



Wear of the implant hexagon with Zirconia and Titanium abutments

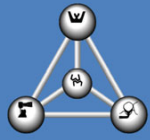


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Introduction

In contrast to the high success rates of osseointegration (95% to 97%), mechanical complications are still common in implant dentistry.^{1,2} Mechanical complications such as screw loosening, screw fracture, and framework fracture have been reported to be as high as 44.9%.^{2,3}

Objectives

Evaluate the wear of the implant-abutment interface after a torsional fatigue test that simulates a loose abutment situation.

Methods

Five external hexagonal implants Lance (MIS Implants Technologies Ltd, Bar Lev Industrial Park, Israel) Lot W0198132, were embedded with acrylic resin Orthocryl (Dentatum GmbH Co. KG, Ispringen, Germany) and divided into 3 groups:

- Control group: with one specimen – non engaging titanium abutment.
- Group A: two engaging titanium abutments, REF ED-TCH13 Lot WO1146577 (MIS Implants Technologies Ltd, Bar Lev Industrial Park, Israel)
- Group B: two engaging zirconia abutment (ICE Zirkon, Zirkonzahn GmbH, Gais, Italy).

Prior to testing the rotational freedom for each pair was access with a custom made device. Each pair was torqued to 35Ncm and placed on an Instron 8874 (Instron Corporation, Norwood, MA, USA) machine and loaded on a rotational test: +/-3,3 degrees at 4Hz, with a compressive force of 100N for 250.000 cycles. After testing the rotational freedom was measured.

A Scanning Electron Microscopy evaluation was made of implants and abutments.



Figure 1 Custom device for evaluating the rotational freedom



Figure 2 Implants prepared for testing

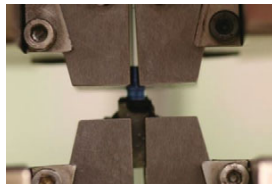
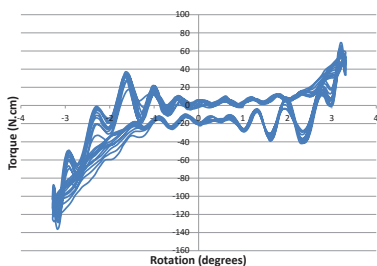


Figure 3 Implant and abutment during testing

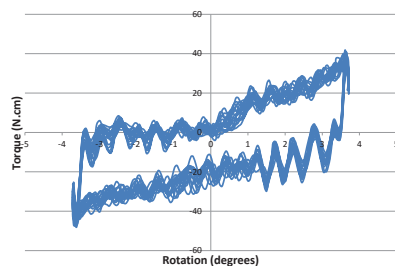
Results

Table 1: Rotational freedom before and after testing (degrees)

	Titanium	Zirconia
Initial	1,63	1,91
Final	7,07	3,29



Graph 1 – Mechanical hysteresis curve from the Titanium abutment



Graph 2 – Mechanical hysteresis curve from the Zirconia abutment

The screws in all groups were loose after testing. In both groups there was an increase in the rotational freedom

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The non hexed titanium abutment did not show evidence of wear but there was wear on the outside ring of the implant, not on the hexagon. There was evidence of adhesive wear and abrasion with the titanium abutment and with the zirconia abutments there was adhesive wear, abrasion and 3 body abrasion.

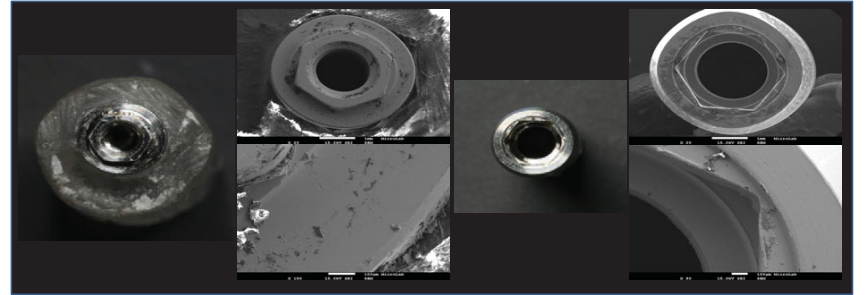


Figure 4 Control group: Implant and no hexagonal titanium abutment

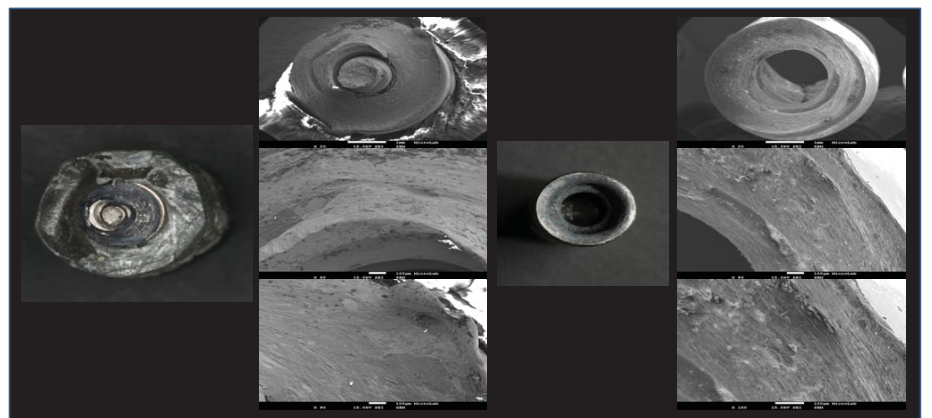


Figure 5 Group A: Implant + hexagonal titanium abutment.

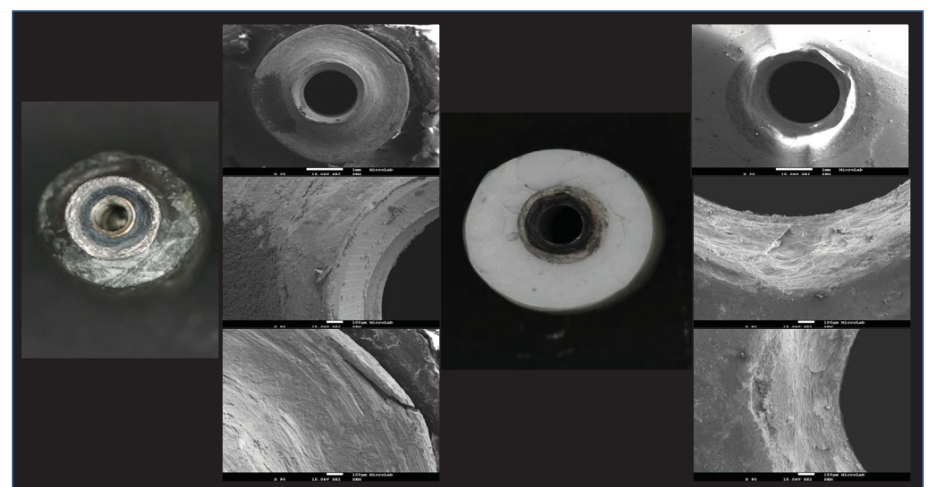


Figure 6 Group B: Implant + zirconia hexagonal abutment

Discussion

Studies that evaluate the rotational freedom of implants or abutments show different results due to differences in machining tolerances of the different implant systems.⁴ The literature is sparse on torsional tests of implants and abutments.^{5,6} The rounding of the implant hexagon is consistent with the findings of Yao and Dhingra.^{5,6} Further testing should be made to understand the implications of the released material.

Conclusions

The loose screw in an implant prosthesis may lead to the wear of the hexagon on both parts. The wear is sufficient to compromise the implant abutment connection beyond repair.

Clinical Implications

When a patient presents a loose screw restoration, special care should be taken to remove the restoration and visual examination of the implant/abutment connection should be made to evaluate it.

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