MODIFIED CONNECTIVE TISSUE PUNCH TECHNIQUE TO INCREASE THE VESTIBULAR/BUCCAL KERATINIZED TISSUE ON FLAPLESS IMPLANT SURGERY: A CASE SERIES

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The aim of this article is to show a simple and predictable technique to enhance both the vestibular/buccal (V/B) gingival thickness (GT) and keratinized tissue width (KTW) improving the soft-tissue profile after flapless implant placement. The technique proposed was named Modified Connective Tissue Punch (MCTP). Fourteen patients (6 men and 8 women) aged between 35 and 69 years (mean value 48.07±13.023 years) were enrolled in this case series. Seventeen implant sites were submitted to flapless procedure. The connective punch (CP) was harvested with a motor-driven circular tissue punch and then a full-split dissection was executed, in order to create a deep pouch, beyond the mucogingival junction, on the V/B side. In this recipient site the CP was placed. The normal flapless surgical protocol was used; implants were inserted and covered with transgingival healing cap screws. GT and KTW were measured: both immediately before and after surgery; at the time of the prosthetic finalization (3-4months, respectively, for mandible and maxilla); 1 year post surgery follow-up. GT was measured at 1 mm, 2 mm and 5 mm on the V/B side, from the outline of the punch. Both KTW and GT at 1 and 2 mm can be effectively increased, while no significant effects for GT at 5 mm can be expected from this technique. Furthermore, the mean values of KTW and GT at 1 mm and 2 mm show significant increases at 3-4 months post-operative, while no further significant increments are shown at 1 year post-operative follow-up. The Authors recommend the use of the MCTP technique to reduce the number of aesthetic complications and soft tissue defects in flapless implant surgery. Longer follow-ups are needed to evaluate the stability of peri-implant tissues over time.

Tooth replacement by means of dental implant is considered to be a predictable procedure in modern dentistry, for both aesthetics and function.

The final goal of implant-supported rehabilitation is to achieve a soft and hard tissue integrity with optimal aesthetics through a minimally invasive surgery combined with an accurate soft-tissue treatment in order to facilitate peri-implant soft-tissue stability over time (1).

Flapless surgical approach was introduced by Ledermann in 1977. In this procedure, a motor-driven circular tissue punch or a circumferential incision

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utilizing a surgical blade was used to remove the soft tissue at the implant site without any surgical flap elevation (2). Another approach of flapless implant surgery is to directly penetrate the alveolar bone through the mucosa with a round bur (3). Among the advantages of this surgery there are the preservation of the circulation, soft tissue architecture and hard tissue volume at the site, accelerated recovery, thus resulting in a better maintenance of the soft tissue profiles, including the gingival margins of adjacent teeth and the interdental papilla (3-6). However, this intervention inevitably entails the removal of the tissue punch at the implant site, often resulting in a significant reduction in width of the keratinized tissue (KT) around the implant.

The importance of a thick, wide keratinized peri-implant mucosa has been indicated for prevention of mucosal recession and maintenance of peri-implant health. Various techniques to augment keratinized tissue on implant sites have been described in the literature: roll flap; connective graft; epithelial and connective graft; coronally advanced flap (7).

The aim of this article is to show a simple and predictable technique to enhance both the vestibular/buccal (V/B) gingival thickness (GT) and KT width (KTW) improving the soft-tissue profile after flapless implant placement.

MATERIALS AND METHODS

Fourteen patients (6 men and 8 women) aged between 35 and 69 years (mean value 48.07±13.023years) were enrolled in this case series. All patients were in good health and gave their informed consent.

Inclusion criteria were:

I. adequate amount of bone volume at implant site, allowing to perform the traditional flapless implant surgery procedure;
II. good general periodontal health and maintenance;
III. no smoking habit;
IV. absence of positive probing depth, bleeding on probing or plaque on teeth next to the implant site, at the time of surgery;
V. at implant site, the KTW should be at least slightly bigger than the selected implant diameter.

Radiographic exams (intra oral X-ray and panoramic X-ray) were initially performed to evaluate the height of available bone. In the selected patients, Cone Beam Computed Tomography (CBCT) (NewTom 5G®, QR, Verona, Italy) was then carried out in order assess whether adequate bone was present at the implant site, for flapless surgery.

The preliminary evaluation of GT and KTW were measured on the V/B side at the implant site by means of a #15 k-file provided with a silicon depth-stop and a periodontal probe respectively (8). The KTW was also measured on the lingual side, while, on the palatal side the presence of palatine fibromucosa made the measurement unnecessary. A scale for endodontic measurement was used to determine the depths recorded with the k-file.

All interventions were subject to the same procedural process: the surgery was performed under local anesthesia (articaine 4% and adrenaline 1:100.000). In the MCTP technique, the only incision was made with a motor-driven circular tissue punch (FAL-31-006-010, FMD, Rome, Italy) of the same diameter of the prosthetic platform of the selected implant. This first incision marked the profile of the connective punch (Fig. 1-4).

The GT was measured inserting the #15 k-file at 1 mm, 2 mm and 5 mm, on the V/B side, from the outline of the punch.

The KTW was measured with a periodontal probe, both on the V/B side and the lingual side, from the outline of the punch.

After taking note of the values, the connective punch was first de-epithelialized by means of a sharp Lucas bone curette (spoon 2.4 mm wide) and then detached with the same instrument.

The Authors recommend performing the de-epithelialization when the punch is still adhering to the periosteum since it is often too small and becomes difficult to handle once detached. To harvest the whole intact punch graft, the same sharp Lucas Curette is used. First the incision margins are marked, then the full thickness punch is elevated, keeping it stable with a small tissue tweezer. This facilitates the graft dissection. The connective punch was temporarily placed in a physiological saline solution. The same Lucas bone curette was then used as a periosteal elevator to execute a full-thickness dissection in order to create a deep pouch beyond the mucogingival junction on the V/B side. This will be the recipient site for the connective tissue graft. Using a small angled dental

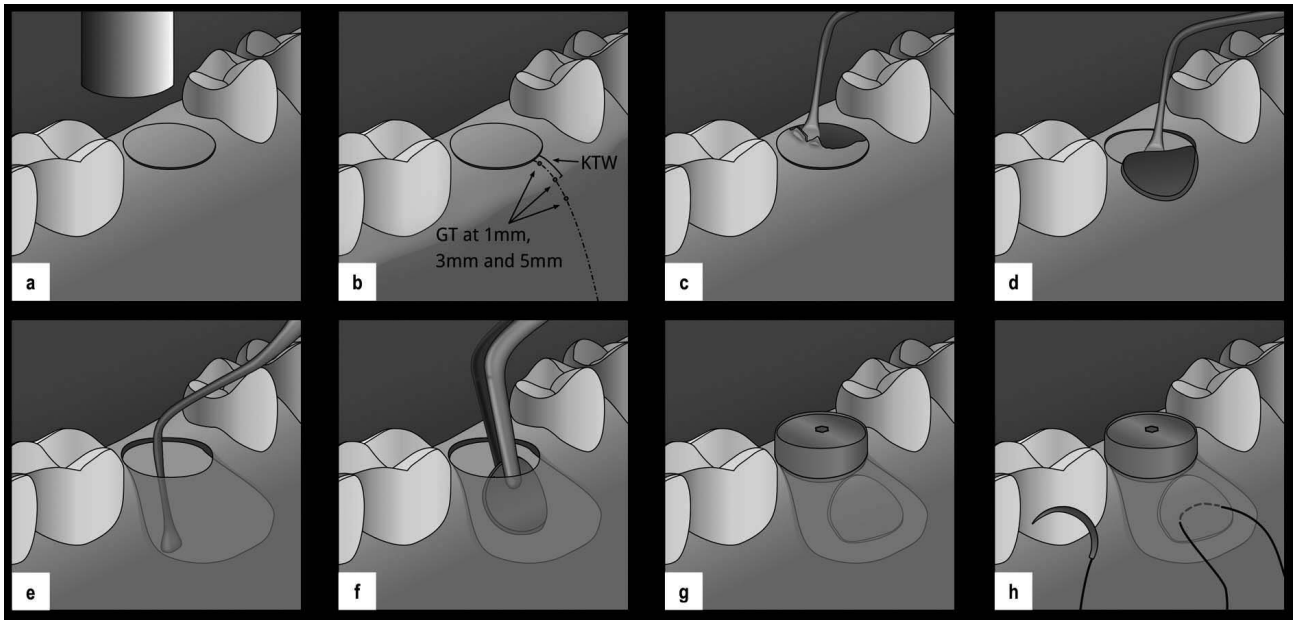

Fig. 1. *Illustrations explaining each step of this procedure:* ***a****) punch incision by means of a motor-driven circular tissue punch of the same diameter of the selected implant;* ***b****) measurement of KTW and GT at 1 mm, 3 mm and 5 mm from the outline of the punch. KTW was also measured, in the same manner, on the lingual side;* ***c****) punch de-epithelialization is performed by means of a Lucas Curette;* ***d****) punch elevation and detaching with the same curette;* ***e****) creation of the recipient site by means of a full-thickness dissection with the same curette beyond the mucogingival junction on the vestibular side;* ***f****) punch inserted in the pouch by means of a small angled dental tweezer;* ***g****) conclusion of the surgical procedure with the transgingival healing cap and the connective punch in place;* ***h****) punch sutured, only in cases of short pouches, when further stabilization is needed.*

Fig. 2. *The motor-driven circular tissue punch used for the initial incision.*

tweezers the punch was inserted into the deep portion of the pouch and left in this position during all the procedures of both implant tunnel preparation and implant placement. The graft must be completely submerged into the pouch during the following implant surgery procedure in order to avoid any undesired movement from its site.

Then the normal flapless surgical protocol was used; the implant was inserted (Elisir, or I-Fix, FMD, Rome, Italy) and covered with a transgingival healing cap screw. A periapical radiograph was taken after implant insertion to verify the correct implant position. The punch was then pushed, along the pouch, from its deeper portion up to its more coronal one, delimited by the transgingival healing cap screw, and stabilized in its position by means of a 2-min finger pressure, to relocate the graft in the position where it is most needed. This step is essential in case there are specific areas where we aim to improve the soft-tissue profile. Usually in most cases, with this latter procedure, the punch does not need a further fixation, but in case of short pouches the stabilization via suture is advisable.

Amoxicillin combined with clavulanic acid was

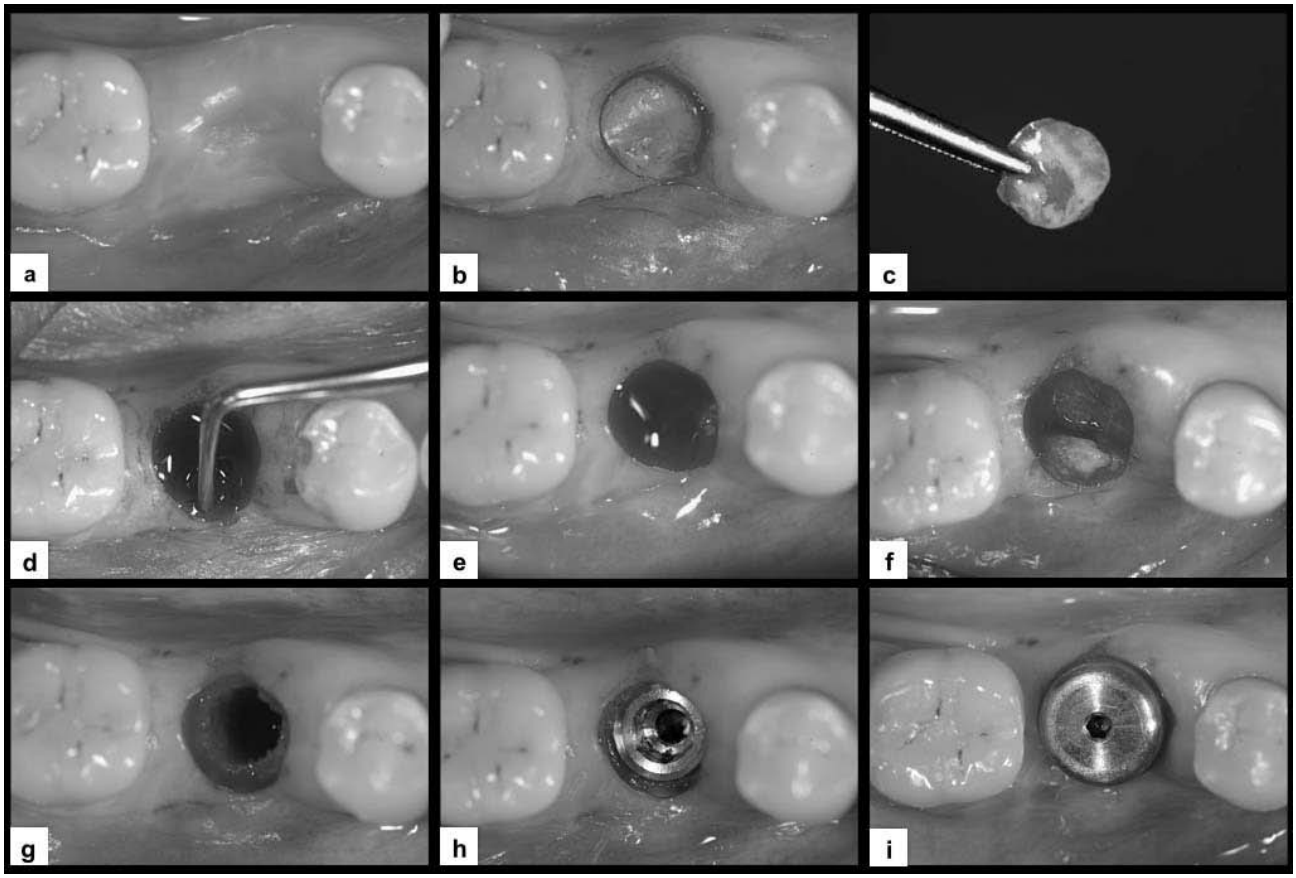

Fig. 3. *Clinical case describing each step of this procedure:* ***a****) clinical situation immediately before surgery;* ***b****) punch incision by means of a motor-driven circular tissue punch of the same diameter of the selected implant;* ***c****) punch de-epithelialized and elevated;* ***d****) operator using the Lucas Curette to create of the recipient site by means of a full-split dissection beyond the mucogingival junction on the vestibular side;* ***e****) recipient site ready to receive the punch graft;* ***f****) punch graft inserted in the recipient site;* ***g****) preparation of the implant tunnel;* ***h****) implant placed;* ***i****) transgingival healing cap screw in place.*

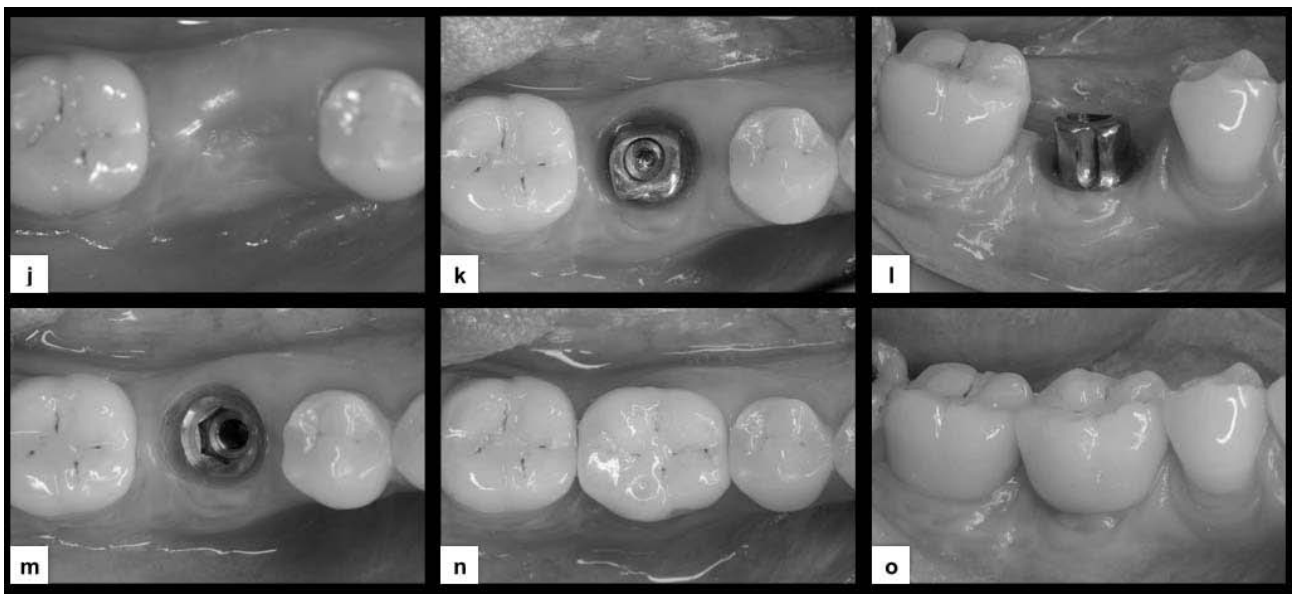

Fig. 4. *Continuation of Fig. 3:* ***j****) initial situation;* ***k-l****) occlusal and lateral views of the definitive abutment;* ***m****) occlusal view of the soft tissue healing around implant fixture at one year post-surgery follow-up, in this particular case the crown was removed in order to facilitate the measurements;* ***n-o****) occlusal and lateral views of the cemented metal-ceramic crown.*

administered, with a dose of 2 g preoperatively, followed by 1 g twice a day for 7 days. Ibuprofen 600 mg was prescribed to be taken as needed. A soft diet was recommended for 2 weeks, together with appropriate oral hygiene. The sutures, when used, were removed 14 days after the surgical procedure.

The implants were finalized with cemented metal-ceramic crowns after 3 months for mandibular implants and after 4 month for maxillary implants, at the same time all the parameters relevant for this study were measured (i.e. GT and KTW).

At the 1 year post surgery follow-up the prosthetic and implant conditions were valued as well as the soft-tissue stability, and all the parameters were measured again.

Both GT and KTW values were statistically compared, within the groups, by means analysis of variance (ANOVA), carried out with a confidence level of 95% ($\alpha = 0.05$) (Primer Biostatistics Ver. 4.02i; McGraw-Hill Comp., USA).

RESULTS

Seventeen two-piece implants were placed. Fixtures replaced: 10 molars (2 upper, 8 lower); 6 premolars (4 upper, 2 lower); 1 incisive (upper). The postoperative course was uneventful for all the patients in this study.

At lingual/palatal side of the healing cap, no dehiscence of the mucosa was observed and the residual KTW was maintained. In fact, the mean values at the time of surgery, at the time of the prosthetic finalization (3-4months) and at 1 year post-surgical follow-up were 2.9+-0.422 mm, 2.9±0.316 mm, and 2.7+-0.675 mm, respectively.

At the vestibular side of the healing cap, variations of both KTW and GT were observed. The average KTW at the time of surgery, at the time of the prosthetic finalization (3-4months) and at 1 year post-surgical follow-up were 2.18±1.282 mm, 3.29±1.2 mm, and 3.65±1.272 mm, respectively.

The average GT at 1 mm at the time of surgery, at the time of the prosthetic finalization (3-4months) and at 1 year post-surgical follow-up were 1.75±0.928 mm, 3.03±0.910 mm, and 3.44±1.088 mm, respectively.

The average GT at 2mm at the time of surgery, at the time of the prosthetic finalization (3-4months) and 1 year post-surgical follow-up were 1.92±0.879 mm, 3.26±0.773 mm, and 3.59±0.888 mm, respectively.

The average GT at 5 mm at the time of surgery, at the time of the prosthetic finalization (3-4months) and at 1 year post-surgical follow-up were 3.22±0.927 mm, 3.56±0.429 mm, and 3.56±0.429 mm, respectively.

Significant differences for both time of surgery *vs* time of prosthetic finalization and time of surgery *vs* 1 year follow-up were found for KTW V/B, respectively p=0.002 and p=0.011.

Highly significant differences for both time of surgery *vs* time of prosthetic finalization and time of surgery *vs* 1 year follow-up were found for GT at 1 mm (p = 0.000 for both) and GT at 2 mm (p=0.000 for both).

No significant differences for time of prosthetic finalization *vs* 1 year follow-up were found concerning: KTW V/B (p=0.411); GT at 1 mm (p=0.240); GT at 2 mm (p=0.266); GT at 5 mm (p=1.000).

No significant differences for both time of surgery *vs* time of prosthetic finalization and time of surgery *vs* 1 year follow-up were found for GT at 5 mm (p=0.183 for both).

No significant differences were found among the groups for KTW L (time of surgery vs 3-4months p=0.556; time of surgery vs 1 year p=0.696; 3-4months vs 1 year p=0.455).

DISCUSSION

Healthy soft tissue surrounding dental implants is essential for health, function, and esthetics (3).

The presence of attached gingiva around implants is important to prevent recession of marginal tissue, to provide a tight collar around implants, to prevent spread of peri-implant inflammation and also to enable patients to maintain good oral hygiene (3, 7, 9). The MCTP technique described in this article is simple, easy to perform and satisfies all the above requirements.

As confirmed by the clinical results, the augmentation of GT is always present and seems to be stable at 1-year follow-up. The changes of KTW appear to be minimal but always favorable. In the Authors' experience, the critical factor that leads towards KT augmentation is the depth of the recipient site where the graft is placed: when the connective punch results as being superficial enough, it seems

to be able to induce a transformation of the external connective tissue into KT, thus augmenting the peri-implant KT.

The results obtained with this technique confirmed that the use of connective tissue grafts at implant placement is effective in increasing soft tissue thickness and improving aesthetics, as declared with other techniques in literature (9).

Both KTW V/B and GT at 1 mm and 2 mm can be effectively increased, whereas for GT at 5 mm, no significant effects can be expected from this technique. Furthermore, the mean values of KTW V/B and GT at 1 mm and 2 mm show significant increases at 3-4 months post-operative, while no further significant increments are showed at 1 year post-operative follow-up.

The success of both dental implant and prosthetic treatment is dependent on the establishment of a stable soft-tissue barrier that is able to shelter the underlying osseous structures and to guarantee peri-implant gingival aesthetics over time.

Different approaches have been used to augment keratinized tissue on implant sites (e.g. roll flap, connective graft, epithelial and connective graft, coronally advanced flap) (7). Although it has been shown that it is possible to improve the soft tissue profile with all these techniques, we found this procedure the most simple to execute when flapless implant surgery is performed. Other techniques often require longer surgical-times and dedicated instruments, present more difficulties in the surgical steps and have a higher morbidity rate.

The Authors recommend the use of the MCTP technique to reduce the number of esthetic complications and soft tissue defects in flapless implant surgery. Longer follow-ups are needed to evaluate the stability of peri-implant tissues over time.

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