Chapter

Simple Surgical Methods for Soft Tissue Management Around Fresh Extraction Sockets during Socket Preservation

Fares Kablan

Abstract

Soft tissue volume and quality are considered important factors for functional and esthetic long-term outcomes around natural teeth and dental implants. However, achieving them is challenging for oral surgeons. Healing of an extraction site is combined with normal physiological ridge resorption and loss of interdental papillae scaffold. Therefore, the rehabilitation of these ridges with dental implants or pontic site of fixed dental prosthesis usually necessitates soft tissue management to achieve natural-looking tooth replacement. The aim of this chapter is to introduce two surgical topics that are used to preserve the soft tissue quality, volume, and architecture during teeth extraction procedure. The first topic is the "transient coronectomy" that is used to save the interdental papilla during teeth extraction, and the second topic is "The back-cut technique" that is used to enhance the socket seal of post-extraction sites.

Keywords: socket preservation, local flaps, interdental papilla, coronectomy, back cut

1. Introduction

The physiological healing process following tooth extraction results in hard and soft tissue losses and ridge contour deformation and has a detrimental effect on the subsequent treatment with dental implants or conventional prostheses [1–4]. Preservation of post-extraction socket has some clinical relevance in preventing physiological bone resorption of the extracted site. Augmentation of post-extraction sockets requires a primary closure of the wound to promote proper ridge regeneration. To achieve that goal, different materials and methods are used to enhance the socket seal such as autogenic free soft tissue grafts [5–10], extraction-site granulation tissue [11], acellular dermal matrix [12, 13], collagen matrix and sponge [14], resorbable and non-resorbable barrier membranes [15, 16], periosteal scraping, and local flaps [17, 18].

Surgical resection of skin lesions results in skin defects that can be treated with local randomized flaps [19]. The back-cut incisions have been used in skin surgeries to enhance the rotation and the advancement of the designed flap for easier closure of an open wound [20] cresent. Flap advancement and rotation are also used in the oral

surgery for reconstruction of soft tissue deficiency around teeth, dental implants, and bone grafts [17, 18].

The modern dentistry is alert to both esthetic and function of the treatment outcomes. Loss of the interdental papilla has a great impact on the final restorative treatment outcomes, especially in the esthetic zones. Therefore, treatment plans should consider maintaining and restoring the interdental papilla anatomy and architecture around dental implants and fixed partial denture pontic sites. Teeth extractions usually lead to sockets collapse, ridge resorption, and loss of interdental papilla volume and anatomy. Reconstruction of interdental papilla in the edentulous sites is considered one of the greatest treatment challenges facing the multidisciplinary dental team [21–25].

Several surgical and nonsurgical treatment modalities have been described for papilla preservation and reconstruction around natural teeth and around implants with their comorbidities and predictability [26–30]. Nonsurgical techniques include orthodontics that is usually used for teeth and root alignment [31–33] and restorative treatment aimed to correct the position of the contact point between two adjacent teeth that has a critical effect on the papilla [34]. Among the surgical techniques, free connective tissue graft and pedicle flaps are used for interdental papilla management. Azzi et al. in 1998 reported the use of subepithelial graft for papilla reconstruction [35] and the use of connective tissue graft that was harvested from the maxillary tuberosity and the palate in 2001 [36]. Socket grafting procedures have also been considered to preserve the ridge contour and to support the soft tissue in the extraction site [37]. As an alternative to socket preservation, the root submergence technique was described and used in order to preserve the periodontal tissue at the pontic site of fixed dental prosthesis [38, 39]. In the past, coronectomy was performed leaving submerged roots inside the ridge, in order to preserve the dimensions of the alveolar ridge and therefore to improve the retention and the stability of conventional removable prostheses [40]. In addition, coronectomy is also performed in surgical extractions of impacted wisdom teeth at the lower jaw as an alternative treatment to minimize the risk of nerve injury and to reduce complications [41–43].

Additional use of coronectomy is described by the author as a novel method, which is delineated as "transient coronectomy." This method includes the removal of the clinical crown of the subsequent extracted tooth by leaving the root submerged inside the ridge in order to prevent the collapse of the interdental papilla during the preparation of the temporary fixed prosthesis. The submerged root will be removed at the end of the treatment appointment.

The present chapter introduces two surgical tips for soft tissue management during tooth extraction. The first method is the "back-cut technique" that enhances mobilization of the flap at a coronal direction to obtain the primary closure of the bone-augmented extraction sites. This technique can be used for single or multiple extraction sockets without affecting the vestibular depth. The second tip is the "transient coronectomy" that carries out intraoperatively in order to preserve the interdental papillae during the treatment appointment and to enhance natural tooth locking around dental implants and natural teeth.

2. Back-cut technique

2.1 Technique presentation

A full thickness flap with intrasulcular incision is carried out around the extracted tooth with two releasing incisions obliquely, mesial and distal, that are extended

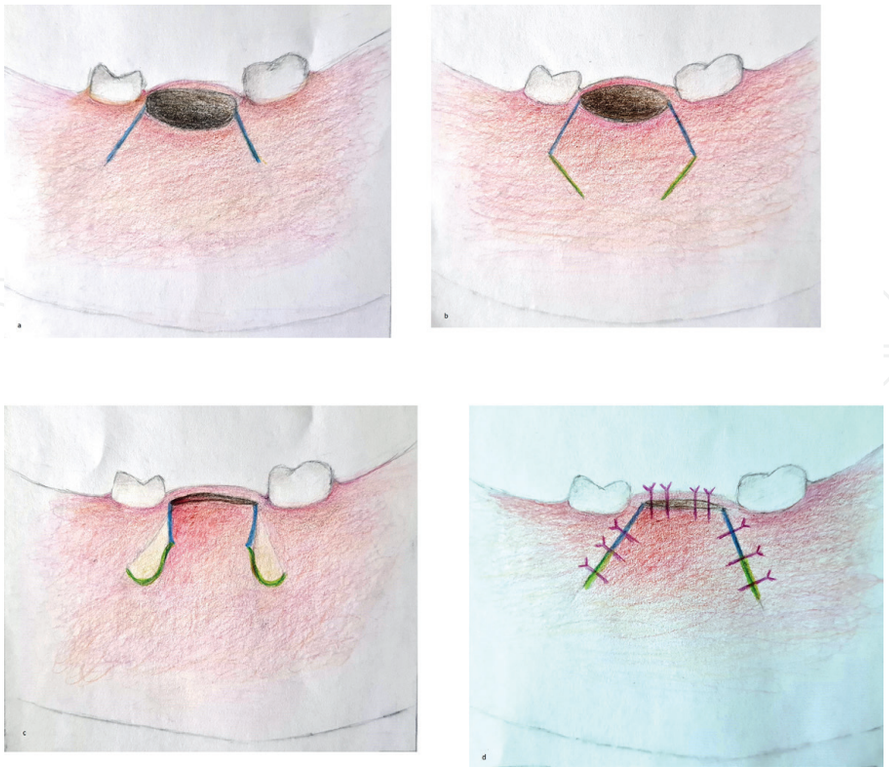

Figure 1.
Schematic view of the "back-cut technique". (a) Trapezoid flap; intrasulcular incision, and two releasing incisions. (b) Two additional incisions anterior and posterior performed as back cuts at the base of the trapezoid flap form the back-cut technique design. (c) Rotation and advancement of the flap at coronal direction covering the sockets as a result of the addition of the two back cuts. (d) The socket seal was obtained with a wide base flap following the final suturing.

3–4 mm apically to the mucogingival junction (trapezoidal flap) (**Figure 1a**). Two additional incisions are performed at the base of the flap; the first incision is angulated distally 110–120 degrees at the anterior releasing incision, and the second incision with the same angulation is performed continuously with the distal releasing incision and angulated mesially. Those two additional incisions are delineated by the author as the "back cuts" (**Figure 1b**), and the flap design is delineated as the "back-cut technique". This technique is performed in order to enhance the rotation and the advancement of the flap coronally covering the socket without periosteal-releasing incisions. As a result of the flap advancement and rotation, all the incisions (two releasing incisions and two back cuts) are dislocated coronally and create enough soft tissue for the socket seal (**Figure 1c**). The tooth might be extracted before or after the flap elevation. The next step is socket grafting with bone particles and the suturing of the flap. The sutures are first performed at the socket area (occlusally), followed by sutures at the releasing incisions of both the mesial and the distal, including the two back cuts in their new location. A wide base flap configuration is achieved at the end of the suturing job and looks like trapezoid flap (**Figure 1d**).

2.2 Clinical cases

2.2.1 Case 1

A 35-year-old patient was referred for the extraction of two maxillary teeth and socket preservation. Clinical and radiographic examinations showed extensive crown

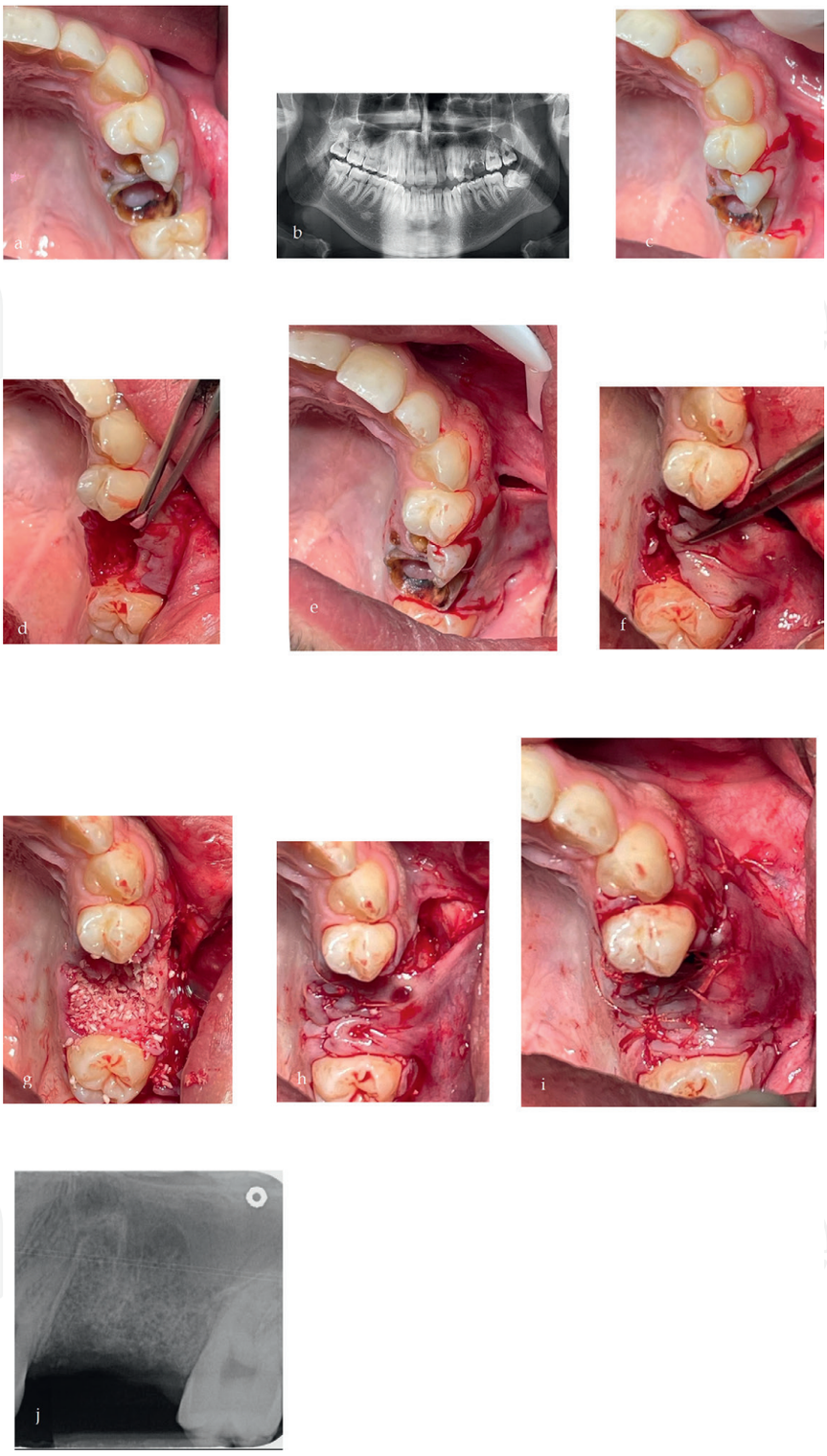

Figure 2.
Back-cut technique, case 1. (a and b) Clinical and radiographic views, crown destruction with periapical lesions involved the left maxillary second premolar, and the first molar. (c)A trapezoid flap was designed and obtained by intrasulcular and two releasing incision. (d) Intraoperative view demonstrates the disability of the flap to cover. (e) Intraoperative view shows that the flap rotation and advancement coronally obtained by the back cuts will enhance the sockets seal. (f) Particulate bone substitute is used to fill the socket. (g) The sockets' preservation with particulate bone graft. (h) The sutures at the occlusal part of the sockets obtained by flap rotation and advancement demonstrate the primary closure. (i) Primary closure at the bone-augmented socket without affecting the vestibular depth; a wide base flap was achieved. (j) Periapical view of the treated site at four months after the surgery demonstrates the bone graft.

destruction of the second premolar and the first molar at the left maxilla accompanied with periapical lesions (**Figure 2a** and **b**). Trapezoid flap was performed by intrasulcular incision followed by mesial- and distal-releasing incisions (**Figure 2c**). Thereafter, the teeth were extracted, and followed by meticulous debridement of the apical lesions. However, the soft tissue covering of the fresh extraction sockets was not obtained by the trapezoid flap (**Figure 2d**), therefore, two back cuts were performed (**Figure 2e**) to enhance the flap rotation and for the advancement in enhancing the soft tissue seal of the sockets (**Figure 2f**). The sockets' preservation was then carried out with an allogenous particulate bone (**Figure 2g**). The back-cut technique was utilized for the primary closure of the augmented socket. The back-cut technique flap design allowed the socket seal, preventing the exfoliation of the bone particles from the socket (**Figure 2h**). Primary closure was obtained at the end of the suturing job (**Figure 2i**). During 4-months follow-up postoperatively, the healing process went very well without any dehiscence of the surgical site or loss of the bone graft (**Figure 2j**). Thereafter, the patient was referred to his oral surgeon for implant placement.

2.2.2 Case 2

A 42-year-old patient was referred for the extraction of her first right mandibular molar and socket preservation (**Figure 3a**). Following trapezoid flap, two back-cut incisions were performed, the first anterior and the second posterior, at the extraction site. After tooth extraction and meticulous debridement of the socket, human-derived bone particles were used to fill the socket (**Figure 3b** and **c**). The extraction open

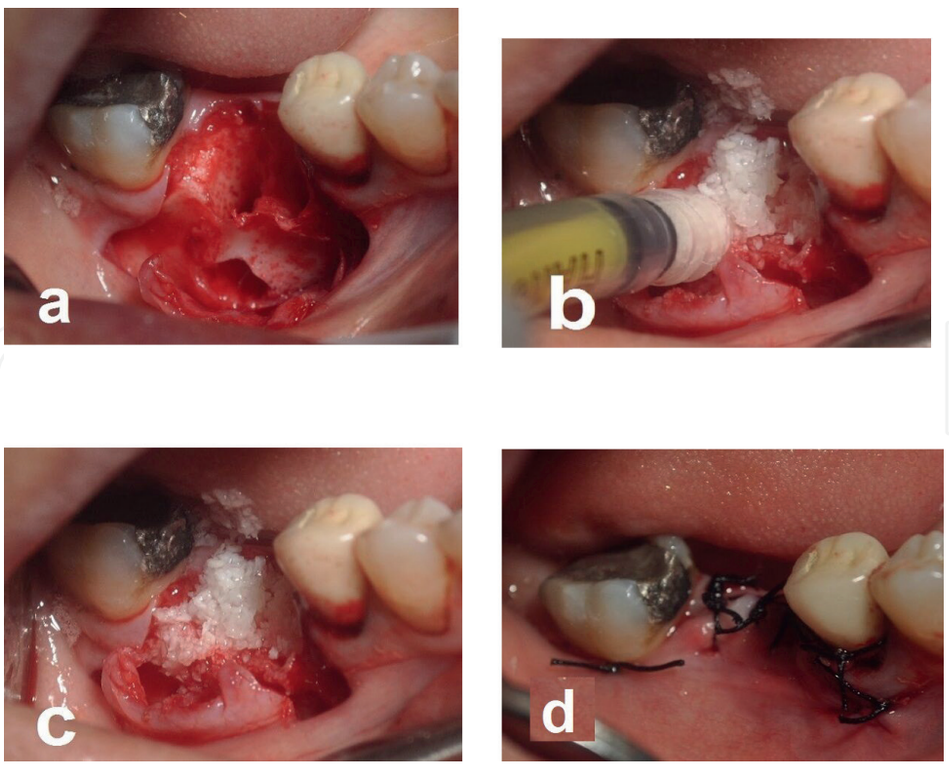

Figure 3
(a) Extraction socket of the first right mandibular molar with two back cuts: anterior and posterior. (b and c) Socket preservation with human-derived bone substitute. (d) Primary closure of the bone-augmented socket, via coronally rotation and advancement of the flap without affecting the vestibular depth.

wound was closed primarily by rotation and advancement of the flap (**Figure 3d**). The earlier designed back cuts enhanced the rotation and advancement of the flap without periosteal scrub and without distortion of the vestibular depth.

3. Transient coronectomy

Transient coronectomy, which is described herein, is indicated when maxillary or mandibular teeth at the esthetic zones should be extracted and reconstructed by temporary fixed prosthesis. The subsequent final rehabilitation might be dental implant-supported or conventional fixed prosthesis.

3.1 Technique

Illustration case: A 50-year-old patient was referred for extractions of his six anterior maxillary teeth that had been used as abutments for an old porcelain-fused-to-metal (PFM) fixed prosthesis and subsequent placement of dental implant. The treatment plan included the extraction of the teeth, socket preservation, and temporary restoration during the healing period. After 4–5 months, dental implants were placed for dental implant-supported fixed prosthesis rehabilitation. The transient coronectomy technique was used during the teeth extractions and the socket preservation procedure and is illustrated in the following 6 steps.

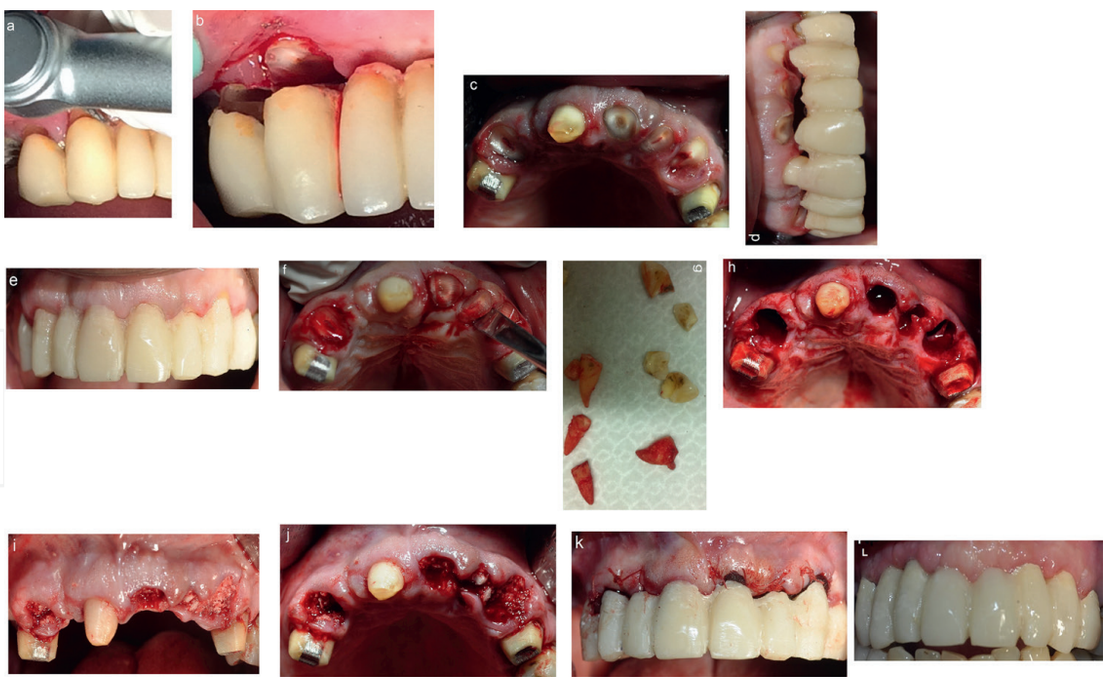

Figure 4
(a) High speed is used to cut the clinical tooth crown (CTC). (b) The clinical tooth crown (CTC) was cut over the level of the gingiva. (c) Grinding of the roots in a concave shape, and the interproximal root shelf was designed as the papilla outline. Abutment teeth were prepared. (d) Try in of the temporary bridge. (e) Passive setting of the temporary bridge inside the submerged roots, keeping the original interdental papilla outline. (f) Atraumatic extraction of the submerged roots. (g) 4 crowns were transected at the beginning of the treatment. (h) Sockets after the extraction of the submerged roots with minimal injury to the soft tissue. (i and j) Socket preservation; excellent preservation of the interdental papilla and the socket soft tissue. (k) Cementation of the temporary bridge, immediately after the suturing. (l) 3 months' follow-up: good ridge contour. The interdental papilla was preserved in its original shape and volume.

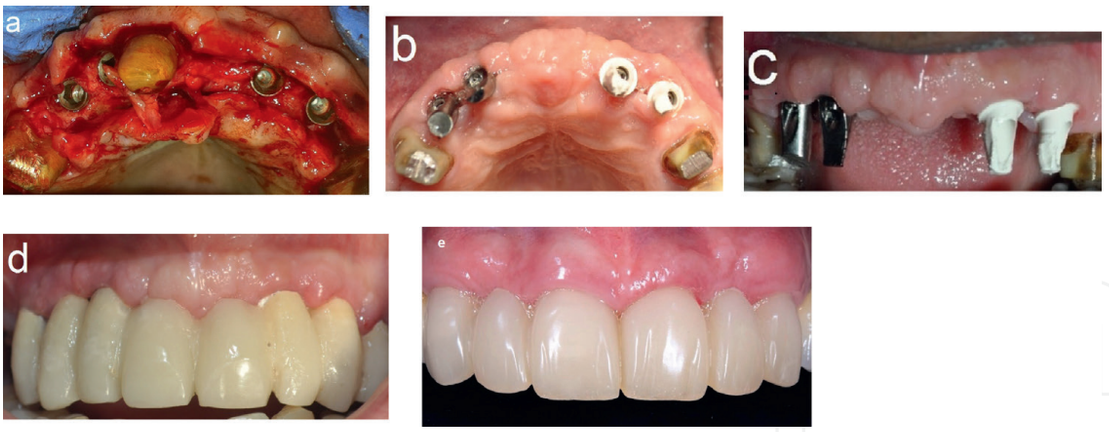

Figure 5
(a) Implant placement (at 5 months). (b and c) Implants follow-up (after 4 months). (d) Temporary bridge over the implants. (e) Follow-up of 24 months: fixed prosthesis over the implants with good esthetic outcome.

Step 1: Decortication of the clinical tooth crown (CTC) was carried out at 1–2 mm above the gingival margins in order to prevent injury to the soft tissue and resulted in submerged roots (**Figure 4a** and **b**). Step 2: The submerged roots underwent a careful concave shaving and trimming, leaving the interproximal thin walls to support the interdental papilla, without injury to the soft tissue (**Figure 4c**). Step 3: Relining of the prefabricated temporary fixed prosthesis was carried out to fit the designed submerged roots outline; this maneuver supports the papillae and preserves the gingival architecture (**Figure 4d** and **e**). Step 4: Atraumatic extraction of the submerged roots was carried out (**Figure 4f** and **g**). Step 5: Socket preservation and soft tissue suturing were carried out (**Figure 4h–j**). Step 6: Cementation of the already relined temporary prosthesis was carried out (**Figure 4k**). The patient had been followed up frequently during the healing time during 4–5 months after the extractions (**Figure 4l**).

Dental implants were placed 5 months after the first surgery (**Figure 5a**), and fixed prosthesis supported dental implants was performed after an additional 4 months. The outcomes have been satisfying during the subsequent follow-up (**Figure 5b–e**).

In cases that the rehabilitation of the extracted tooth will be performed by conventional fixed prosthesis supported abutment teeth, the final rehabilitation was performed 4 months after the socket preservation surgery.

4. Discussion

4.1 Back-cut technique

Extraction of one molar or more than two adjacent teeth creates an open wound at the extraction site. Spontaneous physiological healing of the socket will usually lead to socket wall resorption and soft tissue contracture. This can be prevented by bone grafting of the extraction socket. Bone grafts in the extraction sockets requires a primary closure to promote proper ridge regeneration. Primary closure of the socket is necessary to prevent postoperative flap dehiscence and exposure and migration of the bone particles. Several methods have been described to achieve this goal [6–16]. Landsberg and Bichacho were the first to describe the socket seal surgery, utilizing soft tissue graft or biomaterials to restore the soft tissue volume and architecture [7]. Tal reported the use of an autogenous masticatory mucosal graft to seal the extraction sockets [8]. Others

have used connective tissue grafts [9, 10]. Mardinger et al. described the use of intra-socket soft tissue to cover the augmented sockets [11]. Rotated palatal flaps with full or partial thickness have been reported for the primary coverage of extraction sites [17, 18]. Moreover, alternative non-autogenous grafts are widely used in the socket seal surgeries. Kim et al. in 2011 described the use of collagen sponge and xenogenic bone grafts for socket preservation [14]. Additional materials are also successfully used such as acellular dermal matrix [12, 13] and different types of collagen membranes [14–16]. Rotation flaps with or without advancement are widely used in the cosmetic medicine to close open skin wounds. Rotation flaps with back cuts are also used to enhance the flap length and its movement over the primary defect. Nasseri and Murray in 2015 reported the crescentic back cut that contributes to the better mobilization of the flap, reduces the scar length, and shifts tensions away from the direction of the primary defect closure, while eliminating tissue redundancy at the flap's base [20]. The back-cut technique presented in this chapter is used to achieve the primary closure of the bone-augmented fresh sockets. It provides the oral surgeon similar advantages as those reported in the cosmetic surgery. They increase the mobilization and the sliding of the flap over the open socket wound, lengthen the flap, and enhance the tension free primary closure over the augmented bone. The designed incisions of the flap and their suturing method convert again the narrow base flap resulting from the back cuts into a wide base flap. This improves the blood supply to the flap base and eliminates the possible redundancy of the flap. The addition of mesial and distal back cuts, as described herein, to the original incisions of the trapezoid flap for socket seal surgeries eliminates the need for periosteal-releasing incisions in the inner side. Periosteal-releasing incisions enhance only the flap advancement but miss the rotation ability. In addition, they jeopardize the blood supply and affect the healing of the operated site negatively. The ability to close the extraction open wound without periosteal scrub has several additional advantages that include: preservation of the periosteal integrity and blood supply, the flap thickness and circulation, reduction of infections during the healing period. Moreover, the vestibular depth will not be affected, which will improve the oral hygiene throughout the subsequent site rehabilitation. It is well established in the oral surgery literature that primary soft tissue closure over the surgical site increases the predictability of bone regeneration at the treated sites [44]. Additional indications for this technique include soft tissue primary closure during immediate dental implant placement in fresh sockets, open sinus augmentation combined with teeth extractions, and guided bone regeneration procedures.

In those cases where soft tissue augmentation is not mandatory at the extraction site and is used only to achieve primary closure, the back-cut technique can be used predictably, which eliminates the need for additional surgical procedures for harvesting soft tissue grafts and their accompanying suffering such as pain, discomfort, hemorrhage, or infection. Moreover, the back-cut technique also eliminates the need for non-autogenous covering materials such as barrier membranes, mucografts, and acellular dermal matrix, and as a result, it reduces the potential side effects as foreign materials and their costs. The grafted bone volume at the sockets that are sealed by the back-cut technique was preserved during the healing period and subsequently during the dental implant surgery in the second stage. The inserted implants had an adequate new bone volume and quality at the recipient sites.

4.2 Transient corenectomy technique

The presence of interdental papilla has a crucial role in gingival and teeth esthetics and the patient's smile. The etiology of interdental papilla loss is multifactorial, including

teeth extractions. Preservation or reconstruction of the lost interdental papilla as a result of teeth loss or extractions has been challenging for the dental treatment team [26]. In this chapter, the "transient coronectomy" is described as a novel approach to prevent papilla collapse during teeth extractions. The collapse of the interdental papilla and loss of the gingival contour occur immediately after the extraction of the teeth, so immediate provisionalization is recommended to optimally preserve the tissue during the surgical procedure and thereafter. In 2006, Margeas reported the use of natural teeth as provisional following implant placement to achieve peri-implant gingival esthetics [45]. In 2008, Taleghani et al. reported the use of a temporary bridge with an ovate pontic at the site of extraction to support the proximal papilla and the facial soft tissue and to enhance the healing gingival tissue [46]. For the rational to preserve the soft and hard tissues and to maintain the periodontal attachment complex, the root submergence technique has been reported and used in esthetic implant therapy with favorable esthetic outcomes [38, 39]. However, several complications were encountered with the applications of this technique such as periapical lesions, external root resorption, root caries, and late eruption of the submerged root that can result in the extraction of submerged root. As a result, late failure of the treatment that required more complicated reconstruction procedures may occur [47]. The transient coronectomy technique, as a novel concept, for the use of the submerged root intraoperatively is defined by the author as the "coronectomy" of the hopeless tooth clinical crown, and its extraction at the end of the treatment appointment is defined as "transient." According to this approach, the clinical tooth crown (CTC) is transected at 1–2 mm above the gingival level in order to prevent injury to the soft tissue; thereafter, the final coronectomy procedure is accomplished by shaving and trimming of the residual tooth root carefully in a concave form to the level of the surrounding soft tissue, leaving the interproximal thin walls of the root to support the interdental papilla. According to this work platform, the outline of the trimmed submerged root will support the interproximal papilla during the relining of the prefabricated temporary fixed prosthesis (crown, bridge) with 100% fitting to the original location and shape of the interdental papilla. Moreover, the provisionalization will inhibit immediate papilla collapse that will otherwise occur rapidly if it is performed after entire tooth extraction. The removal of the roots later during the same appointment and socket preservation eliminates the risk of late failure that might be accounted in the scenario of leaving the root submerged. The transient coronectomy technique used by the author predictably maintains the interdental papilla topography and the gingival emergence profile during the treatment appointment, the healing period, and the subsequent treatments with final favorable cosmetic results.

An additional benefit of extraction of the submerged root after the relining of the temporary fixed prosthesis for the dental treatment team is the working in a clean environment. If the entire tooth is extracted at the beginning of the treatment, it will cause oozing during the treatment on the one hand, and the relining of the temporary prosthesis can contaminate the fresh sockets on the other hand.

5. Conclusion

Primary closure of the bone-augmented sockets was obtained and maintained using the back-cut technique with minimal costs and minimal postoperative morbidities. This technique is advocated in cases of socket seal surgery that involve extraction of adjacent teeth or even only one molar. The transient coronectomy technique during tooth extraction is a simple tool to accelerate interdental papilla preservation with

long-term outcomes. Both surgical methods provide the patients and the dental treatment team with simple facilities to enhance the esthetic outcomes of rehabilitation of the extractions sites with minimal morbidity and costs.

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Author details

Fares Kablan[1,2]

1 Department of Oral and Maxillofacial Surgery, Galilee Collage of Dental Sciences, Galilee Medical Center, Naharyia, Israel

2 The Azzriele Faculty of Medicine, Bar-Ilan University, Safed, Israel

*Address all correspondence to: kablanp1@gmail.com

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