Achieving macro- and micro-roughness on Ti alloy by etching without prior sandblasting: a surface characterization.

S Szmukler-Moncler [1], C Blus [1], G Orrù [1]
[1] *Oral Biotechnology Laboratory, Surgical Sciences Dpt, University of Cagliari, Italy*
. [2]

INTRODUCTION: Etching is currently the most popular method used to texture the surface of dental implants. Sandblasting prior to etching (SLA) is the only method to achieve a macro- and micro-surface texture with a S_a in the 1-2 μm range, a 'moderately rough' surface considered to be an optimized surface. However, SLA surfaces harbor remnant particles from the sandblasting process [l]. Some manufacturers consider the residual alumina particles as a foreign material worth getting rid of. Subsequently, they forgo an optimized moderately rough surface and stick to a 'minimally rough' micro-roughened surface displaying a Sa < 1 μm [l].

It has been recently claimed [2] that acid etching is typically not a appropriate treatment for α-β alloys because its biphasic nature leads to an enrichment of the Vanadium-rich β-phase on the surface.

The aim of the present paper is to show that it is feasible to achieve an optimized 'moderately rough' macro- and micro-textured surface on titanium alloy ($TiAl_6V_4$) through etching only, without any prior sandblasting and to characterize the resulting surface.

METHODS: Implants made of $TiAl_6V_4$ were etched according to a proprietary recipe (Bioner, Sant Just Desvern, SP). The surface was characterized by optical non-contact profilometry SEM, XRD, AES profiling and H concentration measurement.

RESULTS: A macro- and micro-textured surface was obtained with a homogeneous texture of macro-pores in the 15-20 μm range (fig. 1), a S_a of 1.3 μm and a S_z of 11.2 μm. AES profil analysis showed no surface enrichment in either Vanadium or Aluminium. H concentration measured on 3 implants was found to be 79 ppm; no Titanium hydride was detected by XRD.

DISCUSSION & CONCLUSIONS: It is possible to achieve a macro- and micro-textured surface similar to the SLA surface without the need of any prior sandblasting. The treatment was reproducible even when applied to several other commercially available implants made of Titanium alloy. Contrary to what has been suggested, etching is suitable for the biphasic $TiAl_6V_4$ alloy. The reason why no hydride layer was identified at the implant surface is due to the presence of the body-centred cubic β phase that accommodates much more H than the close-packed hexagonal α phase does.

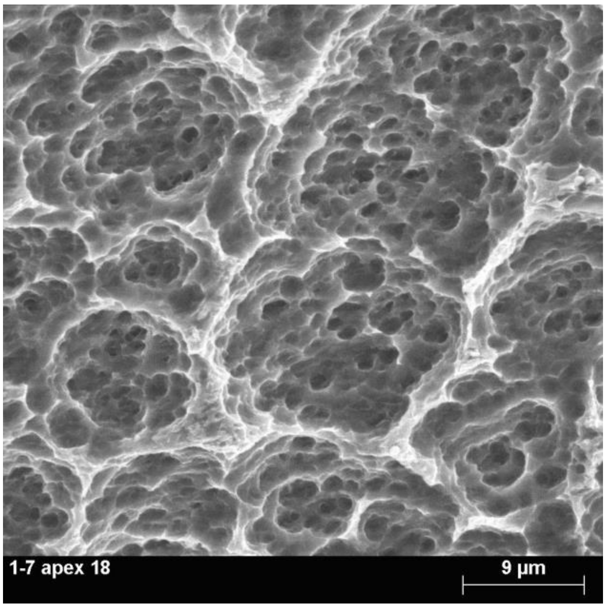

Fig. 1: SEM macrograph showing the macro- and micro-textured surface of the titanium alloy achieved with the proprietary etching recipe (mag x 2700).

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ACKNOWLEDGEMENTS: BIONER SA is acknowledged for allowing publication of this research work.