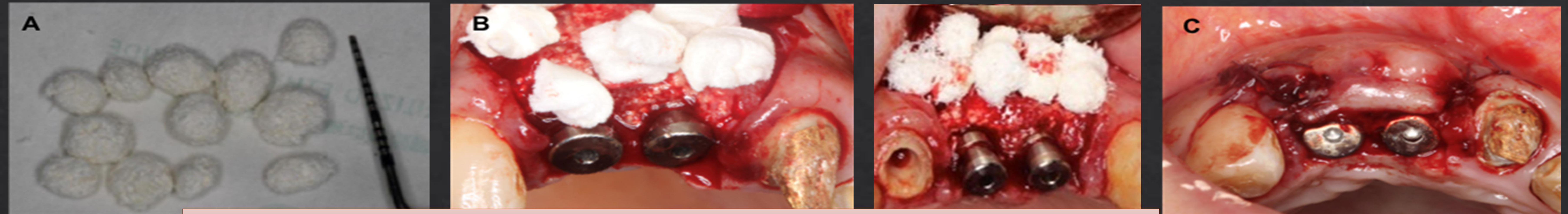
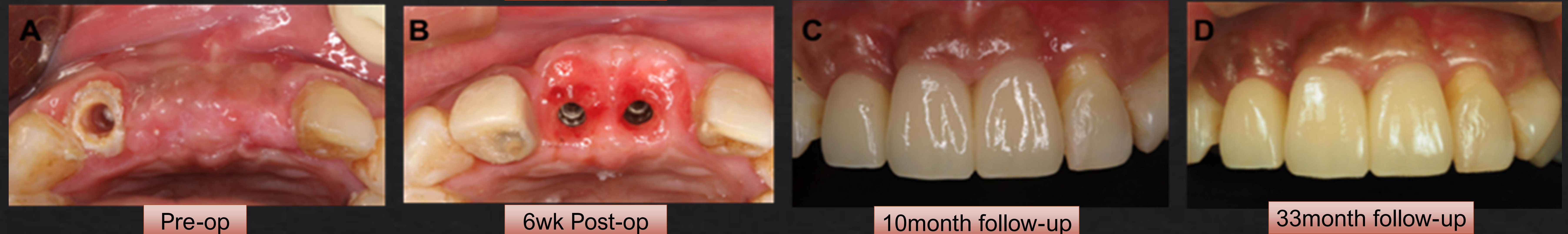
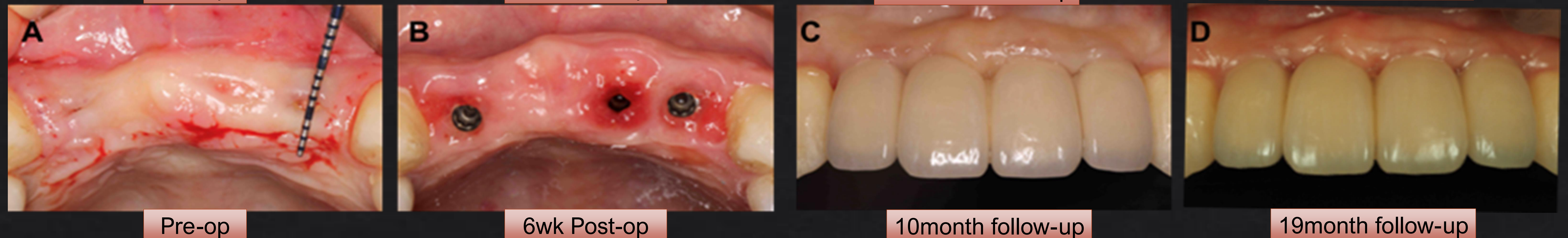


Introduction

- The edentulous anterior maxilla often has the most pronounced post-extraction resorption with loss of both hard and soft tissue volume, which has important effects in the long-term stability and esthetics of the implant restoration.
- Adequate peri-implant mucosa thickness is related to higher peri-implant marginal bone stability. In addition to being a critical factor in marginal bone stability, peri-implant soft tissue thickness is also critical in achieving an esthetic outcome.
- Autogenous subepithelial connective tissue graft (SCTG) has been shown to increase peri-implant soft tissue thickness with a favorable long-term outcome. However, harvesting of autogenous SCTG has been associated with increased postoperative pain, increased intraoperative and postoperative bleeding, longer surgical time, and transient palatal sensory dysfunction.
- The use of a porcine-derived xenogeneic matrix (XCM) has been reported in the literature to have similar esthetic and functional results compared to autogenous grafts for peri-implant soft tissue augmentation, and several advantages including reduced chair time, faster recovery, unlimited supply, and avoidance of donor harvesting.
- 0.7 – 1.6mm gain in horizontal soft tissue volume have been reported in past literature utilizing porcine XCM. In this case series, we present an approach for correction of peri-implant soft tissue volume deficiency in the esthetic zone that utilizes porcine-derived XCM compressed into balls (i.e., the “ball technique”) with an average horizontal soft tissue volume gain of 4.33 mm.



Condensed XCM balls placed at site of soft tissue volume deficiency at time of second stage.



Clinical Techniques

- After successful osseointegration of implants placed in the anterior maxilla, areas of soft tissue volume deficiency were augmented utilizing the ball technique at the time of second stage implant uncover surgery.
- Porcine derived XCM material was manually compressed and condensed into balls ranging 6-7 mm in diameter and placed over the facial bone in areas of peri-implant soft tissue deficiency.
- A periosteal releasing incision was then made in the buccal flap to accommodate for the increase in volume from placement of the XCM balls and to allow for tension-free flap closure. The flap was then re-approximated to cover the graft materials using 4-0 Vicryl suture around the healing abutments.

Clinical Outcomes

- Our case series reported an average horizontal soft tissue volume gain of 4.33 mm.

Case	Implant Site	Augmentation Zone	Horizontal Soft Tissue Volume (pre-surgery)	Horizontal Soft Tissue Volume (post-surgery)	Horizontal Soft Tissue Volume Gain
1	#7, 8	Buccal	9mm	14mm	+5mm
2	#7, 9, 10	Buccal	8mm	11mm	+3mm
3	#8, 9	Buccal	9mm	14mm	+5mm

Discussion

- Our case series reported an average horizontal soft tissue volume gain of 4.33 mm. This finding is higher than results reported in other studies. Cairo et al. reported a peri-implant mucosa thickness gain of 0.9 ± 0.2mm utilizing porcine collagen matrix. Schallhorn et al. reported a soft tissue thickness gain of 0.7mm utilizing porcine based collagen matrix around implants. A gain of 1.6mm in horizontal soft tissue volume utilizing porcine collagen matrix has been reported by Thoma et al.
- One possible reason for the higher reported horizontal soft tissue volume increase noted in our cases compared to other studies utilizing porcine collagen matrix maybe related to the dense compression of the XCM materials into ball shapes prior to placement. In studies that reported increases of 0.7 – 0.9 mm in horizontal soft tissue volume utilized the porcine collagen matrix in single layer while the study that reported a gain of 1.6mm folded the matrix into double layer thickness, but without any compression to increase density of the XCM material.
- Postoperative shrinkage of soft tissue augmentation over time has been commonly reported ranging from 0.20 to 3.06mm up to 50.7% and is subjected to individual variation depending on graft material utilized and surgical technique employed. In our cases, soft tissue augmentation results were maintained for up to 33-month follow-up period, which suggested that soft tissue volume gain maintained stable even after resorption of porcine collagen matrices placed.
- The ball technique described in this article provides a viable method to augment soft tissue volume around dental implants in the anterior maxilla utilizing condensed porcine collagen matrix balls. Future study is still needed to investigate the long-term stability of peri-implant soft tissue following this technique. Some additional areas of interest for future research may include utilization of the ball technique with minimally invasive tunneling approach and the potential synergistic effect of combining the ball technique with growth factors.

References

- Januário AL, Duarte WR, Barriviera M, Mesti JC, Araújo MG, Lindhe J. Dimension of the facial bone wall in the anterior maxilla: a cone-beam computed tomography study. Clin Oral Implants Res 2011;22:1168-1171.
- Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. Int J Periodontics Restorative Dent 2003;23:313-23.
- Giannobile WV, Jung RE, Schwarz F; Groups of the 2nd Osteology Foundation Consensus Meeting. Evidence-based knowledge on the aesthetics and maintenance of peri-implant soft tissues: Osteology Foundation Consensus Report Part I – Effects of soft tissue augmentation procedures on the maintenance of peri-implant soft tissue health. Clin Oral Implants Res 2018;29(suppl 15):7-10.
- Puisys A, Vindasiute E, Linkeviciene L, Linkevicius T. The use of acellular dermal matrix membrane for vertical soft tissue augmentation during submerged implant placement: a case series. Clin Oral Implants Res 2015;26:465-470.
- Linkevicius T, Puisys A, Steigmann M, Vindasiute E, Linkeviciene L. Influence of Vertical Soft Tissue Thickness on Crestal Bone Changes Around Implants with Platform Switching: A Comparative Clinical Study. Clin Implant Dent Relat Res 2015;17:1228-36.
- Jung RE, Sailer I, Hammerle CH, Attin T, Schmidlin P. In vitro color changes of soft tissue caused by restorative materials. Int J Periodontics Restorative Dent 2007;27:251-257
- Thoma DS, Naenni N, Figuero E, Hämmerle CHF, Schwarz F, Jung RE, Sanz-Sánchez I. Effects of soft tissue augmentation procedures on peri-implant health or disease: A systematic review and meta-analysis. Clin Oral Implants Res 2018;29(suppl 15):32-49.
- Griffin TJ, Cheung WS, Zavras AL, Damoulis PD. Postoperative complications following gingival augmentation procedures J Periodontol 2006;77:2070-2079.
- Nevins M, Nevins ML, Kim SW, Schupbach P, Kim DM. The use of mucograft collagen matrix to augment the zone of keratinized tissue around teeth: a pilot study. Int J Periodontics Restorative Dent 2011;31(4):367-73.
- Cairo F, Barbato L, Tonelli P, Batalocco G, Pagavino G, Nieri M. (2017). Xenogeneic collagen matrix versus connective tissue graft for buccal soft tissue augmentation at implant site. A randomized, controlled clinical trial. J Clin Periodontol. 2017;44(7):769-776
- Schallhorn RA, McClain PK, Charles A, Clem D, Newman MG. Evaluation of a porcine collagen matrix used to augment keratinized tissue and increase soft tissue thickness around existing dental implants. Int J Periodontics Restorative Dent 2015;35:99-103.
- Thoma DS, Jung RE, Schneider D, Cochran DL, Ender A, Jones AA, Görlach C, Uebersax L, Graf-Hausner U, Hämmerle CH. Soft tissue volume augmentation by the use of collagen-based matrices: a volumetric analysis. J Clin Peridontol 2010;37:659–666.
- Bassetti R, Stähli A, Bassetti M, Sculean A. Soft tissue augmentation around osseointegrated and uncovered dental implants: a systematic review. Clin Oral Investig. 2012;21,53–70.