



Soft Tissue Closure of Grafted Extraction Sockets in the Posterior Maxilla: The Rotated Pedicle Palatal Connective Tissue Flap Technique

Edgard S. El Chaar, DDS, MS

Contemporary patient expectations have made esthetics a major requisite of all dental treatment plans, especially in situations in which there is a highly visible maxillary arch. Although new restorative materials have greatly improved predictability and esthetic outcomes, management of sequelae subsequent to, or in conjunction with, tooth extractions still remains a clinical challenge. These include possible fracture or loss of the facial plate, progressive vertical and horizontal ridge resorption, severe gingival recession, and loss of the interdental papillae.¹⁻⁵ To prevent compromise of patient function and esthetics, preservation of the natural hard and soft tissue architecture is a primary clinical objective at the time of tooth extraction. This is achieved by using an atraumatic tooth avulsion procedure that preserves residual bone and soft tissue, followed by augmentation procedures to preserve the bone volume and contours of the ridge.

Many techniques have been developed over the last 3 decades to correct postextraction ridge deficiencies,

The sequelae of socket collapse and localized ridge resorption after tooth extraction in the posterior maxilla can adversely affect esthetics, function, and future implant placement. Immediate grafting of extraction sockets may help to preserve natural ridge contours; but lack of available soft tissue can prevent primary closure or exert tension that hampers graft turnover and compromises the visible gingival

scallop. Exposed barrier membranes may also be susceptible to bacterial infection that may lead to secondary graft failure. The rotated pedicle palatal connective tissue flap is a relatively simple technique for soft tissue coverage of grafted sockets without excessive tension. This article presents the technique. (Implant Dent 2010;19:370-377)

Key Words: socket, graft, pedicle, connective tissue

including soft tissue grafts,⁶⁻⁹ which were among the earliest treatment options. Although clinical outcomes with early soft tissue grafting were often impressive, repeated procedures were frequently required before the desired esthetic results could be achieved. Improved surgical procedures for atraumatic tooth extraction and the advent of guided bone regeneration technology have made correction of ridge deficiencies more predictable,¹⁰⁻¹⁶ but graft coverage and containment in extraction sockets remain a clinical challenge. Bacterial contamination of exposed barrier membranes have been associated with infection and graft failure,¹⁷ and use of soft tissue appliances to retain particulate augmentation material may potentially deform graft contours by exerting excessive pressure on the site.¹⁸

Flap manipulation techniques have been developed in an attempt to provide complete soft tissue closure over grafted extraction sockets.¹⁹⁻²²

Many side effects have appeared with these flap manipulations. These include scarring of the soft tissues, loss of keratinized gingival tissue, and complete or partial loss of the natural gingival scallop, which is essential for a natural-looking restoration. It is also important to note that most reported flap manipulation techniques are associated with healed edentulous areas rather than immediate extraction sites.²⁰⁻²¹

This article presents a technique for achieving primary soft tissue closure of grafted maxillary extraction sockets while preserving the natural gingival scallop of the maxilla.

CLINICAL TECHNIQUE

After completing preliminary clinical and radiographic evaluations, patients should be informed about the surgery, postoperative healing, and possible complications and should provide signed informed consent be-

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fore treatment. Administration of a prophylactic antibiotic is recommended 1 hour before surgery: amoxicillin (500 mg, 1 tablet), or clindamycin (150 mg, 1 tablet) for patients with hypersensitivity to penicillin-based medications. Immediately before surgery, the intraoral mucosa is cleaned using a hydrogen peroxide swab and outside facial skin is wiped with a povidone-iodine solution. Local anesthesia is administered via buccal and palatal infiltrations.

Use of conventional elevators to apply lateral pressure for tooth luxation can traumatize both the buccal and lingual plates. If a buccal plate is thin, use of extraction forceps to apply buccolingual pressures can cause fracture or complete destruction of the facial plate. Atraumatic tooth evulsion is designed to help preserve all dimensions of the alveolus. The procedure begins with using extraction forceps to gently rotate the tooth for 30 seconds. This stretches the periodontal ligament and initiates bleeding around it. A resulting build-up of hydraulic pressure in the ligament helps to further loosen the tooth. An intrasulcular incision is made with a periosteal knife, thin-ligament knife, or ultrasonic surgical device (Piezosurgery, Mectron Medical Technology, Carasco, Italy) to sever the gingival attachment and most coronal portion of the periodontal ligament around the tooth. Once the tooth is fully mobile, it is gently removed with twisting movements and vertical elevation. This technique can be further simplified by using an instrument that engages the tooth root with a screw and provides mechanical leverage to extract it from the socket (Easy X-Trac System, Titan Instruments, Hamburg, NY).²³

Teeth with multiple roots, such as molars, must often be sectioned and each root segment removed individually. This can be easily accomplished using a high-speed handpiece followed by use of a piezoelectric surgical device to atraumatically extract the 3 roots. Root fracture can occur in cases in which the physiological gripping force of the Sharpey's fibers exceeds the gripping capacity of the extraction instrument or surgeon's strength, and tooth ankylosis can occur

when Sharpey's fibers are absent.²³ To address these issues, the surgeon may need to use more aggressive surgical procedures, such as root sectioning with a high-speed contra-angle and bur, and/or use of a rongeur or chisel and mallet to extract the root fragment.^{23,24}

An evaluation of the socket is performed immediately after tooth extraction. If the buccal wall is intact, the extraction socket can be immediately grafted in layers of cancellous and cortical solvent-dehydrated mineralized collagen allograft (Puros, Zimmer Dental Inc., Carlsbad, CA) and occluded with a bioabsorbable wound dressing (CollaPlug, Zimmer Dental Inc.) according to the method previously described by Wang and Tsao.²⁵ If the buccal wall is thin or has fractured during root removal, reinforcement of the area with a resorbable barrier membrane should be performed during the augmentation procedure.²³ This can be easily accomplished by elevating a partial-thickness soft tissue flap over the buccal wall and placing the barrier membrane beneath it. If the buccal wall is partially or fully lost, a full-thickness flap may be elevated to expose the buccal defect. This may be accomplished by creating a split-thickness incision on the 2 adjacent papillae and, if necessary, extending it to the neighboring teeth. After exposure, a resorbable barrier membrane is placed over the defect to contain the graft material.

Alternatively, flap elevations may be avoided by trimming a resorbable collagen membrane into a keyhole shape (20 mm × 5 mm × 10 mm), or using a collagen membrane pre-trimmed in those dimensions (e.g., Zimmer Socket Repair Membrane, Zimmer Dental Inc.), and placing the small end of the membrane directly into the extraction site so that it extends laterally and apically over the facial plate defect.²⁶ Prepared graft material is introduced into the socket with a sterile syringe or applicator and carefully compressed with a sterile instrument. This will help to eliminate voids in the apical region of the socket and will push the facial tissue labially for better ridge contour. The wide end of the membrane that extends outside of the socket may be further trimmed,

if necessary, and gently folded over the top of the graft material. Absorbable sutures may be added, if desired, to temporarily stabilize the collagen membrane flap. In some cases, mucogingival junction extension incisions followed by reflection of a pouch flap according to the technique of Park and Wang²⁷ can help to provide improved graft retention, minimize membrane exposure, preserve papilla dimensions, and camouflage the graft site for improved esthetics.

In cases in which there is inadequate available tissue for effective mucogingival flap coverage, harvesting of a pedicle palatal tissue flap is initiated by making a horizontal incision 2 mm from the gingival margin of the teeth on each side of the grafted socket. Because the socket is located in the posterior region, the incision should be directed anteriorly to the needed dimension buccolingual to the socket after the horizontal incision is made. A transversal incision is then made to coincide with the mesiodistal dimension of the socket. An epithelial envelope is elevated over the delineated area (Fig. 1, a). The pedicle connective tissue is harvested, elevated, and rotated to cover the grafted socket (Fig. 1, b). Mesial and distal horizontal buccal mattress sutures are placed to stabilize the rotated pedicle palatal connective tissue flap (RPPCTF). Additional sutures may be added, if required. The palatal location where the connective tissue was harvested should also be securely sutured (Fig. 1, c) or sealed with a biologic glue.

The same technique can be used for 2 adjacent molars, premolars, or molar and premolar combination. After atraumatic extraction of teeth and socket grafting (Fig. 1, d), the connective tissue graft is precisely measured, harvested from the palate, and rotated over the site (Fig. 1, e) as previously described. It is always preferable to create the RPPCTF dimensions 1 to 2 mm longer than the actual graft site, so that it can be tacked under the buccal flap with a minimum tension. The same suturing technique is used between the RPPCTF and the buccal flap. In this case, however, simple interrupted loop sutures will extend

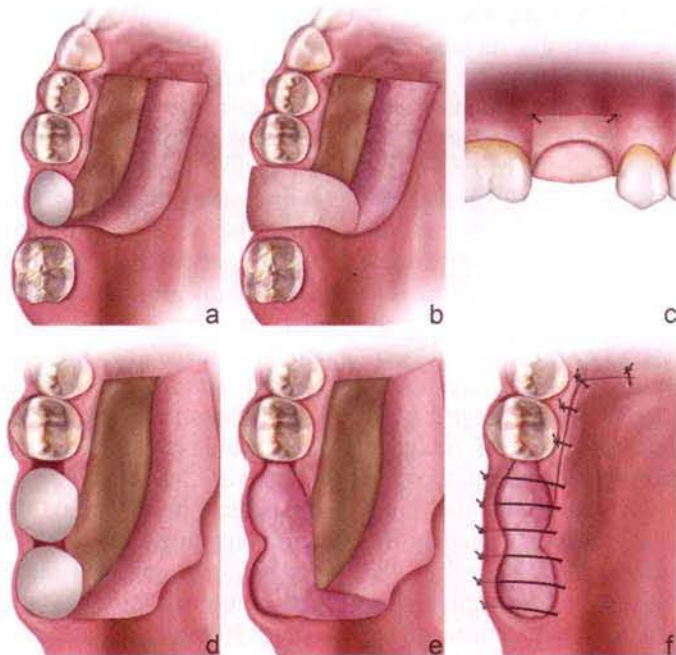


Fig. 1. Single socket graft: (a) A palatal incision is made anteriorly 2 mm from the gingival margin of adjacent teeth, a transversal incision is made to coincide with the mesiodistal dimension of the socket, and an epithelial envelope is elevated. The soft tissue graft is (b) harvested, elevated, rotated over the grafted socket, and (c) sutured in place. Double socket graft: After (d) atraumatic tooth extraction and socket grafting, the RPPCTF is precisely measured, harvested from the palate, (e) rotated over the site, and (f) sutured in place using simple interrupted loop sutures.

from the buccal flap and over the RPPCTF to engage the palatal flap, and the knot will be made on the buccal side (Fig. 1, f).

CLINICAL CASES

Case 1

A 55-year-old woman presented with an abscessed maxillary right first molar. The tooth had a history of apicoectomy and was restored with a prefabricated post placed in the palatal root. The patient had very pronounced buccal corridors and a thin periodontium. Radiographic evaluation revealed 10 mm of bone below the maxillary sinus.

Sequential tooth extraction consisted of first removing the ceramometal crown with diamond and carbide cutting burs (Brasseler USA, Savannah, GA). The tooth was then cut into 3 pieces using an ultrasonic cutting device (Piezosurgery, Mectron S.P.A., Carasco, Italy), and the roots were atraumatically extracted with forceps. The socket had no buccal plate and no interseptal bone between

the mesial and distal roots. After thorough debridement of the socket, solvent-dehydrated mineralized cancellous bone allograft (Puros, Zimmer Dental Inc.) was placed and covered by a resorbable collagen membrane (Bio-Mend, Zimmer Dental Inc.). A RPPCTF was harvested, laid over the socket, and sutured in place. The donor site was closed with sutures.

After 6 months of healing, cone beam tomography (Galileo, Sirona Dental Systems LLC, Charlotte, NC) revealed complete healing of the grafted socket. A dental implant (4.7 mm × 10 mm; Tapered Screw-Vent MTX, Zimmer Dental Inc.) was placed using a flapless surgical technique. A healing abutment (THCW5/5, Zimmer Dental Inc.) was immediately attached for a transmucosal healing procedure. No sutures were placed, and homeostasis was achieved from the pressure from the healing abutment on the surrounding tissue. Healing was uneventful, and osseointegration was confirmed after 4 months. The implant was restored with a ceramometal single-tooth restoration.

Case 2

A 50-year-old man presented with an abscessed maxillary left second premolar caused by endodontic failure 6 months after receiving a ceramometal crown on a vital tooth. On manual palpation, the tooth exhibited Miller's class III mobility²⁸ and was deemed unsalvageable. An intrasulcular incision was made, and an ultrasonic surgical device (Piezosurgery, Mectron Medical Technology) was used to perform an atraumatic tooth extraction. The socket was debrided thoroughly. Clinical examination revealed complete absence of the buccal plate beyond the apex of the alveolus. The socket was augmented according to the lost buccal plate technique, and an RPPCTF was placed as previously described. In 6 months, cone-beam tomography revealed a fully reconstructed ridge. At that time, a dental implant (3.7 mm × 11.5 mm; Tapered Screw-Vent, Zimmer Dental Inc.) was placed using a flapless surgical technique, and a healing abutment (THC3/4, Zimmer Dental Inc.) was immediately attached for transmucosal healing. No sutures were placed, and homeostasis was achieved from the pressure of the healing abutment on the surrounding tissue. After 4 months of uneventful healing, the implant was osseointegrated and subsequently restored with a single-tooth restoration.

Case 3

A 46-year-old woman presented with periapical infections around 2 maxillary right premolars (Fig. 2, a). The teeth were deemed unsalvageable, and extraction was the treatment of choice, followed by ridge augmentation and future dental implant placement. Extractions were performed atraumatically using an ultrasonic cutting device (Piezosurgery, Mectron S.P.A.) (Fig. 2, b), and the sockets were fully debrided. A mineralized, cancellous bone allograft material (Puros, Zimmer Dental Inc.) was placed inside the debrided sockets and covered with a resorbable collagen membrane (BioMend, Zimmer Dental Inc.). The needed dimensions for socket coverage were calculated, and the RPPCTF was harvested, placed in position, and secured with tension-free

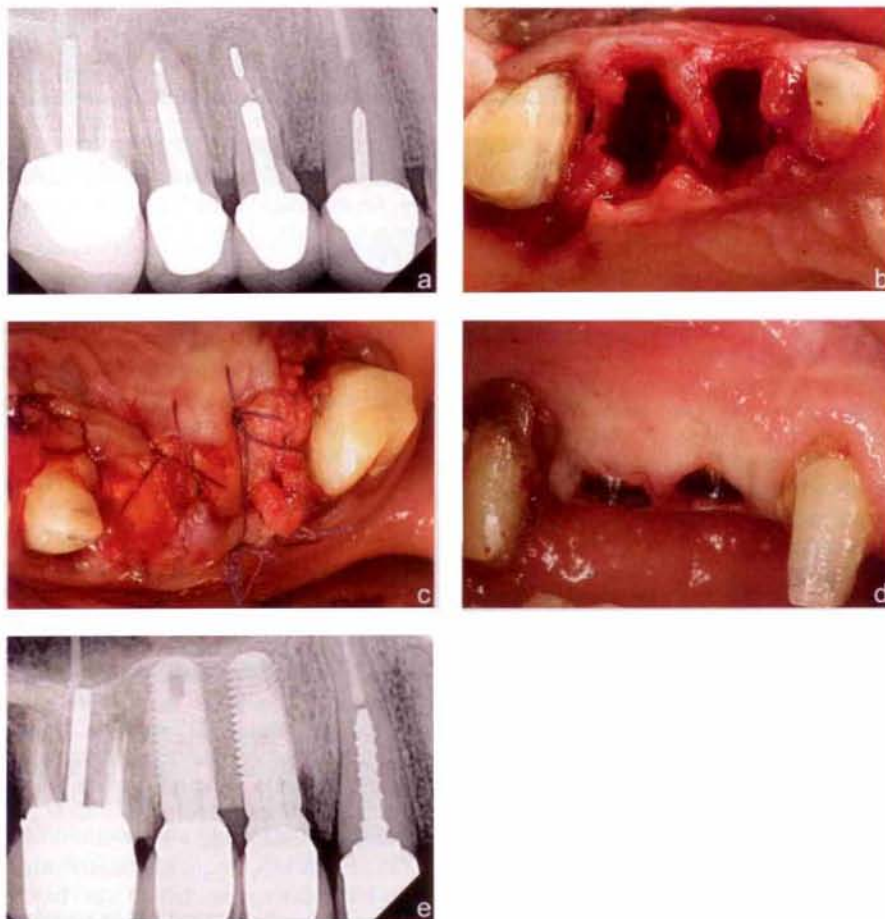


Fig. 2. Clinical case: (a) Preoperative radiograph of the maxillary right first and second premolars and (b) atraumatic extraction of both teeth. (c) Occlusal view of the double socket graft and the RPPCTF placed over the augmentation sites. (d) After 6 months of healing, 2 dental implants (Tapered Screw-Vent, Zimmer Dental Inc., Carlsbad, CA) were placed. (e) Radiograph of the 2 restored implants placed in the grafted sites.

5.0 absorbable polyglactin 910 (Vicryl, Ethicon Inc., Somerville, NJ) sutures on the buccal flap. Five additional interrupted simple loop sutures were passed from the buccal flap and engaged the palatal envelope bordering the graft (Fig. 2, c). The remaining portion of the envelope was sutured to the neighboring tissue. Homeostasis was achieved, and postoperative instructions were reviewed with the patient. After 6 months, cone-beam tomography revealed a fully reconstructed ridge. Two dental implants (3.7 mm × 11.5 mm; Tapered Screw-Vent MTX, Zimmer Dental Inc.) were placed using a flapless technique (Fig. 2, d). Healing abutments (THC3/4, Zimmer Dental Inc.) were immediately placed, and homeostasis was achieved from the pressure of the healing abutment on the surrounding

tissue. Osseointegration was confirmed after 4 months, and the implants were restored with ceramometal single-tooth restorations (Fig. 2, e).

DISCUSSION

After tooth extraction, alveolar sockets tend to rapidly resorb, with approximately 23% of their residual bone mass lost within the first 6 months, followed by another 11% of bone mass resorption over the next 2 years.²⁹⁻³⁰ Such resorption of extraction sockets has been traditionally considered to be inevitable.¹⁻⁵ When a failing tooth also presents with advanced bone loss, clinicians often are faced with the dilemma of how to handle the additional bone recession that will occur after extraction. Reconstruction of the hard and soft tissues is

imperative for implant site development and to address the esthetic concerns of patients, especially in the highly visible maxillary jaw.

Socket augmentation, combined with facial plate restoration and RPPCTF soft tissue grafting can help to preserve or restore the natural ridge contours. In addition to providing graft containment, the RPPCTF can also serve as a barrier membrane during bone regeneration. When the pedicle graft is rotated, the periosteal side of the tissue is placed against the bone. Although it has been hypothesized that this relationship may enhance the barrier and osteoconductive capacity of the bone graft, there has been no research to validate this concept.¹⁸ In ridge preservation procedures, one of the most difficult clinical challenges is how to achieve primary closure without changing the gingival architecture.²¹⁻²² Use of the RPPCTF provides a quick and effective solution to primary closure and helps to reserve the natural gingival scallop for esthetics.

Selection of an appropriate bone graft substitute is also important for reducing the volumetric resorption during the healing phase after socket augmentation. The material must not only be well tolerated by the tissues and have osteoconductive with or without osteoinductive properties but also preferably be a slowly resorbing material, such as mineralized³¹⁻³⁴ or demineralized bone allografts.³⁵⁻³⁸ Further investigative studies are needed to further elucidate the clinical behavior of the tissues grafted in the described techniques and provide more scientific data for establishing the indications and contraindications for its continued use.

CONCLUSIONS

The RPPCTF can provide soft tissue closure of augmented extraction sockets and help to preserve the natural gingival scallop for an optimal outcome in the posterior maxilla area.

Disclosure

The author claims to have no financial interests in any of products or companies listed in this article.

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Abstract Translations

GERMAN / DEUTSCH

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Weichgewebsverschluss transplanterter Extraktionshöhlen im hinteren Oberkiefer: Die RPPCTF-Technik

ZUSAMMENFASSUNG: Die Folgen eines Höhlenkollaps sowie einer lokalen Kammresorption nach Zahnextraktion im hinteren Oberkiefer können Ästhetik, Funktion und zukünftige Implantierung beeinträchtigen. Eine unmittelbare Transplantation in den Extraktionshöhlen kann dazu beitragen, die natürlichen Kammkonturen beizubehalten. Dabei kann aber das Fehlen von verfügbarem Weichgewebe den direkten Schluss verhindern bzw. eine Spannung ausüben, die die Transplantatwundheilung hemmen und den sichtbaren Zahnfleischmuskel beeinträchtigen kann. Freiliegende Barrieremembran können auch für bakterielle Infektionen anfällig sein. Dies kann zu einem sekundären Transplantatverlust führen. Die gedrehte, gestielte Bindegewebsklappe (RPPCTF) stellt eine relativ einfache Methode zur Bedeckung des Weichgewebes bei transplantierten Höhlen ohne besonderen Spannungsaufbau dar. Der vorliegende Artikel beschreibt diese Methodik.

SCHLÜSSELWÖRTER: Höhle, Transplantat, Stiel, Bindegewebe

SPANISH / ESPAÑOL

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Cierre del tejido suave de cavidades de extracción injertadas en el maxilar posterior: La técnica RPPCTF

ABSTRACTO: La secuela del colapso de la cavidad y la reabsorción de la cresta localizada luego de la extracción del diente en el maxilar posterior puede afectar negativamente la estética, función y colocación futura de implantes. El injerto inmediato de las cavidades de extracción podría ayudar a preservar los contornos de la cresta natural, pero la falta de tejido suave puede prevenir el cierre primario o crear tensión que impide el injerto y compromete el festoneado gingival visible. Las membranas expuestas de la barrera también podrían ser susceptibles a una infección con bacteria que podría llevar a una falla secundaria del injerto. El colgajo de tejido conectivo palatal pedicular girada (RPPCTF por sus siglas en inglés) es una técnica relativamente simple para la cobertura de tejido suave de cavidades injertadas sin tensión excesiva. La técnica se presenta en este artículo.

PALABRAS CLAVES: Cavidad, injerto, pedículo, tejido conectivo

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Fechamento de Tecido Mole de Alvéolos de Extração Enxertados na Maxila Posterior: a Técnica RPPCTF

RESUMO: As sequelas do colapso do alvéolo e a reabsorção localizada do rebordo em seguida à extração do dente na maxila posterior podem afetar adversamente a estética, função e futura colocação do implante. O enxertamento imediato de alvéolo de extração pode ajudar a preservar contornos naturais do rebordo; mas a falta de tecido mole disponível pode prevenir o fechamento primário ou exercer tensão que impede a renovação do enxerto e compromete o festonado gengival visível. As membranas protetoras expostas também podem ser suscetíveis a infecção bacteriana que podem levar a falha secundária do enxerto. O retalho do tecido conjuntivo palatal do pedículo giroverso (RPPCTF) é uma técnica relativamente simples para cobertura de tecido mole de alvéolos enxertados sem tensão excessiva. Este artigo apresenta a técnica.

PALAVRAS-CHAVE: alvéolo, enxerto, pedículo, tecido conjuntivo

RUSSIAN / РУССКИЙ

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Закрытие мягких тканей лунок после удаления зуба и вживления трансплантата в дистальной части верхней челюсти. Методика использования перевернутого лоскута соединительной ткани неба с питающей ножкой (rotated pedicle palatal connective tissue flap, RPPCTF)

РЕЗЮМЕ. Последствия деформации лунки и локализованной резорбции гребня после удаления зуба в дистальной части верхней челюсти может неблагоприятно сказаться на эстетике, функции и установке имплантата в будущем. Немедленная трансплантация ткани в лунку удаленного зуба может помочь сохранить естественные контуры гребня, однако отсутствие достаточного объема мягкой ткани может препятствовать первичному закрытию лунки и оказать давление, затрудняющее обновление трансплантата и нарушающее видимую поверхность десны. Открытые барьерные мембраны могут оказаться подвержены бактериальной инфекции, что может привести к вторичному отторжению трансплантата. Методика

использования перевернутого лоскута соединительной ткани неба с питающей ножкой (rotated pedicle palatal connective tissue flap, RPPCTF) является сравнительно простой методикой закрытия мягкой тканью лунки после удаления зуба и вживления трансплантата без излишнего напряжения. Эта статья описывает данную методику.

КЛЮЧЕВЫЕ СЛОВА: лунка, трансплантат, питающая ножка, соединительная ткань

TURKISH / TÜRKÇE

YAZAR: Edgard El Chaar, DDS, MS

Posterior Maksilada Graftlanmış Çekim Soketlerinin Yumuşak Doku ile Kapatılması: RPPCTF Tekniği

JAPANESE / 日本語

上顎後部抜歯窩移植における軟組織創閉鎖: RPPCTF法

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研究概要:

上顎後部抜歯後の抜歯窩陥没ならびに局部的顎堤吸収などの後遺症は審美面をはじめ機能や今後のインプラント埋入に悪影響をおよぼす。抜歯窩即時移植は自然な歯槽堤外郭を維持するために役立つが、軟組織必要量不足は初期創閉鎖を不可能にしたり、また拡張することで移植補填材転換を阻止、もしくは可視歯頸線スキャロップ形態を悪化したりすることもある。それだけでなく露出したバリア膜は細菌感染に罹患しやすくなり、二次的移植失敗につながる可能性もある。Rotated Pedicle Palatal Connective Tissue Flap (RPPCTF)法は軟組織を過度に拡張せずに移植窩を保護できる比較的簡単なテクニックで、当文献はこの方法を説明するものである。

キーワード: 抜歯窩、移植、ペディクル、接続組織

CHINESE / 中国語

後上頷的移植拔牙齒槽窩的軟組織閉合

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摘要:

後上頷拔牙後的後遺症齒槽窩塌縮和局部牙脊吸收，可能對牙齒美觀、功能和日後植體置入產生不良影響。拔牙齒槽窩立即進行移植可能幫助保留天然的牙脊輪廓，不過缺乏可用的軟組織則可能造成無法初步閉合，或產生的張力將妨礙移植體轉換和縮減可見的齒齦殘留高度。暴露的再生膜也可能容易遭受細菌感染，導致次發性移植失敗。旋轉式肉基脰締結組織皮瓣 (rotated pedicle palatal connective tissue flap, RPPCTF) 是一種相對簡單的移植齒槽窩軟組織覆蓋技術，不會產生過大的張力。本文將描述本技術。

關鍵字: 齒槽窩、移植體、肉基、締結組織

ÖZET: Posterior maksilada diş çekiminden sonra çekim soketinin kolapsı ve sırtta lokalize rezorpsiyon gibi sekeller estetiği, fonksiyonu ve ileride implant yerleşimini olumsuz bir şekilde etkileyebilir. Çekim soketlerinde hemen greftleme yapılması, doğal sırtın konturlarını korumaya yardımcı olabilir; ancak, mevcut yumuşak dokunun az olması primer kapanmayı önleyebilir ya da greft rejenerasyonunu engelleyecek bir gerilme yaratabilir ve görünür diş eti tarağını (gingival scallop) tehlikeye düşürebilir. Açıkta olan bariyer membranlar da ikincil greft başarısızlığına yol açabilecek bakteriyel enfeksiyonlara karşı duyarlı olabilirler. Dönmüş pedikül damak bağ doku flepi (rotated pedicle palatal connective tissue flap-RPPCTF), greftlenmiş soketleri aşırı gerilme olmadan yumuşak doku ile kapatmak için nispeten basit bir tekniktir. Bu yazıda bu teknik sunulmaktadır.

ANAHTAR KELİMELER: Soket, greft, pedikül, bağ dokusu

KOREAN / 한국어

상악 전방에서 발치이식 소켓의 연조직 폐쇄: RPPCTF 기법

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요약:

상악 전방 발치 후 국소 치조능 흡수 및 소켓 협착의 후유증은 심미성, 기능 및 향후 임플란트 식립에 유해한 영향을 미칠 수 있다. 발치 소켓에 즉시 이식하는 것은 자연스러운 치조 능선을 보존하는데 도움이 되지만, 이용 가능한 연조직이 부족할 경우 일차 폐쇄를 방지할 수 있고, 이식편 교체를 방해하는 장력을 발생시켜 치조능 가시성을 좋지 않게 한다. 노출된 장벽 막은 이차 이식 실패를 초래할 수 있는 세균 감염에 있어서 또한 취약하다. 회전경상 구개 결합조직판(RPPCTF)법은, 과도한 장력은 발생시키지 않으면서도 이식 소켓의 연조직 커버를 위한 비교적 단순한 기법이다. 본 논문에서는 이 기법을 제시하였다.

키워드: 소켓, 이식, 경상