

Soft tissue augmentation with a collagen-based 3D matrix with directed pore channels

Bastian Wessing¹, Bouke Boekema², and Oscar González-Martín³

¹Dental Practice Clinic, Luisenhospital, Aachen, Germany

²Association of Dutch Burn Centres, Beverwijk, The Netherlands

³University Complutense of Madrid, Madrid, Spain, and The University of Iowa School of College & Dental Clinics, Iowa City, USA

Background and Aim

Following tooth extraction, the buccal side of the alveolar ridge often undergoes physiological resorption.¹ During dental implant surgery, soft tissue augmentation with gingival grafts is used to enhance esthetics by maintaining or reconstructing a convex contour of the alveolar ridge.^{2,3} Autologous grafts are common but pose several disadvantages, including the need for multiple surgical sites, postsurgical discomfort, and limited availability of tissue volumes, which has led to the development of alternative graft substitutes.⁴⁻⁶ The aim of this retrospective study was to evaluate the clinical performance of a porcine-derived native collagen-elastin-based three-dimensional matrix with a modified interconnecting pore structure (CMG) used for soft tissue volume augmentation.

Methods and Materials

This retrospective study included patients who received dental implants with simultaneous soft tissue volume augmentation using CMG (Mucomaix, Matricel GmbH, Herzogenrath, Germany; distributed as creos™ mucogain by Nobel Biocare since 10.2018) between 28.09.2013 and 06.09.2018 at a single dental practice. The implants included NobelActive (n=31), NobelParallel CC (n=13), NobelReplace CC (n=3), NobelReplace straight Groovy (n=2), and NobelPearl (n=1) (Nobel Biocare AB, Gothenburg, Sweden). Change in tissue thickness was evaluated from 4-8 linear measurements taken from superimposed 3D scans of casts prepared from polyether impressions (Impregum™ Penta™, 3M ESPE) taken before implant surgery and before fabrication of the final restoration (Fig 1). Available histologies were analyzed for vascularization, smooth muscle cells, endothelial adhesion, presence of macrophages, and CMG resorption. Implant survival rates and gingival health status were also evaluated.

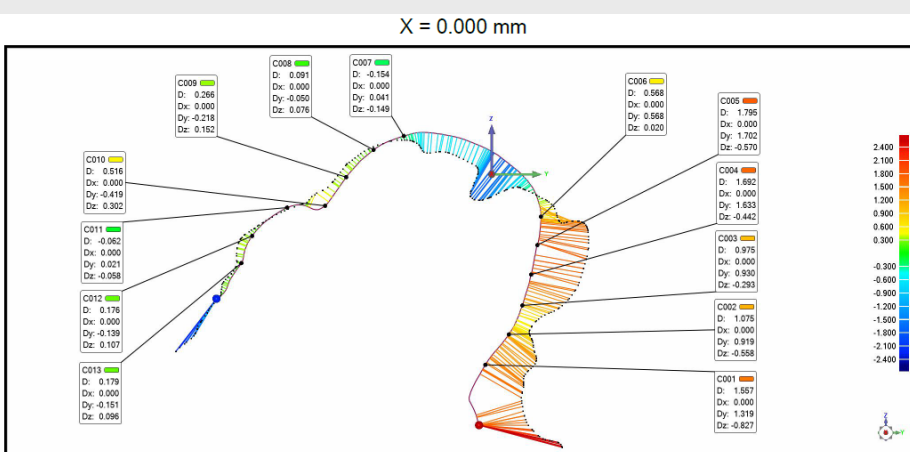


Figure 1
Example of linear measurements (mm) between the pre- and post-operative vestibular profile in the augmented area and colored by loss (blue) or gain (red) of tissue. Original cast data from upper right lateral incisor (FDI position 12) in the study patient shown in the clinical case example in Figs 4-6.

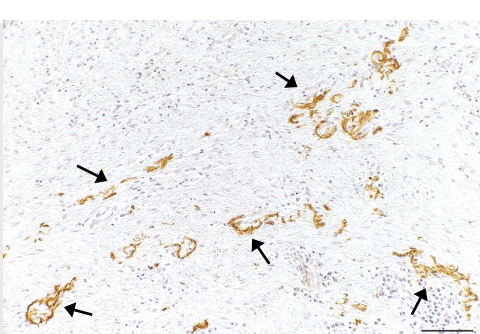


Figure 2
Immunohistochemical staining (BA-4 antibodies) of a gingival biopsy from patient 43. Brown staining (arrows) indicates elastin remnants after 62 days of healing.

Results

- 45 patients (20 male, 25 female, mean age 41.3 ± 13.07 years) received 50 implants and were followed for 1.8 ± 1.3 years (range: 3 months - 4.5 years)
- Stable peri-implant tissue volume** from pre-op to post-op independent of the time of follow-up (n=26 sites; -0.15 ± 1.18 mm for all data points; Spearman's rank correlation: $\rho=0.150$, $P=0.073$; Fig 3)

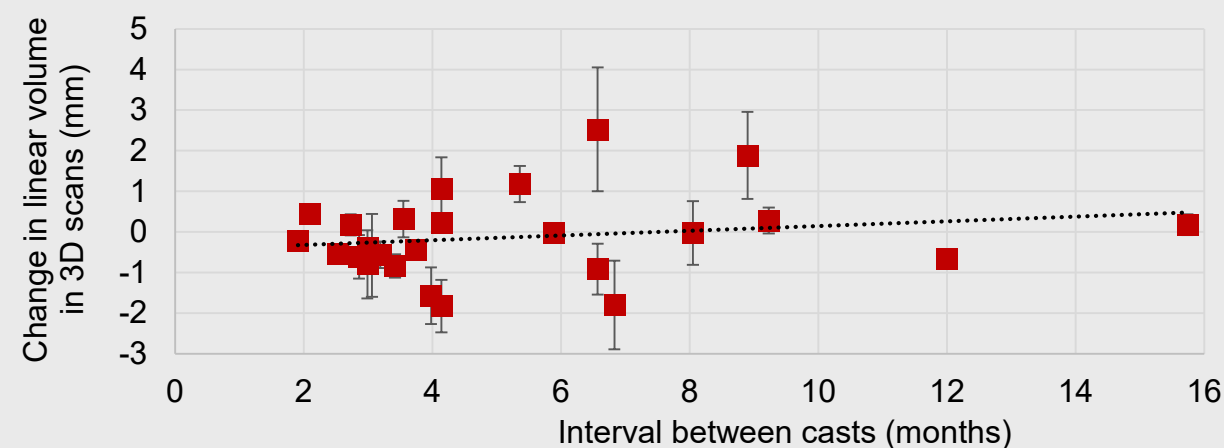


Figure 3
Stability of augmented sites over time based on casts prepared from impressions taken before implant placement and prior to the preparation of the final restoration.

- Healthy matrix integration** (n=3 sites; healthy vascularization and no signs of inflammation; elastin remnants could be detected in 2 biopsies after 62 and 96 days)
- Excellent soft tissue health** (92% of implant sites had a Jemt-papilla-index of 3, 70% of implant sites has ≥ 3 mm of keratinized mucosa, 78% of implants had no bleeding on probing)
- Low complication rate** (only 2 exposed matrices at 1 week post-surgery, resulting in a matrix exposure rate of 4%)
- 100% implant survival and success**

Clinical Case

A 20-year-old female with a congenital absence of the upper right lateral incisor (FDI position 12) received a NobelActive implant with simultaneous soft tissue augmentation using CMG.

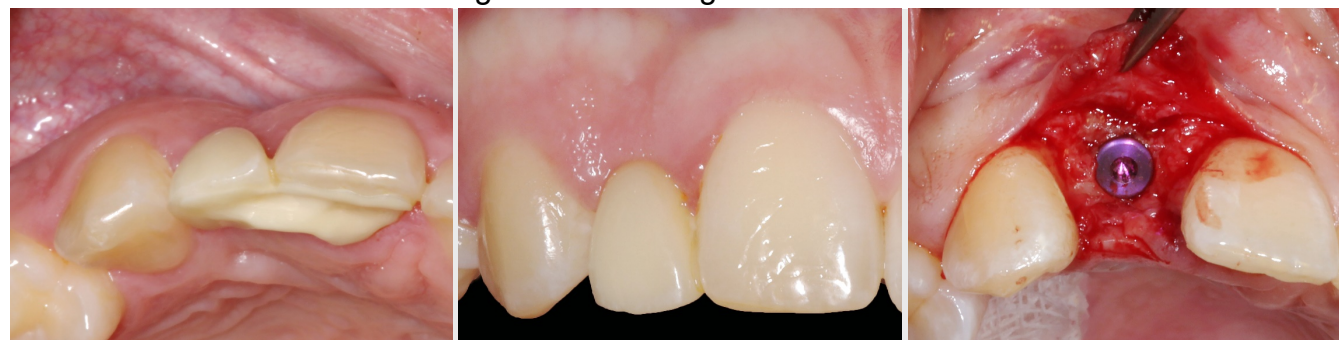


Figure 4
Occlusal (left) and buccal (center) view before treatment. (Right) Full thickness flap on top of the ridge with implant placed and split thickness flap on buccal side.

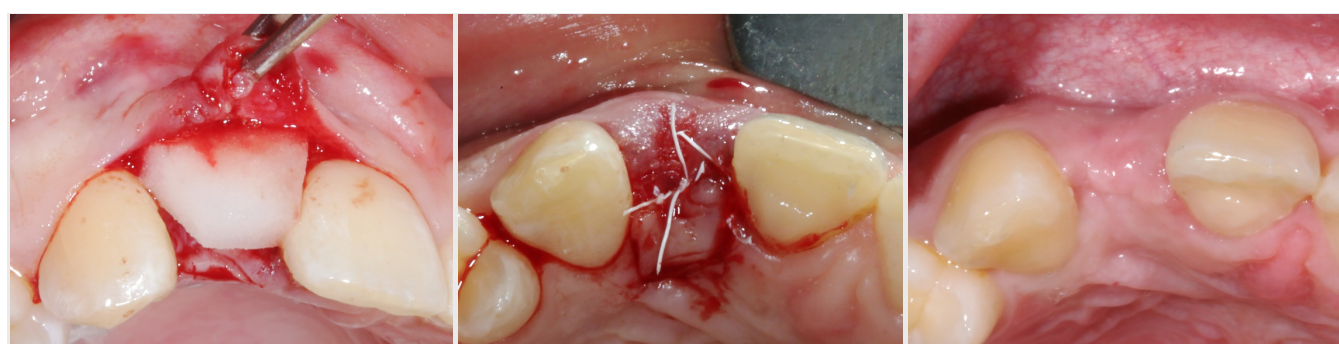


Figure 5
(Left) CMG placed underneath the buccal split flap and on top of the dental implant. (Center) Primary wound closure with palatal island flap to reduce the compression force of the buccal flap on the matrix. (Right) Buccal view at the time of re-entry after 82 days.



Figure 6
(Left) Occlusal view of the emergence profile after soft tissue healing. (Center) Occlusal view of the final prosthetic. (Right) Buccal view of the final crown.

Conclusion

This retrospective analysis demonstrated that CMG promotes soft tissue health and maintains adequate soft tissue thickness when used simultaneously with implant placement. The histological findings demonstrate excellent biocompatibility of CMG and indicate this matrix as a valid alternative to autologous grafts. Further well-designed randomized clinical studies are encouraged to validate these early promising results.

References

- Schropp L, Wenzel A, Kostopoulos L, Karring T. Int J Periodontics Restorative Dent 2003;23(August):313-23.
- Silverstein LH, Kurtzman D, Garnick JJ, Trager PS, Waters PK. Implant Dentistry 1994;3(Winter):231-4.
- Silverstein LH, Lefkove MD. J Oral Implantol 1994;20:135-8.
- Del Pizzo M, Modica F, Bethaz N, Priotto P, Romagnoli R. J Clin Periodontol 2002;29(9):848-54.
- Harris RJ, Miller R, Miller LH, Harris C. Int J Periodontics Restorative Dent 2005;25(5):449-59.
- Griffin TJ, Cheung WS, Zavras AI, Damoulis PD. J Periodontol 2006;77(12):2070-9.

This study was supported by a Nobel Biocare Services AG grant number 2018-1583.

