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A novel surgical technique for soft tissue management in aesthetic areas of the mouth at implant placement

A case report

Une technique chirurgicale innovante pour la gestion des tissus mous dans les zones esthétiques lors de la pose d'implant

À propos d'un cas clinique

ABSTRACT

A new flap design, the multiple coronally advanced flap, originally designed for mucogingival surgery, is proposed for a different clinical indication: access flap for single implant insertion in areas of esthetic relevance.
Clinical features of multiple coronal advanced flap are the absence of a vertical releasing incisions, a variable thickness, combining areas of split and full thickness and the coronal repositioning of the flap.

RÉSUMÉ

Un nouveau tracé de lambeau, le lambeau multiple déplacé coronairement, dessiné à l'origine pour la chirurgie mucogingivale, est proposé pour une indication clinique différente: un lambeau d'accès pour l'insertion d'un implant unitaire dans les zones esthétiques.
Les particularités cliniques du lambeau multiple déplacé coronairement résident dans l'absence d'incisions verticales de décharge, une épaisseur variable, associant des zones d'épaisseur partielle et d'épaisseur totale, et le déplacement coronaire du lambeau.

A clinical case of single implant surgery on a maxillary central incisor is reported to describe step by step the surgical technique.

KEY WORDS

Incision design, implant surgery, coronal flap repositioning.

Un cas clinique de pose d'implant unitaire pour remplacer une incisive centrale maxillaire est décrit pour illustrer chaque étape de cette technique chirurgicale.

MOTS CLÉS

Tracé d'incision, chirurgie implantaire, lambeau déplacé coronairement.

Introduction

In recent years implant surgery has been demonstrated to be a reliable opportunity for replacing missing teeth with high percentage of success (Lekholm *et al.*, 2006; Lindh *et al.*, 1998; Naert *et al.*, 2002; Noack *et al.*, 1999). In clinical situations where esthetic is an important issue, soft tissue management at time of implant placement and soft tissue integration to the final restoration are critical aspects for the success of the therapy (Fürhauser *et al.*, 2005; Belser *et al.*, 2009).

An accurate soft tissue treatment may facilitate peri-implant soft tissue stability over time (Belser *et al.*, 1998; Grunder *et al.*, 2005); although the presence of keratinized mucosa have been demonstrated not to influence long-term implant survival (Albrektsson *et al.*, 1986; Wennström, 1994), nevertheless the presence of keratinized tissue is commonly recommended to allow for an easier plaque control, a major peri-implant soft tissue stability and a better prosthetic and esthetic result (Buser *et al.*, 1990; Block and Kent, 1990).

Various techniques to augment keratinized tissue on implant sites have been described in the literature: roll flaps, connective grafts, epithelial and connective grafts.

The roll flap technique mainly consists in an inversion of the palatal connective tissue that is inserted under the vestibular flap at time of implant placing or at second stage surgery; this technique has been investigated by means of case series that have indicated the possibility of increasing the thickness of the mucosa and the amount of keratinized tissue (Barone *et al.*, 1999; Scharf and Tarnow, 1992; Abrams, 1980).

Soft tissue grafting techniques, both epithelial-connective (Landi and Sabatucci, 2001; Langer and Langer, 1990) and solely connective (Burkhardt *et al.*, 2008; Covani *et al.*, 2007; Bianchi and Sanfilippo, 2004) have been demonstrated to be reliable techniques for increasing soft tissue dimensions and keratinized tissue at time of implant placement.

In recent years another key-issue has been pointed out in implant literature: the importance of a good blending between peri-implant soft tissues and adjacent periodontal tissues (Buser *et al.*, 2004).

Although flapless implant insertion has been widely described and evaluated (Oh *et al.*, 2006; Schwartz-Arad and Chaushu, 1998; Fortin *et al.*, 2006), particularly in immediate insertion (Covani *et al.*, 2008), nevertheless most clinical situations need a flap elevation in order to allow for a good visualization of the bone crest, this instance becomes critical in cases presenting narrow or not regular bone ridges, bone defects, regenerative needs, ridge angulation, thin soft tissue biotype (Hämmerle and Lang, 2001).

The classical flap design described in the literature consists in a trapezoidal flap delimited by a crestal incision, that may be placed at the top of the crest or in a more palatal position, and two vertical incisions on the adjacent teeth (Buser *et al.*, 2004, 2008). This approach, with vertical incisions, may present some limitations when aesthetic is an important issue. Vertical releasing incisions, in fact, can produce scar tissue or areas of hyperkeratosis, which become very evident due to difference in color.

Vertical incisions also reduce the blood supply of the flap itself by cutting off all the horizontal vascular distribution, thus reducing the trophism of marginal tissue (Kleinheinz *et al.*, 2005).

In the work of Kleinheinz, based on an anatomical study of the vascularization of oral mucosa, marginal incisions in dentated areas and midcrestal incisions in edentulous areas demonstrated to be the less traumatic for the vascular supply of superficial tissues.

When repositioning of the flap is not due, the authors suggest to avoid vertical releasing incision.

In designing a flap, the absence of the vertical incisions has to be compensated by means of intrasulcular incisions that will involve at least one tooth adjacent to the recession defect in both mesial and distal directions.

In recent years envelope flaps have been described in implant (Barone *et al.*, 1999; Nemcovsky *et al.*, 1999, 2000) and periodontal surgery and in particular in mucogingival literature for the treatment of recession defects (Zucchelli and De Sanctis, 2000).

Barone describes a technique which mainly consists in a modification of the roll flap procedure previously described (Barone *et al.*, 1999) characterized by the absence of the vertical incisions on the buccal side to improve esthetic result; Nemcovsky has described a technique where a rotated split-thickness palatal flap is performed to allow a primary closure on implant in fresh extraction sockets obtaining an increase of keratinized tissue (Nemcovsky *et al.*, 1999).

Coronally advanced flap is a well documented and validated technique utilized in aesthetic mucogingival surgery (Allen and Miller, 1989; Pini Prato *et al.*, 2000) and more recently also to treat soft tissue dehiscences in implants (Burkhardt *et al.*, 2008). Burkhardt tested the coronally advanced flap, in conjunction with a free connective graft, to treat soft tissue dehiscences on implants. The technique has yield 66% complete implant coverage at 6 months (Burkhardt *et al.*, 2008).

The aim of the present study is to describe the multiple coronally advanced flap, without vertical releasing incisions, originally designed and tested for mucogingival therapy and recession treatment (Zucchelli and De Sanctis, 2000, 2005) in a different application: to gain access to bone crest in single implant insertion procedures reducing the esthetic complications of the implant surgery.

Surgical technique

Following local anesthesia, a horizontal incision is executed with a scapel to design an envelope flap. A full thickness incision is designed at the top of the crest on the edentulous area, then it is continued on the buccal side by intrasulcular incisions involving two teeth both on mesial and distal direction **(fig. 4)**. On the two interdental papillae split thickness oblique incisions are executed: these incisions are converging in the direction of the edentulous area. Papillae incisions are made placing the scapel parallel to the long axis of the tooth in order to create a connective surface that may support the coronal displacement and stabilization of the flap. Flaps are then raised performing a split-full-split thickness approach. An intrasulcular incision is executed also on the palatal side, only on the first tooth adjacent to the edentulous area, both on the mesial and the distal direction. The palatal incisions allow for a better visualization of the bone crest of the edentulous area. When edentulous crest is well exposed implant is positioned following the standard protocol of the manufacturer with a transmucosal procedure. After implant insertion and healing screw positioning, flap is moved coronally by a sharp dissection of the buccal mucosa with a first "deep" incision on periosteum and the elimination of muscular insertions with more superficial incisions. Flap has to move without tension from lip and peri-oral muscles. Flap mobilization is considered adequate when the marginal portion of the flap is able to passively reach a level coronal to the CEJ of the teeth and when surgical papillae cover passively anatomical papillae. Flap should be stable in its final position without sutures. Anatomic interdental papillae need to be carefully de-epithelialized to improve connective tissue beds and to eliminate epithelium that may interfere with the healing of the two connective surfaces of the new papillae. When flap is advanced coronally, surgical papillae are rotated towards the ends of the flap and are displaced on the prepared connective beds of the anatomical papillae. In particular the surgical papilla located mesial to the implant rotates in a mesial-coronal direction while the papilla distal to the implant rotates in a distal coronal position. Gingival margin in the edentulous area is moved coronally towards healing abutment and stabilized in this position by the coronal displacement of the flap. Sling sutures are performed to allow a precise adaptation of the flap around implant healing screw and to stabilize every single surgical papilla over interdental connective surface. First sutures that have to be placed are the ones that stabilize the peripheral area of the flap; the central area is sutured last. Sutures are then removed after 10 days from surgery.

Clinical case

A patient, B.S., female, age 38, presenting a root fracture on the left maxillary central incisor, has been selected for an immediate implant insertion in order to test the clinical result of a coronally advanced flap in implant procedures.
The tooth (21) had a previous crown restoration and has been judged not maintainable due to a root fracture **(fig. 1 to 3)**.
In order to reduce the times for the whole treatment, an approach with tooth extraction and immediate implant placement was chosen.
Following local anesthesia, a coronally advanced flap has been executed involving the teeth from 12 to 23 with the technique previously described **(fig. 4)**.
On the tooth 21 a marginal incision has been executed both on vestibular and palatal side.
Following the incision and the raising of the flap **(fig. 5 and 6)**, a careful extraction of 21 has been performed; particular attention was given to avoid possible damages to the thin vestibular cortical bone plate **(fig. 7)**.
Alveolar socket was then cleaned by curettes eliminating granulation tissue, a good visualization of alveolar bone walls was obtained.
Then a 3i implant (FOS 423) was inserted following the criteria of a correct tridimensional implant positioning for esthetic restorations (Buser *et al.*, 2004) **(fig. 8 and 9)**.
Since a transmucosal technique was selected, a healing screw was placed and the flap was sutured in a coronal position anchoring surgical papillae on the new connective beds of de-epithelialized anatomical papillae **(fig. 10)**.
A provisional mobile restoration was given to the patient for esthetic reasons during the first weeks after implant placement.
After six weeks from implant surgery, implant has been loaded and a provisional fixed restoration has been placed **(fig. 11 to 14)**.

Case study *(fig. 1 to 14)*

Présentation d'un cas *(fig. 1 à 14)*


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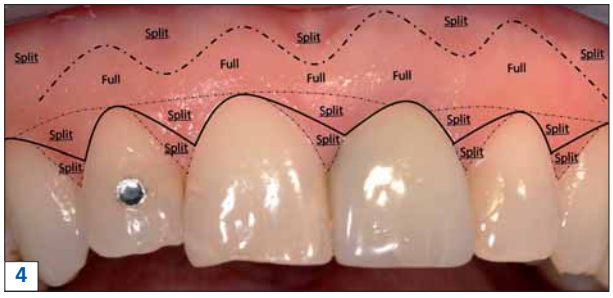

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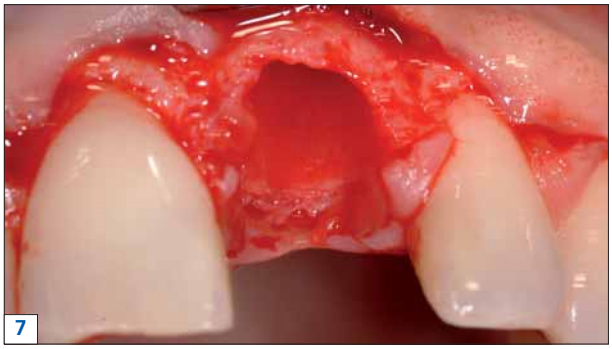

Fig. 1. Pre-surgical image. Tooth 21 presents a root fracture.

Fig. 1. Situation préopératoire. La 21 présente une fracture radiculaire.

Fig. 2. Occlusal pre-surgical view.

Fig. 2. Vue occlusale préopératoire.

Fig. 3. Tooth 21 after crown removal.

Fig. 3. La 21 après la dépose de sa couronne.

Fig. 4. Multiple coronally advanced flap technique. Split-thickness incisions on interdental papillae are executed, followed by intrasulcular incisions on the buccal side of adjacent teeth. In this case an intrasulcular incision is executed on tooth 21 before extraction. Full thickness flap elevation is then made for 3-4 mm. A split-thickness incision is executed in the apical portion of the flap in order to cut muscular insertions allowing for flap coronal displacement.

Fig. 4. Technique du lambeau multiple déplacé coronairement. On réalise des incisions en épaisseur partielle sur les papilles interdentaires, suivies d'incisions intrasulculaires du côté vestibulaire des dents adjacentes. Dans ce cas, on réalise une incision intrasulculaire sur la 21 avant l'extraction. On élève ensuite un lambeau d'épaisseur totale de 3 à 4 mm. On réalise une incision en épaisseur partielle dans la partie apicale du lambeau de façon à sectionner les insertions musculaires permetttant le déplacement coronaire.

Fig. 5. Buccal and papillae incisions.

Fig. 5. Incisions vestibulaires et papillaires.

Fig. 6. Flap raising. / **Fig. 6.** Élévation du lambeau.

Fig. 7. Tooth extraction. / **Fig. 7.** Extraction de la dent.

Fig. 8. Implant insertion. / **Fig. 8.** Pose de l'implant.

Fig. 9. Healing screw placement. / **Fig. 9.** Insertion de la vis de cicatrisation.

Fig. 10. Flap repositioned after suturing. / **Fig. 10.** Lambeau repositionné après sutures.

Fig. 11. Healing after 4 weeks.
Fig. 11. Cicatrisation au bout de 4 semaines.

Fig. 12. Occlusal view after 4 weeks.
Fig. 12. Vue occlusale au bout de 4 semaines.

Fig. 13. Final restoration 6 weeks after implant placement.
Fig. 13. Restauration finale 6 semaines après la pose de l'implant.

Fig. 14. One-year follow-up.
Fig. 14. Suivi à 1 an.

Discussion

Soft tissue management of dental implants has become an important aspect of implant surgery in order to satisfy the increasing patient esthetic demands.
Studies on coronally advanced flap for the treatment of recession type defects have demonstrated that coronal stabilization of the flap is possible and maintainable during time when the interdental attachment level is maintained (Allen and Miller, 1989; Tenenbaum *et al.*, 1980; Cairo *et al.*, 2008).
Multiple coronally advanced flap has been described for the treatment of multiple recession defects and has been demonstrated to be effective in obtaining complete root coverage (Zucchelli and De Sanctis, 2005). Results from this technique have been proved to be stable at five years.
The features of this flap could be utilized in implant surgery: possible advantages of this technique in fact are: absence of vertical incision, better esthetic result, major respect of flap's vascularization, possibility of coronal soft tissue stabilization.
One of the basic principles when performing plastic surgery is to modify incision design in order to avoid the presence of scar tissue in esthetic areas.
Vertical incisions in anterior segments of the mouth may expose the patient to experience scar tissue white lines at the end of the healing processes.
The use of the multiple coronally advanced flap may produce better esthetic results and soft tissue blending, by hiding vertical incisions into gingival margin. Incisions have to be extended on the two adjacent teeth in mesial and distal directions to allow flap mobilization; the absence of vertical incisions has to be compensated with a greater flap including a higher number of teeth.
Advantages of this envelop flap are given by the respect of the vascularization of oral mucosa: incisions are intrasulcular or midcrestal, these are areas where vascularization

is terminal and no major vessels may be damaged (Kleinheinz *et al.*, 2005). This approach may reduce the risk for intra-surgical hemorrhage and may lead to an easier healing phase.

In a recent randomized clinical trial on 32 patients and 92 recession defects (Zucchelli *et al.*, 2009), comparing multiple coronally advanced flap with and without vertical incisions, it has been demonstrated, although an uneventful healing was obtained for all cases, a statistically significantly better result for flap without vertical incisions in terms of postoperative course, surgical chairtime (surgeries without vertical incisions needed less time for their execution). An independent esthetic evaluation of final results made by a blind examiner, regarding contour, contiguity and degree of keloid formation has evidenced that in patients were vertical incisions were utilized, a major incidence of swelling, pain and bleeding when compared with patients having received an envelope flap.

An important aspect of this surgical technique is the incision at adjacent teeth papillae: the use of oblique split thickness incisions at the base of anatomical papillae and the de-epithelialization of remaining part of the anatomical papillae allows the stabilization of new surgical papillae on exposed connective beds in a coronal position. The split thickness incision at the base of the flap, by excluding muscular insertion, allows for the coronal displacement of the flap that has to passively reach its new coronal position.

Post-operative soft tissue shrinkage (+ 1 mm) is described for both two-stage (Grunder, 2000) and one-stage implant procedures (Cochran *et al.*, 2002) at 1-year follow-up. The risk for post surgical soft tissue contraction may be a very bad complication on implant sites.

To reduce this risk, on implant site, the flap is raised full thickness, in order to include the periostium, obtaining more thickness in the critical area and reducing the risk of recession.

Moreover, the coronal displacement of the flap may minimize the risk for apical shrinkage, finally, in particular cases, where gingival recession defects are present on teeth adjacent to implant site, this surgical approach may also obtain the coverage of the exposed root surfaces together with an implant insertion combining mucogingival and implant goals in one surgical procedure. □

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