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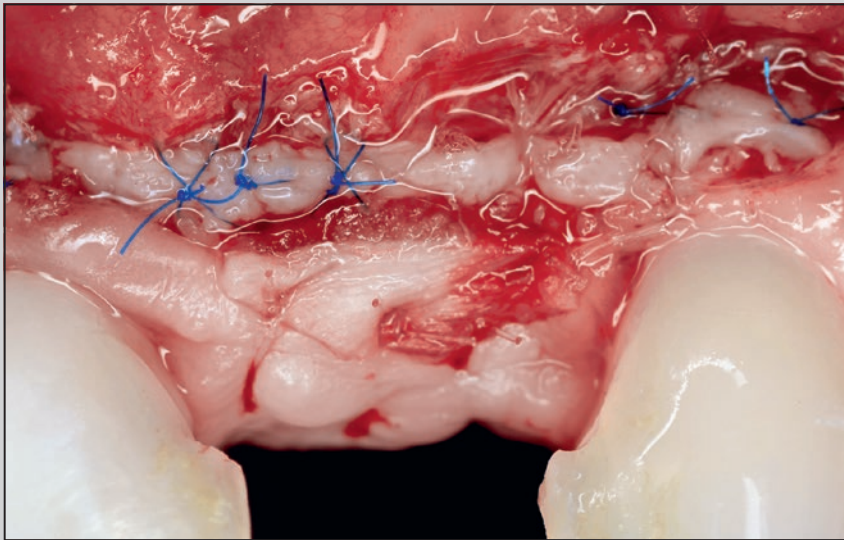


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Labial Strip Gingival Graft for the Reconstruction of Severely Distorted Mucogingival Defects: A Prospective Case Series



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Several techniques involving the harvesting of a soft tissue graft from the palate have been proposed for regenerating keratinized mucosa (KM) at implant sites. However, patient morbidity and poor esthetic outcomes are considered the main drawbacks of these approaches. Therefore, the aim of this study was to describe and evaluate a new technique for harvesting keratinized tissue from the adjacent labial site (labial gingival graft [LGG]), in combination with a xenogeneic collagen matrix (XCM) or a connective tissue graft (CTG). Eighteen patients were enrolled and participated in this case series. The primary outcomes were KM gain after 12 months and patient-reported satisfaction, esthetics, and morbidity using a visual analog scale (VAS). All treated sites healed uneventfully, showing a mean KM gain of 6.8 ± 2 mm. The average VAS score for patient satisfaction and the self-reported esthetic outcomes were 95.6 ± 6.9 and 93.4 ± 9.2 , respectively, and the score for morbidity was 22.8 ± 22.3 . However, the VAS score for morbidity dropped to 8.7 ± 8.4 when CTG-treated subjects were excluded. Higher esthetic results were observed when XCM was used instead of CTG and when LGG was harvested from the anterior region of the implant site ($P < .05$ for both comparisons). LGG with XCM or CTG is a viable technique for regenerating KM at implant sites with high patient satisfaction and esthetics and low morbidity outcomes. *Int J Periodontics Restorative Dent* 2020;40:845–852. doi: 10.11607/prd.4912

Whether a minimum width of keratinized mucosa (KM) is necessary for maintaining peri-implant health has been a controversial topic in the last decade.^{1–3} Several authors have shown that a lack of or an inadequate peri-implant KM width is associated with high plaque accumulation, tissue inflammation, mucosal recession, and attachment loss,^{1,4} while other investigations failed to demonstrate this association.² Nevertheless, recent studies suggest that having < 2 mm of KM width may be associated with peri-implant diseases.^{4,5} While this does not necessarily imply that implants without KM cannot remain healthy over time, it is reasonable to assume that, in the absence of KM, the probability of having suboptimal plaque control increases along with the chance of developing marginal bone loss, mucosal recession, and bleeding on probing.^{3–6}

Major bone augmentation procedures may also result in severe translocations of the mucogingival junction (MGJ)^{7–10} and reduced vestibular depth, which can negatively impair patients' oral hygiene. Among the techniques that have been suggested for re-creating an adequate KM width around implants, the free gingival graft (FGG) is considered the treatment of choice^{3,11} that also repositions the MGJ and deepens the vestibule.¹²

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Nonetheless, patient morbidity and color mismatch have been reported as major shortcomings of FGG.^{3,13,14} Therefore, it is not surprising that clinicians have explored alternative graft materials—such as collagen matrices, the acellular dermal matrix, and tissue-engineered constructs—for reducing patient morbidity and improving the final esthetic outcome.^{15,16} However, these materials were not able to provide the same clinical outcomes as FGG.^{11,15,16} Thus, based on the original concept of Han and coworkers,^{17,18} Urban et al have introduced a technique involving the combination of an apically placed strip of gingival graft from the palate (PGG) with a xenogeneic collagen matrix (XCM) positioned coronal to the graft.⁸ The autogenous soft tissue graft plays a key role as a mechanical barrier for repositioning the MGJ and deepening the vestibule, and as a cell source for promoting cellular migration and differentiation within the 3D collagen scaffold.^{7,8} Another advantage of this technique includes the reduced morbidity compared to the traditional FGG.^{19,20} Therefore, the aim of the present study was to investigate the clinical and patient-reported outcomes of the strip gingival graft technique in which the autogenous graft is obtained from the adjacent labial keratinized tissue for the reconstruction of severely distorted mucogingival defects.

Materials and Methods

The PROCESS (Preferred Reporting Of CasE Series in Surgery) for

improving the quality of reports²¹ was followed in the preparation of the present manuscript. The protocol for the follow-up study was approved by the Ethics Committee of the University of Szeged, Hungary, and was in full accordance with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all recruited participants. The current study was designed as a single-center prospective case series, in which individuals presenting with at least one site lacking KM in conjunction with the loss of vestibular depth as a result of advanced horizontal and vertical ridge augmentation were consecutively screened for eligibility. Patients were considered eligible to participate only if they were in good periodontal and systemic health, nonsmokers, able to maintain good oral hygiene, and willing to comply with the study protocol.

All surgical procedures were performed at the Urban Regeneration Institute (Budapest, Hungary) by the same experienced operator (I.A.U). The surgical intervention consisted of a combination of an apically placed autogenous strip of gingival graft with an XCM (Mucograft, Geistlich) or a connective tissue graft (CTG) that was positioned coronal to the graft, as previously described.^{7,8} Open healing was utilized for CTG when more mucosal thickness was needed. In the present investigation, the autogenous strip gingival graft was harvested from the keratinized tissue adjacent to the mucogingival defect. Briefly, after applying local anesthesia (articaine hydrochloride

4% with epinephrine 1:100,000; Novocol Pharma), a horizontal incision was made on the keratinized tissue parallel to the MGJ. If the previous regenerative procedure had been performed simultaneously with implant placement and the implants were still submerged, the horizontal incision was placed on the palatal side of the ridge. For implants that were already restored, the horizontal incision was performed intrasulcularly to preserve the maximum thickness of the peri-implant mucosa. The flap was then elevated with a split-thickness dissection to apically reposition the MGJ at its original position (before the bone regeneration procedure) using T-mattress sutures (5-0 Monocryl, Ethicon). The resulting recipient site consisting of the periosteal bed was smoothed using sharp dissection to avoid any loose fibers or irregularities. An autogenous strip gingival graft was harvested from the labial keratinized tissue of the adjacent mesial or distal-site labial gingival graft (LGG) in a way that its length was able to cover the full apical extension of the recipient bed. The LGG was only 2 to 3 mm in height (apicocoronal dimension) and was sutured immediately after harvesting to the apical end of the recipient bed with absorbable monofilament sutures (6-0 Glycolon, Resorba). The remaining periosteal bed coronal to the LGG was covered with the XCM that was trimmed and customized for the available space and sutured with single interrupted and cross-mattress sutures (6-0 Glycolon; Fig 1). When additional mucosal thickness was needed, a subepithelial CTG

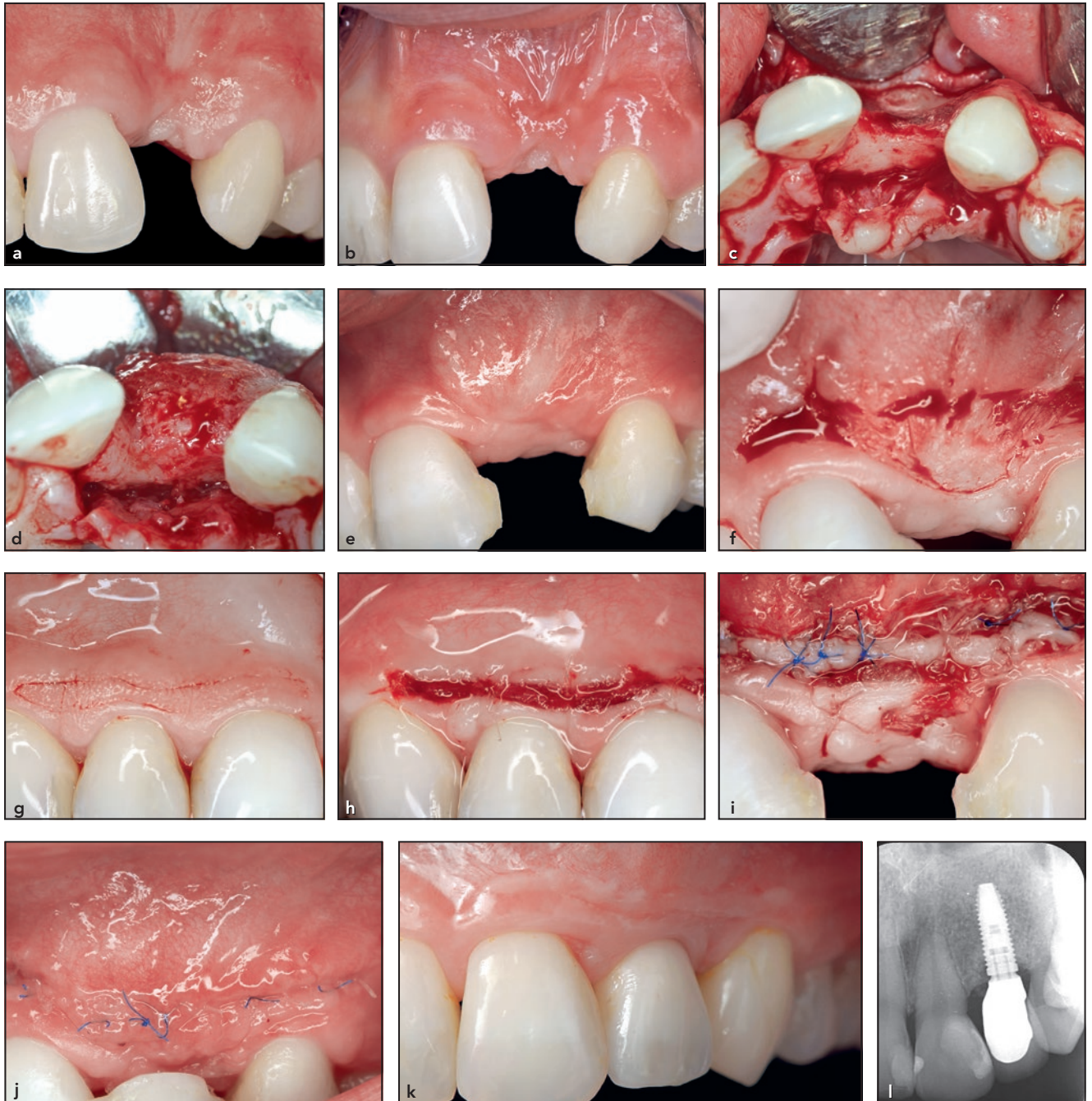


Fig 1 Representative case of an LGG in combination with an XCM. The patient presented after implant failure with severe bone loss, loss of the papilla, and a mucogingival distortion. (a) Facial view of soft tissue defect after implant loss. (b) Labial view of the mucogingival distortion caused by previous unsuccessful surgeries. (c) Occlusal view of the severe bone defect after flap elevation. (d) Occlusal view of the regenerated bone. (e) Labial view of the site after bone reconstruction, implant placement, and closed connective tissue grafting. (f) Apically positioned flap at the soft tissue defect area. (g) LGG donor site. (h) An XCM strip was sutured over the donor site. (i) LGG and XCM in place. (j) Healing progress after 1 week. (k) Facial view of the donor site after 7 months of healing. (l) Periapical radiograph of the implant 7 months after placement. In this patient's evaluation, they noted that the graft strip around the implant is visible. However, because its color is the same as the surrounding gingiva, it was very satisfying to the patient. Further, the patient could not see a difference in the donor-site tissue.



Fig 2 Representative case of an LGG in combination with an open healing CTG. (a) Facial view of the mucogingival distortion after bone reconstruction and placement of implants. (b) Apically repositioned flap + LGG. (c and d) Facial and occlusal views of the LGG and CTG, with a collagen matrix in place. (e) Facial view of the grafts after 2 weeks of healing. (f) Facial view of the soft tissue graft after 10 months of healing. Note that zirconium provisional crowns are in place on the implants. This patient reported excellent satisfaction of this case; however, there is a clear difference in gingival color. This color difference can be attributed to the graft being harvested more palatally as well as to the CTG's open healing. Note that gingival symmetry has not yet been achieved and that there is a slight recession at the right central incisor, potentially caused by the strip that was sutured close to this area. This is the only patient who had this type of complication, and it is planned to correct the recession before fabrication of the final restorations. (g) Periapical radiograph of the implants after loading.

harvested from the palate using the single-incision technique²² was used together with XCM and was stabilized coronal to the LGG with single

interrupted and cross-mattress sutures (6-0 Glycolon; Fig 2). The LGG and XCM/CTG were left exposed during healing, while a collagen ma-

trix (Mucograft) was applied on the labial donor site.

The primary aim of the present study was to evaluate the increase in

the width of KM between baseline and 1 year postsurgery. The baseline reference measurement point was either the free mucosal margin around the implants or, when the implants were still submerged, the MGJ projected from the adjacent teeth. Immediately after surgery at the same visit, the augmented tissue was assessed with a periodontal probe (UNC, Hu-Friedy) from the apical extension of the graft to the established baseline reference point, and rounded up to the nearest 0.5 mm. These measurements were also performed at the 6- and 12-month follow-ups.

The secondary aim was to evaluate patient-reported outcomes in terms of satisfaction, esthetics, and morbidity/discomfort, measured using a visual analog scale (VAS) from 0 to 100. Specifically, patients were asked to grade the esthetics of the gums around their implants comparing it to the gums around the adjacent teeth in a VAS, where 0 indicated "completely different" and 100 indicated "I can't distinguish the gum around the implants from that of around the teeth." In the VAS for measuring satisfaction, 0 indicated "not satisfied at all" and 100 indicated "extremely satisfied." For the VAS measuring morbidity/discomfort, 0 indicated "no pain at all" and 100 indicated "worst pain ever experienced." In addition, patients' willingness to undergo the same procedure again, if necessary, was assessed. These patient-reported outcomes were collected at the 12-month follow-up.

Lastly, this study aimed to compare the clinical and patient-

reported outcomes when LGG was used with XCM or with CTG and when LGG was harvested mesial or distal to the implant site.

Statistical Analysis

Data were expressed as means \pm SDs. Comparisons between baseline and the 6- to 12-month KM values were performed using paired Student *t* tests ($\alpha = .05$). Linear regression analysis was performed to evaluate if factors such as LGG being harvested from anterior vs posterior sites or using XCM vs CTG affected the clinical and patient-related outcomes. All analyses were conducted in RStudio version 1.1.383.

Results

Eighteen systemically healthy patients (7 men and 11 women; mean age: 40.2 ± 14.2 years) participated in the present study. All participants received LGG between implant placement and the second-stage surgery. In 11 patients, the LGG was harvested mesial to the implant area, while the LGG was obtained distal to the implant site in the remaining 7 cases. Eight patients also received a CTG harvested from the palate, whereas only XCM was applied coronal to the LGG for the other 10 patients. None of the patients had any relevant postoperative complications (severe pain, infection, bleeding, or loss of the LGG).

Immediately after surgery, the average graft width (including the LGG with the XCM or CTG) was 11.8

± 4 mm. The average KM width after 12 months was 6.8 ± 2.0 mm, corresponding to a graft shrinkage of 42.4%. The average 12-month VAS score for patient satisfaction was 95.6 ± 6.9 , while esthetic outcomes and morbidity were 93.4 ± 9.2 and 22.8 ± 22.3 , respectively. When subjects who received CTG were excluded, the morbidity score was reduced to 8.7 ± 8.4 . When only patients who had additionally received a CTG were considered, the VAS score for morbidity was 39.2 ± 33.2 . Despite similar patient satisfaction rates for sites with and without the additional CTG, a significantly higher self-reported esthetic score was observed for sites that did not receive the additional CTG compared to those who received CTG in addition to LGG + XCM (97.9 ± 3.9 vs 75.6 ± 34.8 , respectively; $P < .05$; Table 1). Furthermore, the linear regression analysis showed that higher self-reported esthetics were obtained when the LGG was harvested from the mesial compared to the distal side (coefficient from the mode: 15.25 [95% confidence interval: 9.38, 21.12]; $P < .001$). The willingness to undergo the same procedure again if necessary was 100%. None of the patients reported pain or esthetic concerns from the labial donor site.

Discussion

The present study was aimed at evaluating the efficacy of a new technique for augmenting peri-implant KM and assessing patients' self-reported morbidity, satisfaction,

Table 1 Patient-Reported Outcomes at 12 Months

	Satisfaction	Esthetics/color match	Morbidity/discomfort	Willingness to retreatment, %
LGG (overall)	95.6 ± 6.9	93.4 ± 9.2	22.8 ± 27.3	100
LGG + XCM	95.7 ± 7.9	97.9 ± 3.9	8.7 ± 8.3	100
LGG + CTG	95.5 ± 6.4	75.6 ± 34.8	39.2 ± 33.2	100

Satisfaction, esthetics, and morbidity values are reported as mean ± SD evaluations based on a 100-point visual analog scale. High numbers indicate a positive response for satisfaction and esthetics but indicate a negative response for morbidity.

esthetic rates, and willingness to undergo retreatment. Patient-reported outcomes have progressively become important outcome measures of periodontal and implant therapy.^{23–25} It has been demonstrated that FGJ is the treatment of choice to regenerate peri-implant KM.¹¹ However, morbidity and poor esthetic outcomes are considered the main drawbacks of this approach.^{3,13,26} The strip PGG technique used in combination with XCM has been shown to be able to regenerate 6.33 mm of KM on average, with an overall patient discomfort of 23.5 (out of 100 [maximum discomfort]).⁸ In addition, a recent article demonstrated that KM augmented with PGG + XCM histologically resembles the “normal” keratinized tissue.⁷ Nonetheless, FGJ harvested from the palate tends to retain its original appearance, displaying a poor color match to the adjacent sites.^{3,26} The present study investigated the efficacy of using FGJ harvested from the adjacent keratinized tissue (LGG) for regenerating KM at implant sites. With this technique, the LGG is sutured apically to the periosteum and serves as a mechanical barrier that maintains the MGJ at the desired apical

position, promoting cell migration into the scaffold (XCM). The present findings showed that LGG was able to promote a KM gain of 6.8 mm, which is in line with previous studies using FGJ or PGG + XCM.^{8,27,28} In particular, the current studies also showed that PGG + XCM resulted in a similar KM gain (6.3 mm vs 6.8 mm of LGG) and shrinkage (43.7% vs 42.4% of LGG) after 12 months, suggesting that LGG is as effective as the previously described PGG.

The overall reported morbidity for LGG was 22.8 ± 22.3 on the VAS, with no patients reporting discomfort at the labial donor site. However, when patients who received CTG with LGG were excluded from the morbidity assessment, the numbers dropped to 8.7 on the VAS. Although a direct comparison between the PGG + XCM and LGG + XCM cannot be performed due to the design of the present study, the results seem to suggest that LGG + XCM is equally effective to the PGG + XCM in regenerating KM at implant sites but with less discomfort. Indeed, harvesting a strip graft from the adjacent sites and not from the palate not only limits the surgery to a single surgical

site, but it also reduces the surgical time and the risk of complications from the palatal donor site.^{29,30}

In addition to the observed high patient satisfaction and willingness to undergo retreatment, the results from the questionnaires also showed a high patient-reported color match of the LGG with the adjacent sites (VAS score of 93.4 ± 9.2). This is probably due to the fact that the harvested keratinized tissue graft comes from areas adjacent to the implants and not from the palate. Interestingly, a greater self-reported esthetic score was found when the LGG was obtained mesial to the implant site compared to distal harvesting. This was also confirmed by the authors’ clinical impression. However, the reasons for this finding are open to speculation.

Another interesting finding from the present analysis was that adding CTG to the LGG resulted in lower patient-reported esthetic scores and higher morbidity compared to LGG + XCM. The rationale for using CTG was increasing mucosal thickness at the most coronal aspect of the implants, which has been shown to be associated with less marginal bone loss over time.¹¹

However, an increased mucosal thickness may also be achieved at the time of second-stage surgery, with the CTG positioned below the flap rather than exposed during the healing.

Among the limitations of the present study, the lack of a control group has to be mentioned, as it does not allow for a direct comparison between the described technique and the PGG or FGG. Future studies are necessary to further assess these findings and to compare the outcomes of this approach to other techniques.

Conclusions

The present study showed that the LGG in combination with an XCM or CTG is a valid technique for regenerating KM at implant sites, presenting high patient satisfaction and esthetics and low morbidity. In particular, harvesting the graft mesial to the implant site and using XCM instead of CTG seemed to be related to higher patient-reported outcomes. Nevertheless, future studies are necessary to validate these preliminary findings.

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