

Pontic Site Development using Soft-tissue Augmentation with Connective Tissue Graft in Maxillary Anterior Region: A Case Report

SHRUTI HIRALAL KALBAGE¹, SUJEET V KHISTE², AESHA ISRAR AHMED KHAN³, SHRUTI NIVRUTI MHATRE⁴

ABSTRACT

Restoring a localised alveolar ridge defect in the anterior aesthetic zone poses the greatest challenge in the field of Perio-aesthetics. Various soft-tissue augmentation techniques have been recommended for soft-tissue augmentation. The present case report shows treatment of a Siebert's Class-III ridge defect using an interpositional connective tissue augmentation technique and restoration with an ovate pontic design to achieve an increase in soft-tissue volume and aesthetic outcome. A 58-year-old male patient was referred to the Department of Periodontics for the replacement of a missing tooth at position 11. The patient was given two treatment options: Guided Bone Regeneration (GBR) followed by the placement of an implant or Soft-tissue augmentation with Connective Tissue Graft (CTG) and restoration with a Fixed Dental Prosthesis (FDP). The patient opted for soft-tissue augmentation along with FDP, and the procedure was carried out. The results showed that this technique improved the soft-tissue quality and quantity without the use of any hard-tissue grafts. The soft-tissue augmentation mimicked the natural healthy emergence profile in a Siebert's Class-III ridge defect. The use of subepithelial CTG gives a predictable results in FDP as a prosthetic option and is cost-effective compared to other synthetic graft materials. The technique used in the present case report is simpler, predictable and less invasive compared to the morbidity associated with the harvesting of an autogenous bone graft for augmentation.

Keywords: Aesthetics, Connective tissue grafts, Interpositional graft, Localised ridge defect

CASE REPORT

A 58-year old male patient was referred to the Department of Periodontics because the patient desired the replacement of missing tooth 11. Dental history revealed tooth loss due to trauma five years ago. The patient is physically healthy but has been hypertensive for the past 15 years and is on medication for the same, taking Tab. Telmikind 20 mg once daily and Tab Ecosprin 75 mg once daily.

Clinical examination revealed missing teeth with tooth no. 11 {according to the Fédération Dentaire Internationale (FDI)} along with a localised ridge defect categorised into Siebert's Class-III defect, which is the loss of hard-tissue as well as soft-tissue in the buccolingual and apico-coronal directions. According to Siebert's classification: Class-I-buccolingual loss of tissue, Class-II-apico-coronal loss of tissue, and Class-III-a combination of buccolingual and apico-coronal loss of tissue. The adjacent teeth were vital and periodontally sound. Clinically, other sites had missing teeth 31,32,41,42. There was an absence of bleeding, periodontal pockets, and the amount of alveolar bone present was adequate. There was a presence of generalised Class-I gingival recession.

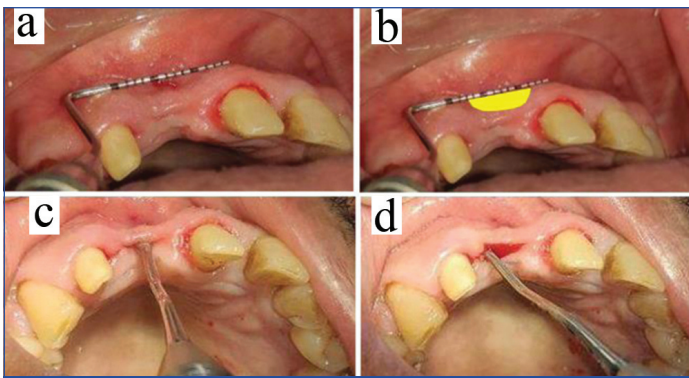
The patient was given two treatment options: the first being GBR followed by implant placement, and the second being a tooth-FDP with teeth 21 and 12 serving as abutments along with soft-tissue grafting. The advantage of soft-tissue grafting is that it is minimally invasive with the defect being localised, and autogenous grafts offer the advantage of cost-effectiveness and predictably positive results. GBR followed by the placement of an implant would be an ideal option for restoring Siebert's Class-III defect, but this treatment option is comparatively invasive, using synthetic bone substitutes, and a long-time process for completing the entire treatment, as well as requiring additional costs for the bone grafts and membranes. After all the planning and discussion, the patient opted for FDP and soft-tissue grafting, owing to its advantages of being less traumatic, simpler, predictable, requiring less time duration, and being cost-effective. Hence, an interpositional graft technique was planned using CTG for augmentation. An Adams

clasp retainer was fabricated to protect the donor site postsurgery. A written informed consent was obtained from the patient to undergo the surgical procedure and include clinical images for publication. As the patient was hypertensive and was on an antiplatelet drug, a physician's consent and physical fitness certificate were also obtained before surgery. The patient did not have any deleterious habits such as smoking, or the consumption of alcohol or tobacco, which might influence the treatment outcome related to healing and necrosis of the graft.

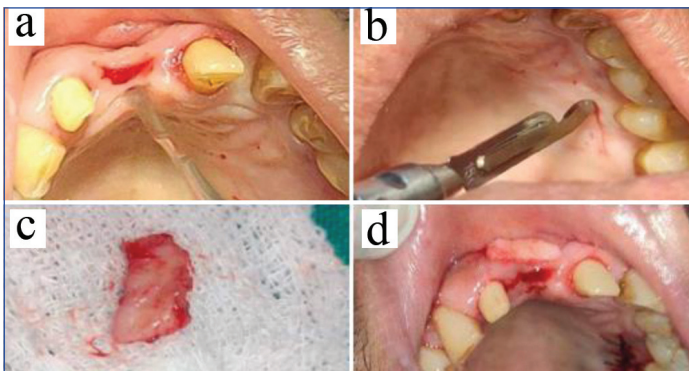
Surgical Procedure: Pre operative condition of the patient with collapsed ridge in the bucco-palatal direction. [Table/Fig-1]. Assessment of the ridge defect was done before the start of the procedure. [Table/Fig-2a-d]. The patient was given a presurgical rinse using 0.2% chlorhexidine. After achieving analgesia with 2% lignocaine and 1:200,000 adrenaline, a horizontal incision was given slightly buccal to the alveolar ridge as the defect was present on the buccal aspect. This incision provided proper access to the defect without involving the interdental papilla. A #15c blade was used for the incision, ensuring that the interdental papilla was not included in the incision to avoid the loss of papilla, may cause black triangles impairing the aesthetics and to avoid food impaction. A supra-periosteal pouch was then created with the help of a tunnelling instrument [Table/Fig-3a-d]. A tunnelling instrument is a spoon-shaped blunt instrument used for elevating partial-thickness flaps or pouches. It helps preserve and maintain papillary height and it causes minimal damage to the soft-tissue.



[Table/Fig-1]: Preoperative photograph. Collapsed ridge in the bucco-palatal direction



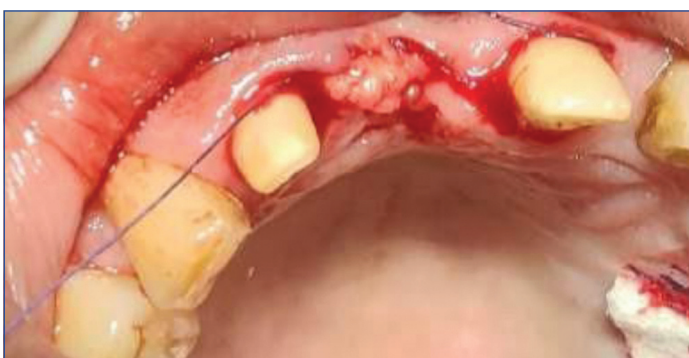
[Table/Fig-2]: a) Assessment of the ridge defect; b) Highlighted area showing the ridge defect; c,d) Crestal incision given with no #15c blade and partial thickness flap elevation using tunneling instrument.



[Table/Fig-3]: a) Pouch created using tunneling instrument; b) CTG harvested using single incision technique; c) Connective Tissue Graft (CTG) harvested; d) Volume of the graft assessed at the defect site.

Once the dimensions were gauged using a University of North Carolina (UNC #15) probe, a subepithelial CTG was harvested from the palate using a #15c blade. The graft was obtained from the region between the canine and first molar using a single incision technique. The incision starts 3 to 4 mm away from the gingival margin, with a layer thickness of 1.5-2 mm and a width of 10 mm. The tissues were sharply undermined to separate the connective tissue layer from the epithelium. After preparation, the deep-lying connective tissue was separated by incisions reaching the bone and detached from the bone with a periosteal elevator [Table/Fig-3a-d]. The graft was then tucked into the pouch and secured using 4-0 Vicryl sutures [Table/Fig-4]. An initial suture was given apically to the pouch to avoid displacement of the graft further apically [Table/Fig-5]. After suturing the graft into the pouch, a periodontal pack was placed to give further protection to the operated area. The donor site flap was secured using interrupted 4-0 black silk sutures, and Abgel was applied [Table/Fig-6a,b]. Abgel is a haemostatic agent that helps in arresting the bleeding at a faster rate forming a matrix for thrombus formation.

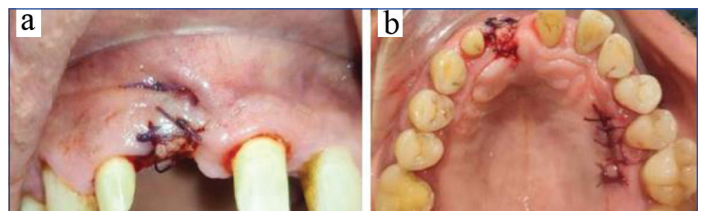
The patient was given a retainer to protect the donor site [Table/Fig-7]. The patient was prescribed Antibiotics (Amoxicillin 500 mg TDS) and Analgesics (Enzoflam TDS) for 5 days. The patient was



[Table/Fig-4]: CTG being tucked into buccal pouch.



[Table/Fig-5]: Initial apical suture given to avoid displacement of the graft.



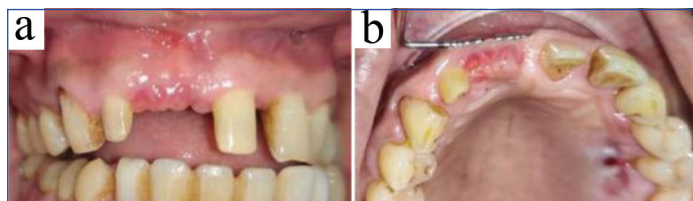
[Table/Fig-6]: a) Suturing done at the recipient site using 4-0 Vicryl suture; b) Suturing done at donor using 4-0 black silk sutures.



[Table/Fig-7]: Retainer given on the palate protect the donor site.

instructed not to brush or floss the surgical site for at least two weeks and was prescribed 0.2% Chlorhexidine mouthwash twice daily to be used two days after the surgery. Suture removal at the donor (palatal) site was done seven days after the evaluation of the healing and the wound. Suture removal of the recipient site was evaluated and removed after 14 days, followed by which a provisional ovate pontic restoration was delivered to the patient to develop the emergence profile [Table/Fig-8a,b,9]. A temporary prosthesis was removed to evaluate the emergence profile post one month of the surgery [Table/Fig-10]. Final tooth preparation finishing was done after the removal of the provisional prosthesis. The metal trial was done two days after the final tooth preparation [Table/Fig-11a,b]. The final prosthesis was delivered to the patient two days after the metal trial. The patient was evaluated for healing and the stability of the graft at one month, three months, and six months [Table/Fig-12a-c]. At one month, the volume of augmentation was stable without any signs of inflammation or redness. Keratinised tissue was adequate, consistency of tissue was slightly soft without any signs of necrosis. Healing was adequate without any events. At three months postsurgery, there was maintained soft-tissue volume with tissues being more firm and resilient compared to the one-month result. Keratinised tissue was still adequate. At six months and post six months of the surgery similar stable results were achieved with very minimal shrinkage of the augmentation. These results suggested that the graft helped in gaining soft-tissue volume to achieve pontic site development. The patient's tolerability of pain

was assessed using the Visual Analogue Scale (VAS) score, a scale measuring from 0 to 10, with 0 being no pain and 10 being the most intense type of pain. The patient was asked to mark on the VAS sheet, according to which the score marked by the patient was 2. No adverse events or outcomes were seen postsurgery.



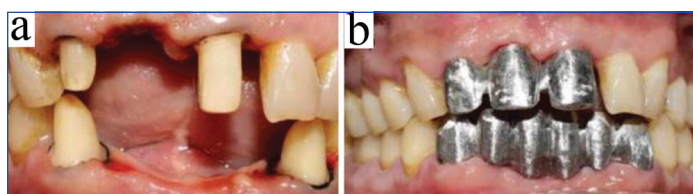
[Table/Fig-8]: Post 14 days of suture removal soft-tissue volume achieved.



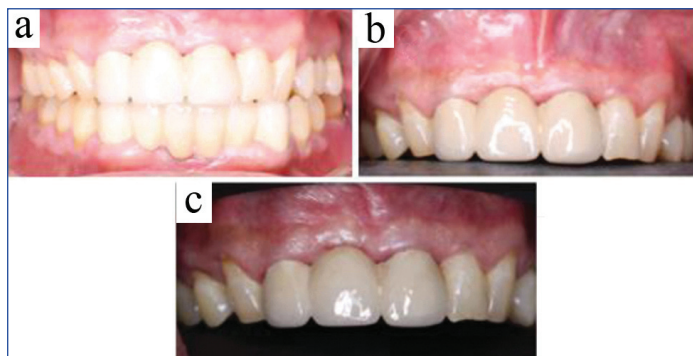
[Table/Fig-9]: Post 14 days temporary prosthesis given with ovate pontic to achieve emergence profile.



[Table/Fig-10]: Removal of prosthesis done for evaluation of pontic site post one month of surgery.



[Table/Fig-11]: a) Final tooth preparation done; b) Metal trial done.



[Table/Fig-12]: a) Healing post 1 month of the surgery; b) Healing post 3 month of the surgery; c) Healing post 6 month of the surgery.

DISCUSSION

In the past decade, augmentation surgeries majorly focused on hard-tissue augmentation. However, with changing concepts, more attention is being given to soft-tissue augmentation along with hard-tissue augmentation to achieve excellent aesthetics [1]. The absence of a tooth or teeth frequently involves a deficiency

in hard-tissue as well as soft-tissue, resulting in the need for surgical correction [2]. The replacement of missing teeth in the anterior region is unavoidable and becomes a big challenge in the field of perio-aesthetics. Minimally traumatic extraction is key to preserving hard and soft-tissues at the extraction site, especially in the aesthetic zone. Horizontal and vertical ridge loss mainly occurs in the first year after tooth extraction. There can be up to a 50-60% loss of alveolar ridge by 2-3 years. These ridge defects create a functional and aesthetic challenges in maintaining the normal anatomy of oral tissues [3]. These defects result from traumatic extraction, advanced periodontal disease, or underlying pathology. Siebert's classification categorises ridge defects into three classes: Class-I involves buccolingual tissue loss, Class-II involves apico-coronal tissue loss, and Class-III involves a combination of buccolingual and apico-coronal tissue loss [4]. Surgical or restorative procedures can correct these ridge defects. In the case of anterior maxillary teeth, it becomes important to achieve a proper emergence profile along with restoration. This can be accomplished through soft-tissue augmentation in cases of deficiency [5]. The ovate pontic is the preferred choice for achieving an accurate emergence profile in the anterior aesthetic zone, mimicking a natural tooth and enhancing soft-tissue augmentation to achieve a favourable emergence profile along with the interdental papilla.

There are various surgical techniques to augment soft-tissue in localised defects, which is a well-documented approach. The choice of therapy depends on the dimensions and position of the defect. These techniques include the subgingival CTG, the roll technique, a connective tissue pedicle graft, the full-thickness gingival onlay graft, and combination onlay-interpositional grafts, as well as Vascularised Interpositional Connective Tissue Graft (VIP-CTG) [6]. The buccal roll technique is majorly used around the implant region to develop the site deficient sites. Its advantage is having a single operative site and maintaining the colour and consistency with adjacent tissues. However, a disadvantage is that the buccal tissue roll used may not be enough if the defect is wider and deeper and is limited to Siebert's Class-I defect [5,6]. VIP-CTG has the advantage of covering a large defect area without the need for additional graft harvesting sites. The disadvantage is the difficulty in correcting any additional mucogingival problems in the same surgical procedure, such as a shallow vestibule or inadequate width of keratinised tissue [7,8]. The combination onlay interpositional graft has the advantage of restoring a larger defect area, but the disadvantage is that the use of large onlay grafts results in a lack of blood supply and no colour blending with adjacent soft-tissues [9,10].

Alveolar ridge defects confined to a single tooth may be corrected by two different approaches: hard-tissue augmentation followed by implant placement or soft-tissue augmentation only, along with incorporation of FDP with an ovate pontic design. When FDP is considered as the treatment choice, soft-tissue augmentation alone can be sufficient to provide satisfactory outcomes, as soft-tissue augmentation has now become a common procedure for pre-prosthetic site development. The rationale of CTG is that, since it is an autogenous graft, there are no chances of foreign body reaction associated with the graft. It is cost-effective for the patient, as other synthetic grafts are costly.

According to the evidence, CTG is considered the gold standard for soft-tissue augmentation. The GBR option was not considered, as it is an invasive procedure requiring ridge augmentation using synthetic bone grafts, and its healing period for bone formation takes 4-5 months, followed by placement of the implant [11,12].

Various soft-tissue augmentation techniques have been described in the literature, but the advantage of this technique is that it is simpler and more predictable compared to hard-tissue augmentation in the buccopalatal direction and other surgical

techniques, as well as the use of autogenous connective tissue [9]. The latest technique used for harvesting graft is minimally invasive with reduced incision lines for graft harvesting, no sloughing of the overlying flap, accelerated healing, less compromised blood supply, and cost-effectiveness. However, it is technique-sensitive and requires higher expertise to execute [13,14].

For increasing the width of keratinised gingiva, treatment of furcation, root coverage, management of peri-implant tissue, alveolar ridge deficiencies, abnormalities, and papillary loss, CTG has become a reliable treatment modality. The CTG used provides a higher soft-tissue volume and a better colour match with the surrounding tissues [10,15]. Palatal CTGs are known for higher success rates due to the presence of abundant vascularity the chances of graft necrosis are minimal [16,17]. Currently, for most soft-tissue augmentation surgeries, it is still deemed the gold standard treatment. Evidence supports the use of CTG as the gold standard for creating a stable volume of soft-tissue [18].

The following case report presents a surgical treatment case of a localised ridge defect using soft-tissue augmentation with the interpositional CTG technique, followed by provisional restoration with an ovate pontic. The use of CTGs along with the ovate pontic, with passive tissue contact, yielded a greater results, along with the formation of an emergence profile and the development of the papilla.

The cases and studies mentioned in [Table/Fig-13] [9,17-23] used subepithelial CTG as the material of choice for soft-tissue augmentation techniques with different surgical techniques. The case series, case reports, and clinical studies have shown superior

and stable results with autogenous soft-tissue augmentation. Studies compared autogenous and Xenogenic soft-tissue substitutes have showed a comparable results in terms of the stable volume of tissue after augmentation.

CONCLUSION(S)

The use of subepithelial CTG yielded predictable results in Fixed Partial Denture (FPD) prosthetic options. The technique used in the present case report is simpler, more predictable, and less invasive, showing improved results with soft-tissue quality and quantity without the use of any hard-tissue graft. The soft-tissue augmentation mimicked a natural, healthy emergence profile in Siebert's Class-III ridge defect. One limitation of this technique is that the defect should be localised. Although the technique is simpler, expertise is required for graft harvesting.

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S. No.	Author and year	Title	Results	Material used for surgical procedure	Technique
1.	Thoma DS et al., in 2023 [19]	Soft-tissue augmentation with a volume-stable collagen matrix or an autogenous CTG at implant sites: Five-year results of a randomised controlled trial post implant loading	This study compared Volume-stable Collagen Matrix (VCMX) and Subepithelial Connective Tissue Graft (SCTG) for the implant site augmentation. The results showed that the soft-tissue substitutes as well as SCTG both showed comparable results in terms of mucosal thickness of soft-tissue augmentation up to five years post implant loading.	1. VCMX- Volume stable collagen matrix. 2. Sub-epithelial CTG.	Pouch technique
2.	Ammar AH et al., in 2022 [21]	Clinical comparison of the volumetric changes in single pontic site development through CTG using modified pouch technique versus pouch technique in the maxillary aesthetic zone: A randomised controlled clinical trial	In this study, both the techniques that used SCTG showed successful soft-tissue volume augmentation and increase in keratinised tissue thickness at pontic site development.	Use of subepithelial CTG.	1. Pouch technique. 2. Modified pouch technique
3.	Strauss FJ et al., in 2022 [20]	Pontic site development for fixed dental prostheses with and without soft-tissue grafting: 1-year results of a cohort study	This study compared pontic site development in two groups one with soft-tissue augmentation and other without soft-tissue augmentation. The results showed stable soft-tissue augmentation results in test group upto one year but very slight shrinkage by 6 months.	Subepithelial CTG	Pouch technique
4.	Adawi HA in 2021 [22]	Use of a rotational flap with soft-tissue graft and tunnelling technique for ovate pontic site development for a highly aesthetic outcome: A case report	This study used rotational flaps, wherein the soft-tissue was rotated and tucked into the pouch which was created, the need for the second site for harvesting graft was avoided. This technique also showed stable and successful results.	Soft-tissue flap present on the ridge	Rotational flap with tunnel technique.
5.	Thomas DS et al., 2016 [23]	Randomised controlled clinical study evaluating effectiveness and safety of a volume-stable collagen matrix compared to autogenous CTG for soft-tissue augmentation at implant sites	This study demonstrated that use of the 3D stable collagen matrix and the SCTG for soft-tissue augmentation at implant sites showed similar results with gain in soft-tissue volume but minimal shrinkage were observed at 90 days of follow-up.	Subepithelial CTG	Pouch technique
6.	Narayan SJ et al., in 2015 [9]	Soft-tissue development around pontic site: A case series	This case report incorporated the use of SCTG using interpositional graft technique. The case report showed two cases with similar indication and procedure the results showed stable soft-tissue volume post 3 months of the surgery. However long-term follow-up was not mentioned which was the drawback of the case.	Subepithelial CTGs	Interpositional graft technique.
7.	Present study	Pontic site development using soft-tissue augmentation with CTG in maxillary anterior region- A case report	This case report also incorporated the use of connective tissue as a choice of graft for pontic site development in the anterior region with Sieberts Class-III defect using interpositional pouch technique. The results showed a stable pontic site post 6 months of the surgery without the use of any hard-tissue grafts.	Subepithelial CTG	Interpositional pouch technique.

[Table/Fig-13]: Similar cases from the literature [9,17-23].

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