Biomechanical Analysis of Dual Acid-Etched and Chemically Modified Implant Surfaces

Carrilho, E.V.P.[1]; Jesus, R.N.R.[1,2]; Antunes, P.V.[3]; Ramalho, A.L. [3]; Zanetta-Barbosa, D.[2]

[1]Faculty of Medicine, University of Coimbra, Portugal
[2]Departamento de Cirurgia e Traumatologia Buco-Maxilo-Facial e Implantodontia, Faculdade de Odontologia – Universidade Federal de Uberlândia, Uberlândia/MG, Brasil.
[31]Faculty of Sciences and Technology, University of Coimbra, Portugal

INTRODUCTION

The current technological advances applied to changes in dental implant surfaces resulted in different biomechanical properties, including morphology, chemical composition and physical structure, which directly define their potential bioactive and osteoconductivity, the process of directing tissue formation provided by a solid structure. However, there is a question about the ideal condition of primary stability.

OBJECTIVES

The objective of this preclinical in vivo study was to compare the biomechanical fixation intrinsic to the removal torque properties, such as energy and stiffiness between two types of surfaces of dental implants: sandblasted and dual acid-etched followed by microwave treatment and insertion in isotonic saline solution (H - Hydrophilic; n = 12) and the control group were only sandblasted and dual acid-etched (E - Etched, n = 12).

MATERIALS AND METHODS

1. Selection of Samples

Selection and installation of 4 implants (10mm x 4mm, L x Ø) along the proximal tibia of 6 beagle dogs.

2. Surgical Procedure

Ethics Committee (Protocol 098/10 - UFU, Brazil)

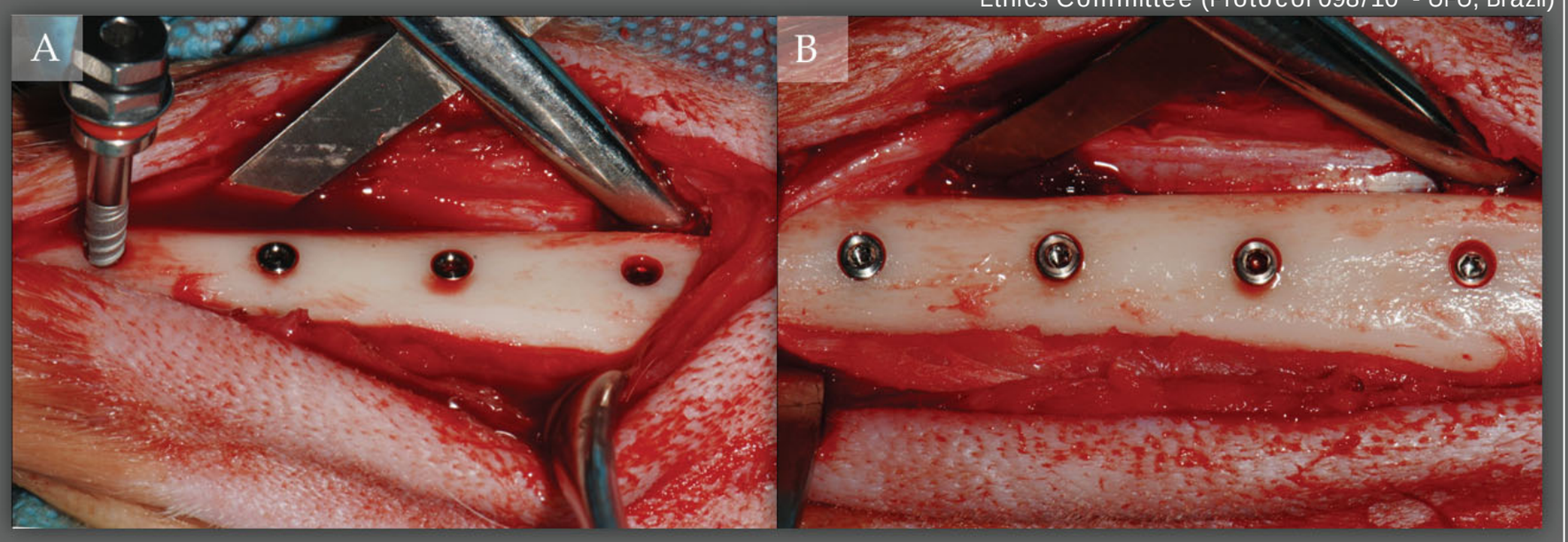
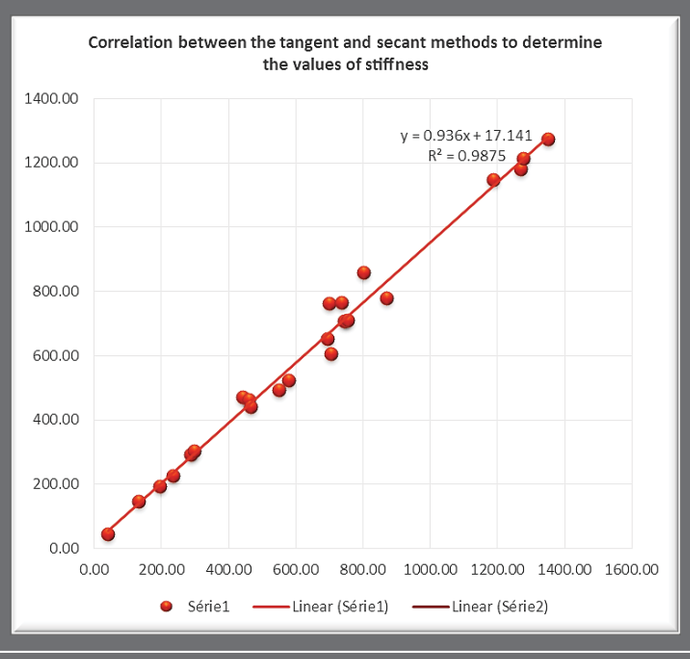


Fig.: A e B: Two pairs of implants (10mm x 4mm, L x Ø) from each of the experimental groups were placed in each tibia according to the manufacturer's instructions under copious sterile saline irrigation and with a torque of about 45Ncm (last drill 3.5 mm in Ø). The implants were placed with an alternating fashion regarding the group, but with the first implants' group chosen at random.

3. Removal Torque Test

Removal torque test performed in a universal testing machine with a speed of 1.96 mm / min.

4. Energy[J] and Stiffiness[Ncm/rad] Calculation



Energy and stiffness calculation	
Maximum torque [Ncm]	53.18
Energy [J]	193.71
Stiffness [Ncm/rad]	707.47

The Tukey test for multiple comparisons and ANOVA with 95% significance level were used for statistical analysis.

RESULTS

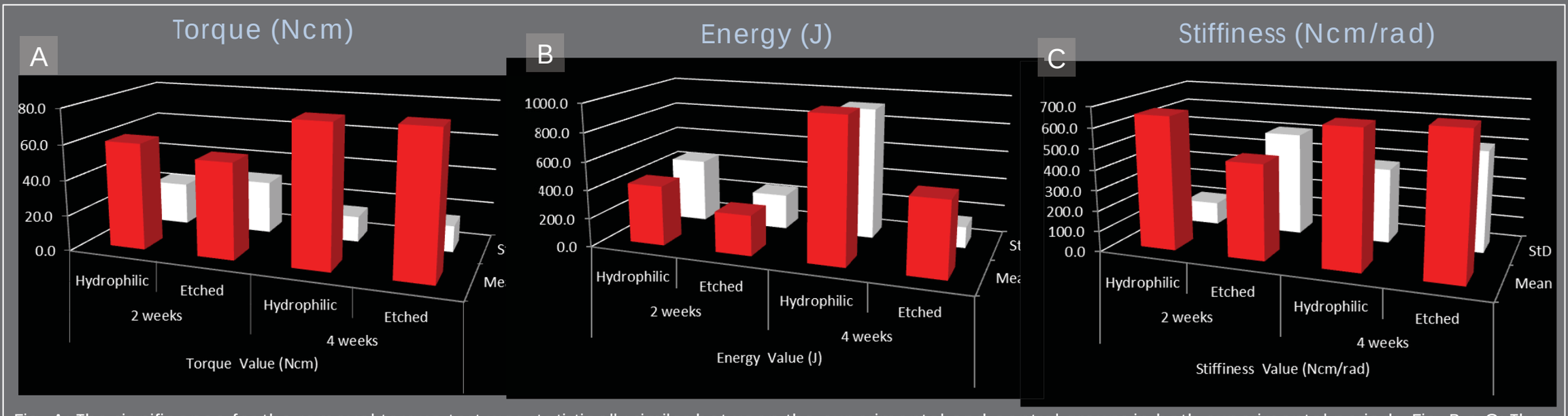


Fig. A: The significance for the removal torque test was statistically similar between the experimental and control groups in both experimental periods. Fig. B e C: The experimental group showed higher values of energy required to remove the torque, while the stiffiness values showed to be very similar between the groups tested.

CONCLUSION

The biomechanical results suggest that the initial phase of bone repair can be positively impacted by chemically modified surfaces, allowing the installation of early or immediate functional loads.

REFERENCES

1. Coelho PG, Suzuki M, Guimarães MVM, Marin C, Granato R, Gil JN, Miller RJ. Early bone healing around different implant bulk designs and surgical techniques: A study in dogs. Clin Implant Dent Relat Res. 2010:12(3):202-8.
2. da Cunha HA, Francischone CE, Filho HN, de Oliveira RC. A comparison between cutting torque and resonance frequency in the assessment of primary stability and final torque capacity of standard and TiUnite single-tooth implants under immediate loading. Int J Oral Maxillofac Implants. 2004 Jul-Aug;19(4):578-85.

Source of funding: