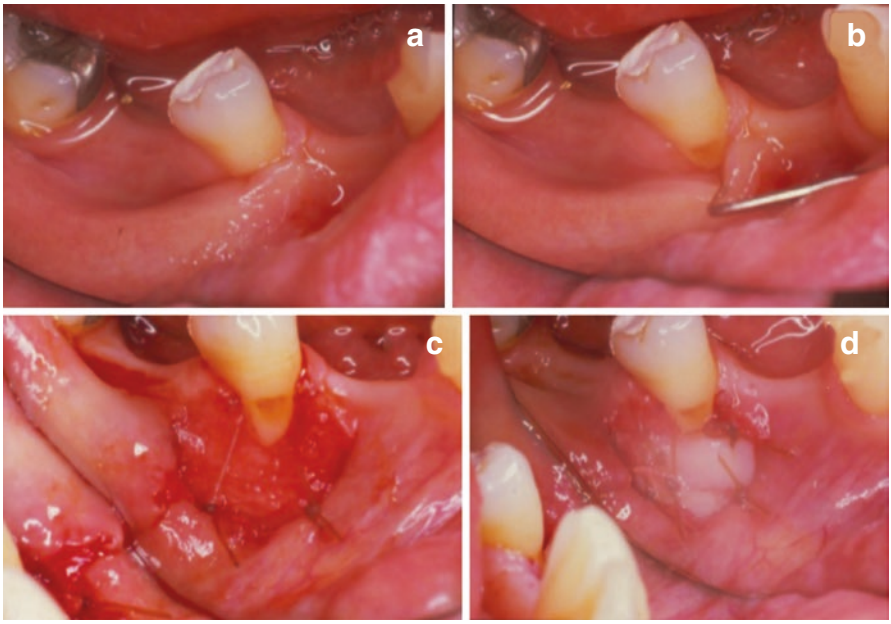

Fig. 10.2 Management of an aberrant frenum attachment with a free gingival graft. (**a**) Preoperative appearance of the buccal frenum attachment facial to #29. (**b**) Retraction of the frenum revealed that the frenum is concealing a facial carious lesion. (**c**) Excision of the frenum and preparation of a free gingival graft recipient site. (**d**) The apical end of the freed oral mucosa is sutured in order to maintain the apical position of the oral mucosa. The class V carious lesion was restored as soon as the facial tissue had matured sufficiently to allow cavity preparation without disrupting the graft attachment

The Free Connective Tissue Graft Procedure

Figure 10.3 provides the surgical steps in performing the free connective tissue graft on the facial aspect of a tooth with severe gingival recession. The primary consideration for survival of the connective tissue graft is to provide vascular support for the graft directly over the exposed root surface. This is accomplished by coronally positioning gingival tissue over the graft or by preparing laterally positioned pedicle flaps from each side of the exposed root surface, as shown

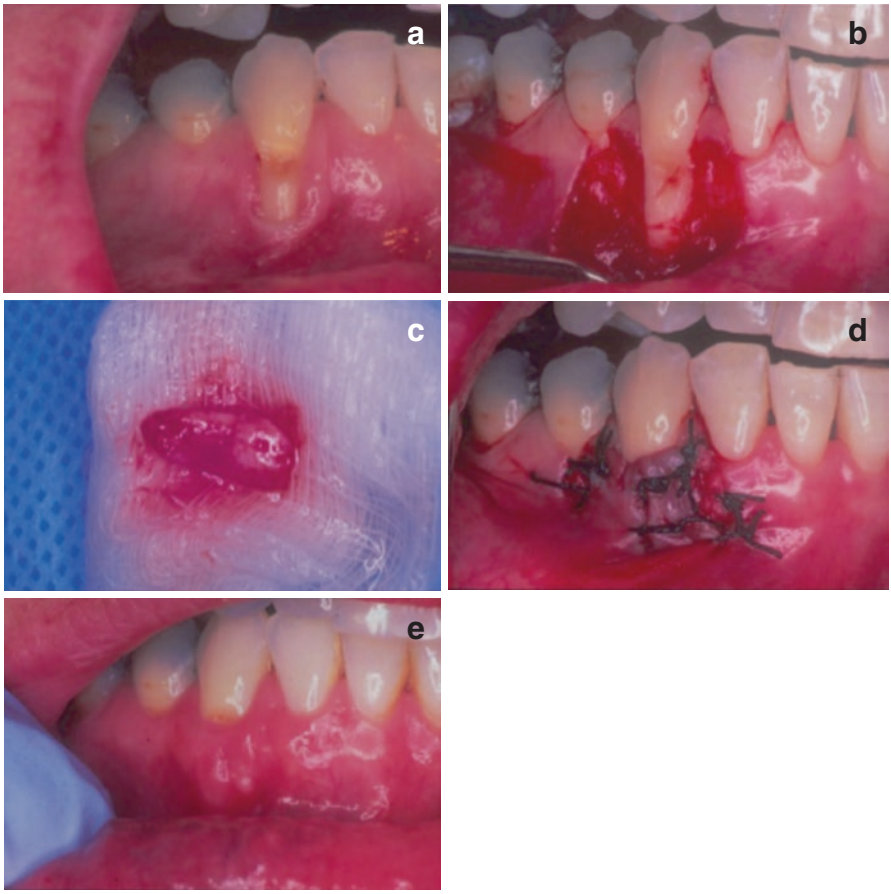

Fig. 10.3 Free connective tissue graft procedure to treat an isolated area of severe gingival recession. (**a**) The preoperative appearance of recession on the facial aspect of #27. (**b**) Preparation of the recipient site using a double pedicle flap procedure. (**c**) The harvested connective tissue graft should be as long as the recipient bed. (**d**) The palatal connective graft is harvested and secured to the recipient site. (**e**) The healed graft demonstrates a zone of keratinized gingiva and substantial root coverage where gingival recession was evident preoperatively. Photographs courtesy of Dr. Nina Hirshman

in Fig. 10.3b. Once the two pedicle flaps are released by dissecting full-thickness flaps using vertical incisions well beyond the mucogingival junction, the flap margins should contact each other on the facial aspect of the exposed root and lay passively in this location. The margins of the pedicle flaps are sutured together with interrupted sutures to achieve primary closure. The joined pedicle flaps provide vascular support to the underlying connective tissue graft when it is placed over the root surface. Therefore, the connective tissue graft will receive plasmatic support and eventual vascular ingrowth from the pedicle flaps during the graft healing. In contrast to the free gingival graft, the free connective tissue graft harvests palatal connective tissue without including the overlying epithelium. This is usually accomplished by making two parallel incisions in the palate approximately 1.5 mm apart followed by releasing the connective tissue at its base. Care must be taken to avoid severing the greater palatine artery during the harvesting of the graft [9]. The connective graft should be as long as the recipient bed (Fig. 10.3c). Once harvested from the palate, the connective graft is placed over the recipient site and secured to the mesial and distal keratinized gingiva at the coronal and lateral margins. The previously joined pedicle flaps are then secured over the connective tissue graft using interrupted and sling sutures as needed (Fig. 10.3d). This procedure is not associated with sloughing of the gingival keratinized epithelium. As shown, healing of free connective graft will provide substantial root coverage (Fig. 10.3e) so long as the interproximal tissue height is adequate as described for the Miller class type I or II defects [13–15]. Although an increase in keratinized tissue width is also evident, this procedure will not increase vestibular depth. In addition, root coverage is more predictable when the facial aspect of a prominent root is reduced by odontoplasty. Figure 10.3 shows that the free connective tissue graft procedure is an effective technique in managing root recession.

Surgical Management of High Frenum Attachment

The frenum release (frenectomy or frenotomy) procedure shown in Fig. 10.2 required the placement of a free gingival graft to provide vestibular extension and prevention of frenum reattachment. By contract, it is not always necessary to place a free gingival graft to maintain vestibular extension. Figure 10.4 shows a frenotomy procedure where the narrow frenum was excised with a scalpel and because the oral mucosa passively retracted from its attachment site, a free gingival graft was not needed at this site. For this procedure to be successful, it is necessary to excise the frenum from labial alveolar bone well apical to the frenum attachment (Fig. 10.4c) so that a triangular area of thin unmovable connective tissue is exposed. An interrupted suture can be placed in the apical extent of the exposed connective tissue bed in order to prevent reattachment of the frenum. The suture bridges the two sides of the excision site so that primary closure of the oral mucosa is achieved from the left and right tissue margins at the base of the exposed connective tissue bed. Release of the labial frenum can provide an improved gingival architecture for cleaning the facial aspects of the mandibular incisors.

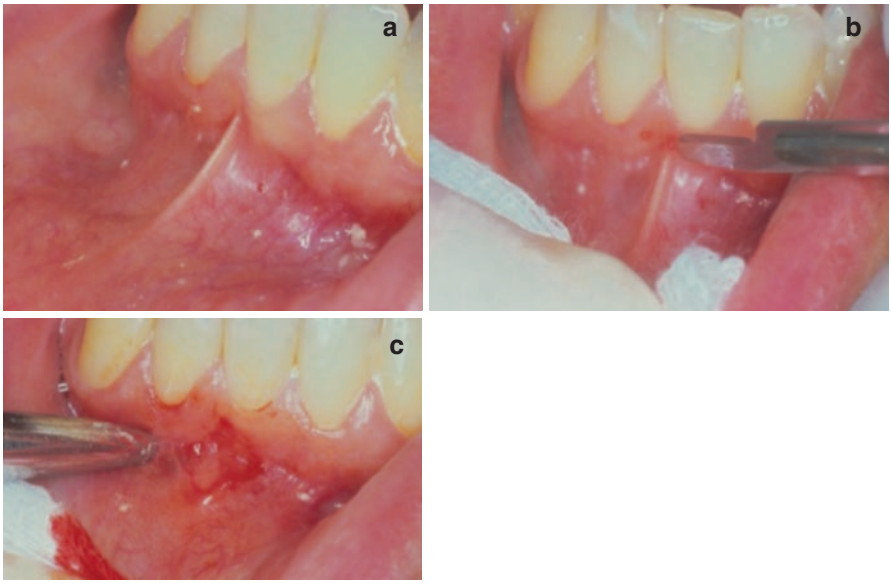

Fig. 10.4 Frenotomy procedure. (**a**) Note the high frenum attachment on the facial aspect of #24 with a minimal zone of keratinized gingiva. (**b** and **c**) Dissection of the labial frenum at its base using a Bard Parker scalpel. Also consider placing a free gingival graft over the exposed connective tissue if vestibular extension is desired or if a coronal positioning of gingiva is planned during a second procedure (see Figs. 10.1 and 10.2 for details)

Creating a Zone of Keratinized Gingiva on the Facial Aspect of Bone Level Implants

The last example shows the management of keratinized gingiva associated with bone level implants [16–19]. Two implants were placed distal to the lower left cuspid and were surgically covered. After osseointegration of the implants, it was noticed that the facial aspect of the mesial implant cover screw was exposed through a gingival fistula at the junction of the keratinized gingiva and oral mucosa. Because of the shallow buccal vestibule and the presence of a fistula to the cover screw, the keratinized gingival tissue was excised horizontally over the closure screws of the implants and two vertical incisions were extended laterally into the buccal vestibule for apical/lateral displacement of the keratinized gingiva much like an apically positioned flap procedure (Fig. 10.5b). The buccal flap was elevated as a pedicle flap and the implant closure screws were removed and replaced with healing abutments (Fig. 10.5c). The buccal flap was then adapted to the buccal alveolar process by using sling sutures around the healing abutments (Fig. 10.5d). Note that the excision of the gingival tissue was initiated lingual to the actual implants in order to ensure preservation of the maximum amount of keratinized gingival tissue on the facial aspect of the implants (Fig. 10.5e). After healing, the implants were restored with splinted crowns and the keratinized gingival tissue on the facial aspect was preserved (Fig. 10.5f).

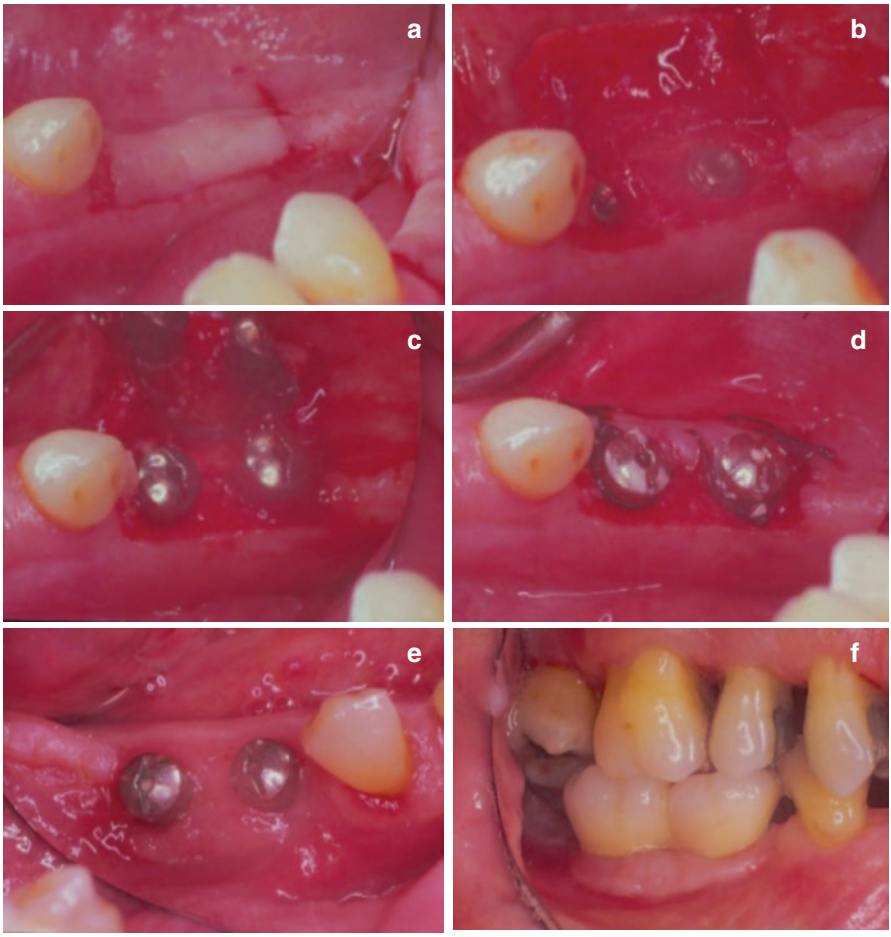

Fig. 10.5 Creating a zone of keratinized gingiva on the facial aspect of submerged implants during surgical uncovering. (**a**) Horizontal gingivectomy and vertical incisions used to reflect the keratinized gingiva covering two posterior implants (**b**) Lateral reflection of the flap that extends beyond the mucogingival junction as with an apically positioned flap. (C) Healing abutments placed on the implants. (**d**) The pedicle flap secured to the healing abutments with sling sutures. (**e**) Healing of the surgical site after 1 week. (**f**) Appearance of the healed keratinized gingiva facial to the restored implants

Summary Comments

These procedures demonstrate the use of free gingival grafts or laterally positioned flaps, or both, to provide not only a zone of keratinized tissue but also to increase vestibular depth. By doing so, the patient's oral hygiene measures are facilitated with better access to the facial aspects of teeth. The surgical principles outlined in

this chapter also provide a guide for successful management of grafting procedures and manipulation of gingival tissues to help to preserve the dentition where dental disease persists due to the architecture of the gingiva. Connective tissue grafts are not generally helpful in this regard. Further information about these procedures can be found in the following references.

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