Soft-tissue substitute versus autologous tissue

Enhancing vestibular depth and tissue thickness with porcine-derived acellular dermal matrix to ensure peri-implant health—a case report

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The existence or development of a sufficient peri-implant soft-tissue cuff seems to play a significant role in influencing both the dimensions of the surrounding bone and soft tissue as well as the seamless integration of the superstructure into the peri-implant environment.[1] This also contributes to establishing a condition free of inflammation over the long term.[1] Although numerous studies over the years have proved that keratinised tissue around an implant is essential to enhance the protective environment for the crestal bone,[2] Wennström and Derks suggest that further research is required to explore the importance of keratinised tissue around implants and determine the precise amount of soft tissue necessary to effectively prevent peri-implant disease.[3] Nonetheless, there is indirect evidence suggesting that enhancing soft tissue over the long run has a positive impact on peri-implant health.[1] This case report advocates the use of porcine dermis as a soft-tissue substitute, instead of autologous tissue, to augment the tissue thickness (facially as well as vertically) in second-stage implant surgery to gain vestibular depth, facial tissue thickness and vertical tissue thickness at the crest and maintain peri-implant health.

Case presentation

A female patient in her fifties approached our facility with the desire to have her edentulous posterior maxillary quadrants rehabilitated with a fixed restoration. She was in good health and had fair oral hygiene. CBCT scans were obtained (CS 9600, Carestream Dental; magnification: 1.4×; voxel size: 75 µm; exposure time: 5.5–40.0 seconds; continuous scan mode). Her scans revealed poor posterior maxillary dentition that would need to be extracted and hard-tissue deficient for implant placement (Figs. 1 & 2).

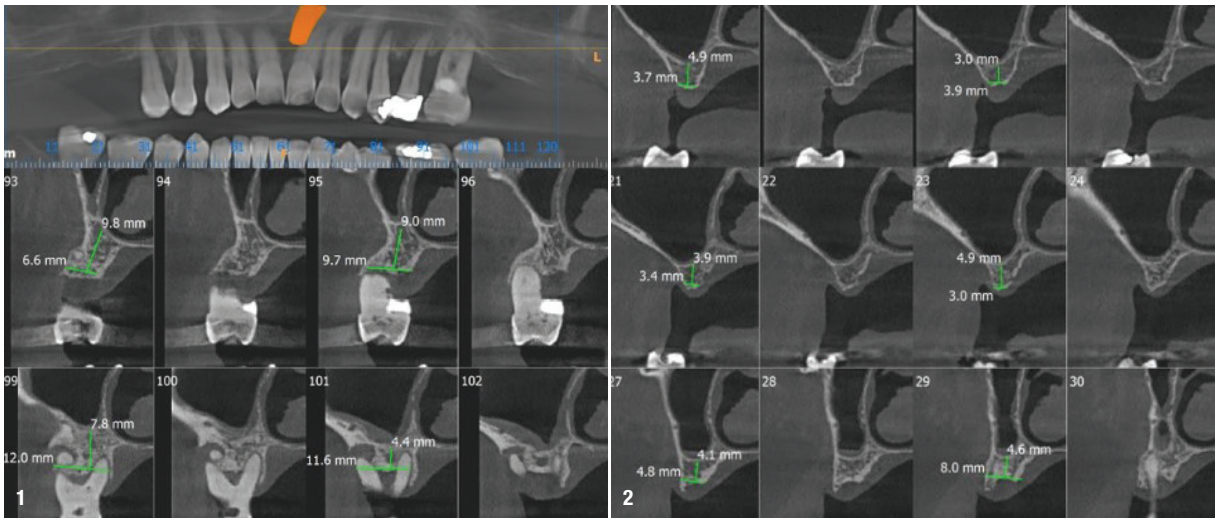

Fig. 1: Preoperative scans revealed mutilated posterior dentition along with poor bone quantity in the vertical and horizontal vector. **Fig. 2:** Good sinus health was confirmed prior to treatment planning by radiological as well as clinical methods.

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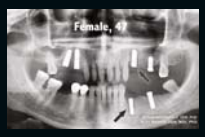

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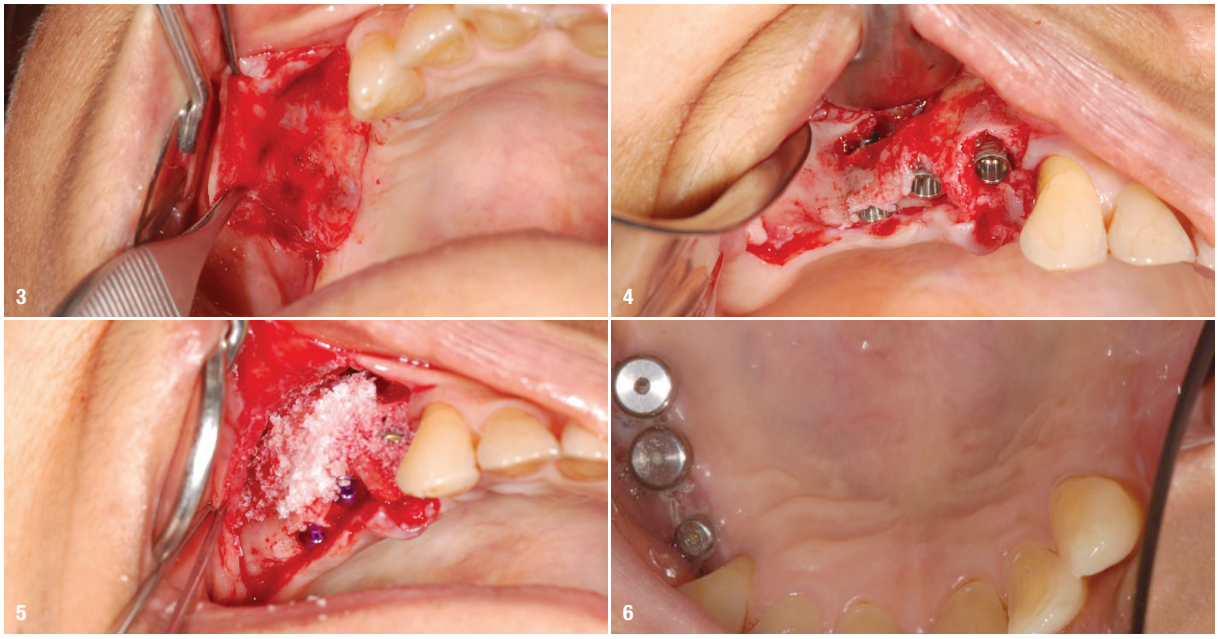

Fig. 3: An apically repositioned flap was made (split tissue thickness) to relocate the non-bound tissue away from the crest and gain vestibular depth. **Fig. 4:** Lateral window sinus augmentation was carried out and three CONELOG PROGRESSIVE-LINE implants (BioHorizons Camlog) were placed in regions 16 (4.3 × 9.0 mm), 15 (4.3 × 9.0 mm) and 14 (3.8 × 11.0 mm). **Fig. 5:** The biomaterial used for augmentation was autogenous bone obtained with a Micross scraper (Osteogenics) mixed with MinerOss XP (BioHorizons Camlog). A cross linked collagen Membrane Mem-Lok (BioHorizons Camlog) was used to cover the site. Augmentation was done to restore the vertical and horizontal deficit. **Fig. 6:** After a waiting period of six months bone maturation was optimal to proceed, but there was lack of adequate crestal keratinised tissue along with deficient vestibular depth.

Lateral window sinus augmentation was planned on the posterior of the right as well as the left maxillary quadrants. The patient was advised to undergo a thorough periodontal protocol including prophylaxis, root planning and subgingival curettage, which was deemed necessary prior to the surgical appointment. Informed consent was obtained after thorough discussion of a detailed treatment plan that involved immediate implant placement and hard-tissue augmentation. The patient was also informed of the possibility of a second-stage soft-tissue surgery.

Surgical procedure

Local anaesthesia was administered by way of nerve blocks as well as infiltration using 2% lignocaine with 1:200,000 epinephrine along with 0.5% bupivacaine. After lateral window sinus elevation, three CONELOG PROGRESSIVE-LINE implants (BioHorizons Camlog) were placed in regions 16 (4.3 × 9.0 mm), 15 (4.3 × 9.0 mm) and 14 (3.8 × 11.0 mm; Figs. 3 & 4). This region was grafted to correct the vertical and horizontal deficits using autogenous bone scrapings collected with a Micross bone scraper (Osteogenics) and MinerOss XP (2 cm^3; BioHorizons Camlog) and covered with a cross-linked 20 × 30 mm collagen barrier (Mem-Lok, BioHorizons Camlog; Fig. 5). Closure was obtained using 4/0 Vicryl sutures. The same procedure using similar biomaterials was carried out in the maxillary left quadrant after two weeks using three CONELOG PROGRESSIVE-LINE implants in regions 24 (4.3 × 11.0 mm), 25 (4.3 × 9.0 mm) and 26 (4.3 × 9.0 mm).

After a waiting period of six months of bone maturation, it was observed that there was lack of adequate crestal keratinised tissue along with deficient vestibular depth (Fig. 6). Therefore, an apically repositioned split-thickness flap was planned. Porcine dermis (NovoMatrix, BioHorizons Camlog; Figs. 7a & b) would be used as a poncho, stock healing abutments securing the dermis at the crestal aspect and sutures at the facial aspect under the split flap (Figs. 8 & 9). With a single procedure, adequate bound-down tissue and vertical soft-tissue thickness at the crest was achieved. This is imperative to prevent crestal bone loss, according to Linkevicius et al.[2] The implants on both sides were restored with CONELOG pre-milled abutments and cement-retained zirconia crowns (Fig. 10).

Observations

An obvious increase in the hard tissue was seen in the vertical dimensions from 3 to 4 mm preoperatively to 11 mm postoperatively. The postoperative vestibular depth was 6 mm, measured from the crest anteriorly, and 4 mm at the posteriormost locations (Figs. 11a & b). A vertical soft-tissue thickness of ≥ 2 mm was observed at the crest together with the gain in peri-implant keratinised soft-tissue thickness (Figs. 12a & b).

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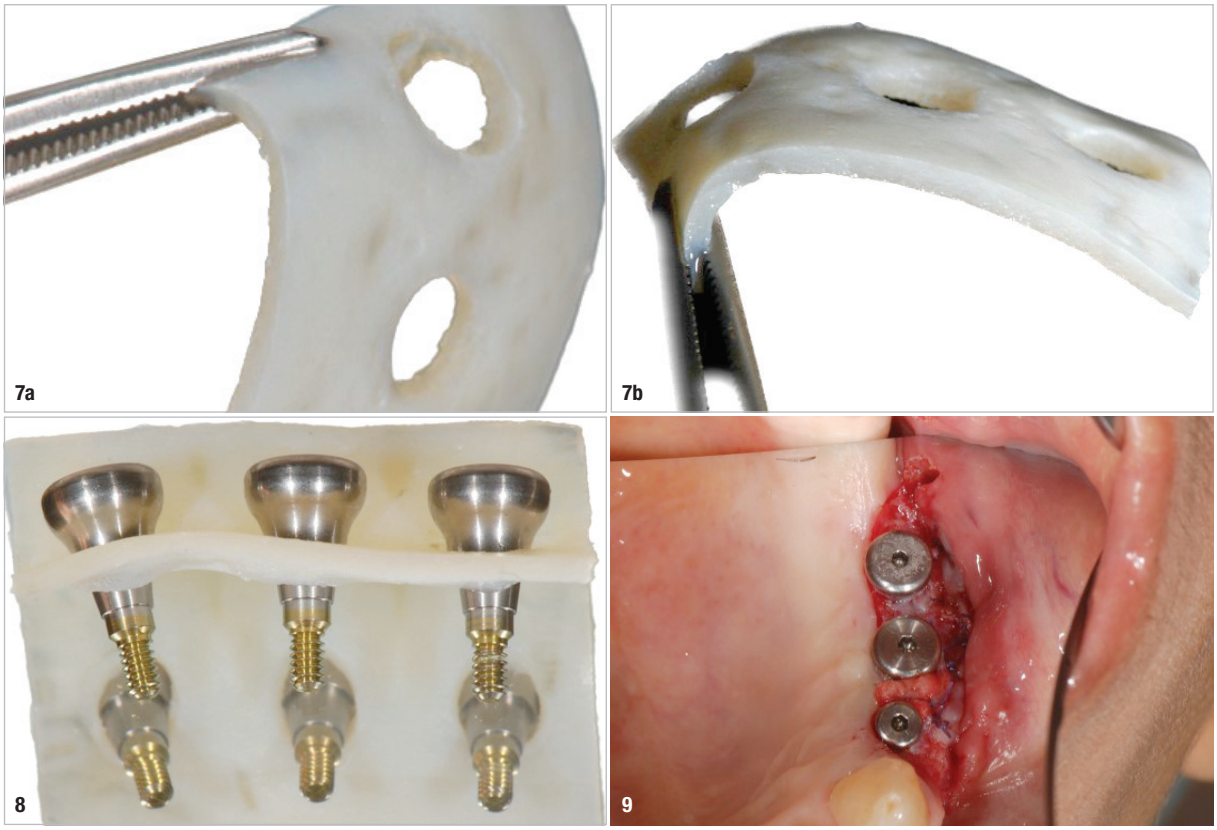

Figs. 7a & b: A tissue punch is used to prepare the porcine dermis (NovoMatrix) as per the implant locations. **Fig. 8:** The gingival formers used as a poncho provide stability to the crestal tissue. **Fig. 9:** Porcine dermis (NovoMatrix) was used as a poncho along with stock gingival formers and left exposed at the crest. The dermis was simply tucked under the palatal tissue and secured along with the apically repositioned flap using stay sutures Vicryl 5/0.

Discussion

The absence of keratinised mucosa and vestibular depth has been speculated to play a significant role in the development and aggravation of peri-implant inflammation.[1, 4, 5] Consequently, some patients may require additional surgical procedures, which may be performed simultaneously with either an augmentative or non-augmentative treatment, in order to improve the condition of their peri-implant soft tissue. Studies on autogenous soft-tissue grafts have demonstrated significant increases in peri-implant keratinised mucosa width, peri-implant soft-tissue thickness and peri-implant supracrestal tissue height.[1] However, the need for additional surgical sites, the resulting high postoperative discomfort, and inadequate quality and quantity of tissue can potentially compromise clinical outcomes.[6]

Allogeneic dermal matrix and xenogeneic collagen matrix have been proposed as alternatives to autogenous soft-tissue grafting as a means of bypassing these limitations.[7, 8] Allogeneic dermal matrices come in various thicknesses, and selecting the appropriate thickness for a particular procedure can be critical. Using a graft that is too thick or too thin for the intended purpose can lead to suboptimal results. Several studies on porcine-derived collagen membranes have shown favourable clinical outcomes in peri-implant soft-tissue surgery.[9] Since these collagen matrices maintain their mechanical stability, they are able to support cell adhesion, cell proliferation and blood vessel ingrowth, resulting in fully functional tissue.[10–12]

A preliminary *in vitro* study demonstrated that the proprietary tissue processing method of NovoMatrix allows rapid growth of blood vessels and fibroblast adhesion

Fig. 10: CONELOG premill contour abutments were used and monolithic zirconia crowns cemented onto the milled abutments.

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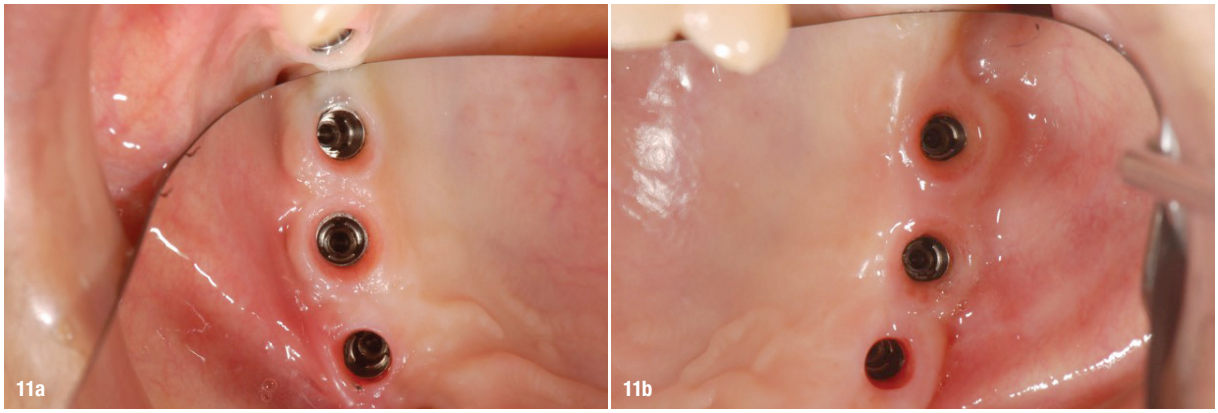


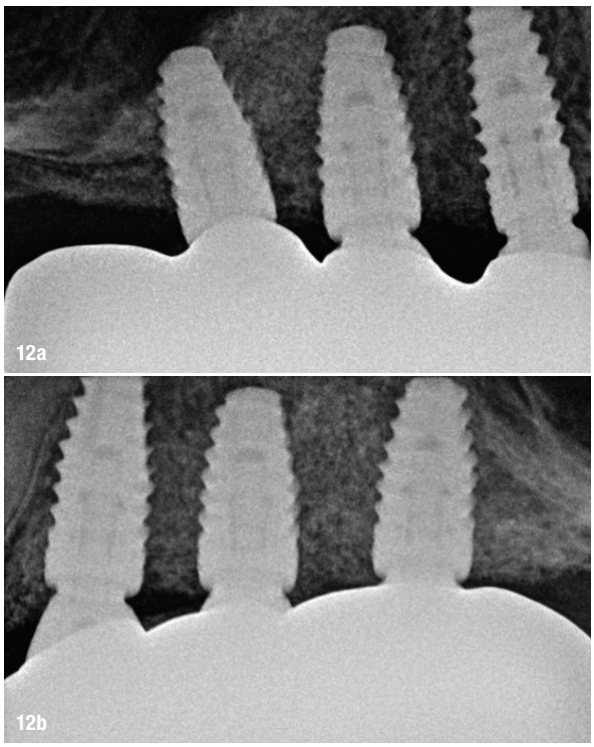
Figs. 11a & b: Adequate keratinised gingiva was gained, and vertical soft-tissue thickness was achieved. Post-op vestibular depth on the right was 6 mm as measured from the crest anterior as well as posterior locations.

and proliferation with a minimal inflammatory response (data on file at Allergan).[13, 14] An individual layer of this matrix can be sectioned and superimposed to achieve the desired thickness.[9] The poncho technique, coupled with the split-thickness flap, allows the periosteum and muscle insertion to be preserved so that periosteal vascularisation of the bone can be retained and soft tissue is available for suturing.[9] A remarkable increase in the post-operative vestibular depth and soft-tissue thickness after the use of porcine-derived dermal matrix demonstrates that one can achieve a favourable clinical outcome in terms of peri-implant tissue health, comparable to autogenous soft-tissue grafting.

Conclusion

Porcine dermis is a viable alternative to autologous soft-tissue grafts and provides optimal gains in soft-tissue quality and quantity. Its uniform thickness and handling characteristics give it an edge over its predecessors. It also gives the clinician the freedom to augment a larger region given that there is no dearth of tissue, which would be the case if we used autologous tissue, and favourable clinical outcomes can be gained in terms of peri-implant health.

Literature



Figs. 12a & b: Post-op X-ray reveals good adaptation and seating of the restoration on the right and the left side.

about the author

Dr Yazad Gandhi attended dental school at King George's Medical College where he graduated with honours. He completed his Masters in Oral & Maxillofacial Surgery from the same institution. He is a key opinion leader for BioHorizons, Geistlich and Fellow of the ITI and the Director of Fusion Education, an organisation that conducts CDE courses for dental surgeons across India. Dr Gandhi has several national and international publications to his credit. He maintains a specialty practice at a private facility in Mumbai along with attachment to multispeciality hospital.

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