

# Clinical study with gradually anodized implants restored with two-piece anodized abutments – preliminary results

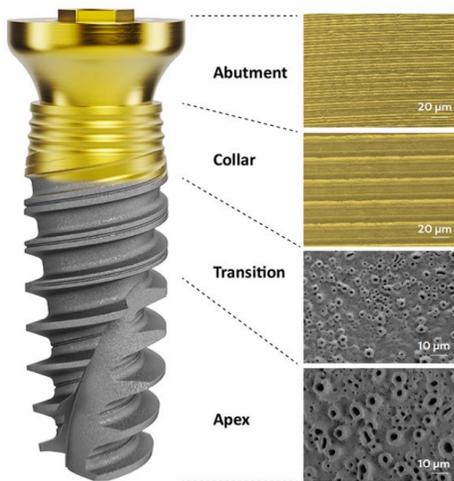
Giacomo Fabbri and Giorgio Ban

Studio Odontoiatrico Specialistico, Via del Porto 17, 47841 Cattolica (RN), Italy

## Background and Aim

Surface chemistry and topography of the implant-abutment complex play a key role in implant osseointegration and proper adhesion of the soft tissue to the restoration.<sup>1</sup> To optimize tissue integration at every level, novel anodized implant and abutment surfaces were developed. The implant surface has a gradual change in topography designed to promote early osseointegration and to support stable marginal bone, while the new surface at the tissue-level base promotes undisturbed mucointegration (Figure 1).<sup>2</sup>

This prospective study aims to evaluate the clinical performance of the gradually anodized implant surface and the smooth anodized abutment surface after 3 years of function. The primary outcome is soft tissue health, thickness and stability evaluated from implant insertion to the 3-year follow-up. Here we present the clinical outcomes collected by final prosthesis delivery.



**Figure 1**  
Implant system with the newly engineered surfaces (left) and low magnification SEM images of the surfaces at indicated regions.  
*The image on the left side has been updated since EAO presentation to reflect the actual system used in this study.*

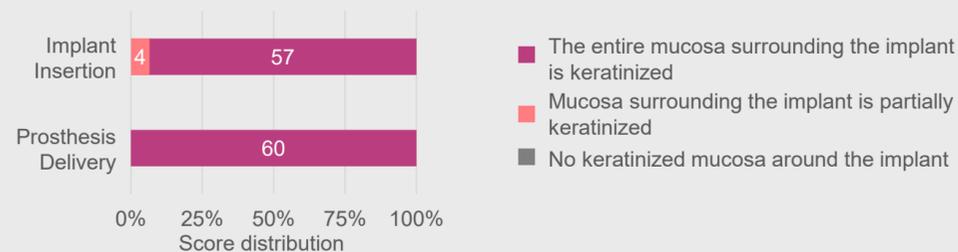
## Methods and Materials

Patients requiring one single tooth replacement in the premolar or molar area in either jaw were enrolled in this study. Variable thread tapered implants with gradual anodized surface (NobelActive TiUltra, Nobel Biocare AB, Gothenburg, Sweden) were placed in healed sites and an On1 base with anodized surface (On1 Base/Xeal; Nobel Biocare AB) was immediately attached to the implant, and subsequently connected to an On1 healing cap. Digital impressions were taken on the day of surgery, while the final prosthesis was placed after a 12-week healing period. Clinical follow-ups are planned at 6, 12, 24, and 36 months post final prosthetic delivery. The secondary endpoints at final prosthesis delivery include soft tissue health assessments and oral health related quality of life based on OHIP-14 questionnaire. Data analysis was performed with SPSS v25 (IBM, Armonk, USA).

## Results

- 61 patients (30 females, 31 males; mean age  $51.4 \pm 12.6$  years) enrolled in the study.
- 35 implants were placed in the mandible and 26 in the maxilla. Most implants ( $n=39$ ; 64%) were placed in hard bone (quality 1 and 2). The final mean insertion torque was  $58.2 \pm 12.5$  Ncm ( $n=61$ ).
- The prosthetic delivery visit on average took place  $16.4 \pm 7.3$  weeks after implant placement and was completed by 60 patients (60 implants).

### Keratinized mucosa status



**Figure 2**  
Improvement in keratinized mucosa status from implant insertion to prosthetic delivery.

### Outcome assessment:

- **Healthy soft tissue** demonstrated by improved keratinized mucosa status (figure 2), low sulcus bleeding index: 51 sites (85%) showed no bleeding when a periodontal probe was passed along the gingival margin adjacent to the implant, and healthy gingiva with 56 sites (93%) showing no signs of inflammation surrounding the crown. 35 sites (58%) had no plaque, while 20 and 5 sites showed minimal and moderate plaque accumulation, respectively.
- **Excellent implant survival rate** of 100% and success rate of 96.6%.
- **Very high patient satisfaction** with function and esthetics (mean score of 9.9 and 9.8, respectively, on a scale of 0 to 10) and improved oral-related quality of life ( $p=0.0420$ ) from pretreatment to final prosthesis delivery.

## Clinical Case



**Figure 3**  
Left panel: Occlusal view of the soft tissue healing and maturation 10 weeks after the surgery. Middle panel: Prosthetic finalization according to a fully digital workflow with the On1 IOS (intraoral scannable) healing cap. Right panel: final prosthesis in situ.



**Figure 4**  
Left panel: Soft tissue health and quality on the day of the prosthetic delivery. Note the ideal soft tissue thickness and quality necessary to create optimal conditions to achieve an excellent esthetic outcome and long term stability. Right panel: Clinical view at the 6-month follow-up visit demonstrating the biological and esthetic integration.

## Conclusion

Within the limitations of the short follow-up, 100% implant survival combined with improvement in keratinized mucosa status indicate that the novel anodized surfaces at implants and abutments are safe and promote excellent peri-implant soft tissue health.

## References

1. On implant surfaces: a review of current knowledge and opinions. A Wennerberg, T Albrektsson. Int J Oral Maxillofac Implants. 2010;25:63-74.
2. Rational design and in vitro characterization of novel dental implant and abutment surfaces for balancing clinical and biological needs. V Milleret, P S Lienemann, A Gasser, S Bauer, M Ehrbar, A Wennerberg. Clin Implant Dent Relat Res. 2019 Mar;21 Suppl 1:15-24.

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