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BASIC RESEARCH

Stability of zirconia mesio-abutments bonded to titanium bases restored with monolithic crowns

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Background and Aim

The development of the titanium bonding-bases allows a combination of a metallic connection to the implant with different all-ceramic supra-structures, including monolithic reconstructions. Until today, it remains still not clear how stable these reconstructions are.

The **aim** of this study was to assess the:

- **bending moments**
- **failure mode**

*of **zirconia mesio-abutments** on **titanium bonding-bases** restored with different **all-ceramic monolithic crowns** after aging.*

Methods and Materials

Four different CAD-CAM abutment-crown combinations (n=12 per group) were tested (Fig. 1). The respective abutments were screw-retained onto 48 implants with an internal connection (Conelog, Camlog) and the crowns were cemented onto these abutments.

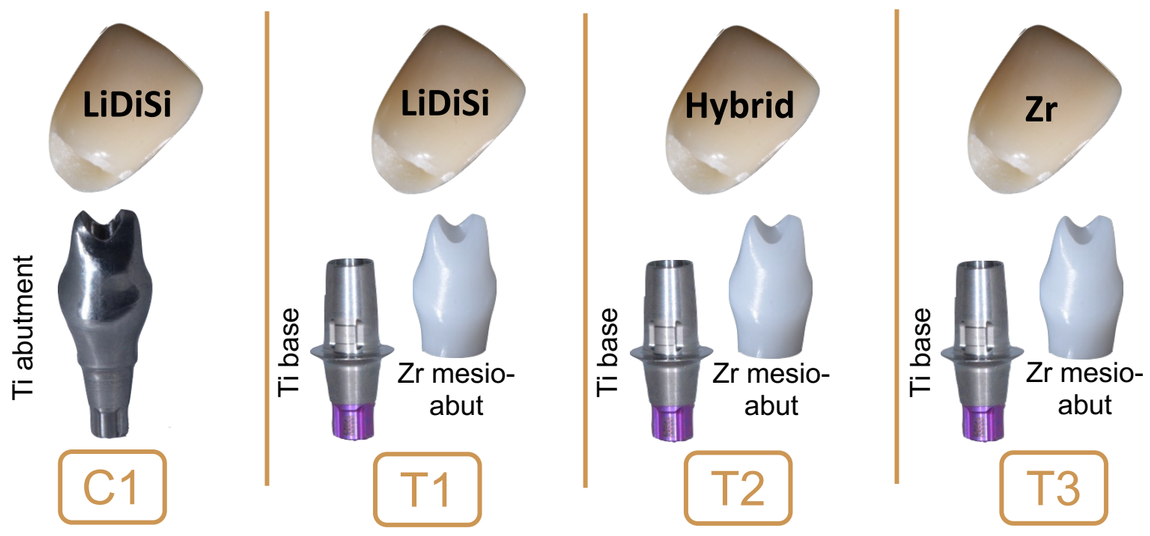


Figure 1: Four study groups with different combinations of abutments and crown material.

Pre-treatment of surfaces + bonding (Panavia 21 TC)

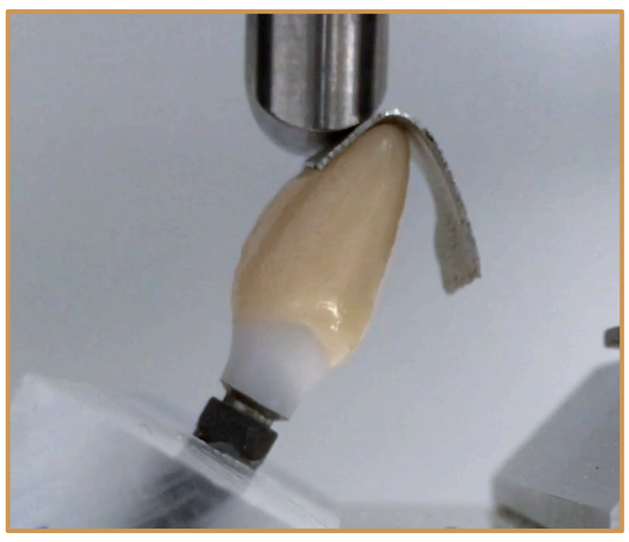
Embedding of samples in acrylic holders (ISO-Norm 14801) [1,2]

Aging (dynamic load)

Failure analysis

Chewing simulation (1'200'000 cycles, 49 N, 1.67 Hz, thermal cycles: 5°C-50°C, 120s) [1,2]

Fracture test (static load)



Cross-head speed (1mm/min) [1,2]

Video 1: Static load applied until failure. (Note that the video speed is edited).

Failure analysis

Bending moments **(MPa)**

Statistic analysis

- Bending moments values: 1-way ANOVA followed by Tukey post hoc test ($p<.05$).
- Failure mode: analyzed descriptively.

Results

After aging (dynamic load):

All samples survived the aging and no failures were registered.

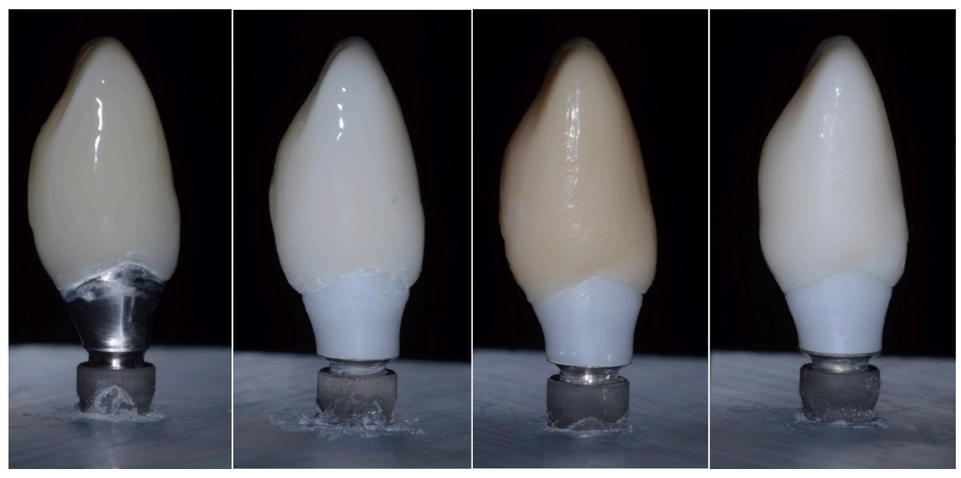


Figure 2: Samples of the groups C, T1, T2 and T3 after aging.

After fracture test (static load):

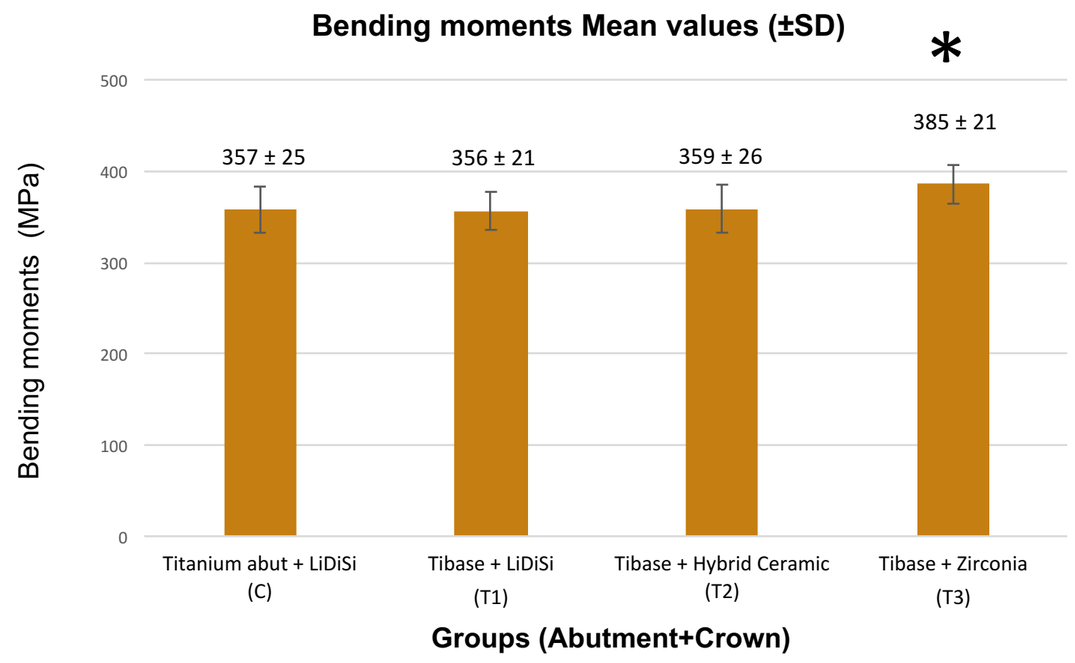


Figure 3: Graphic of the bending moments (MPa) (mean ± SD) for the 4 study groups. Note that * refers to statistically significant difference ($p<.05$).

→ Zirconia crowns (T3) exhibited significantly higher mean bending moments than the other groups ($p<.05$).

→ No statistically significant differences were found between:

- zirconia mesio-abutments on titanium bonding-base abutments
- customized titanium abutments

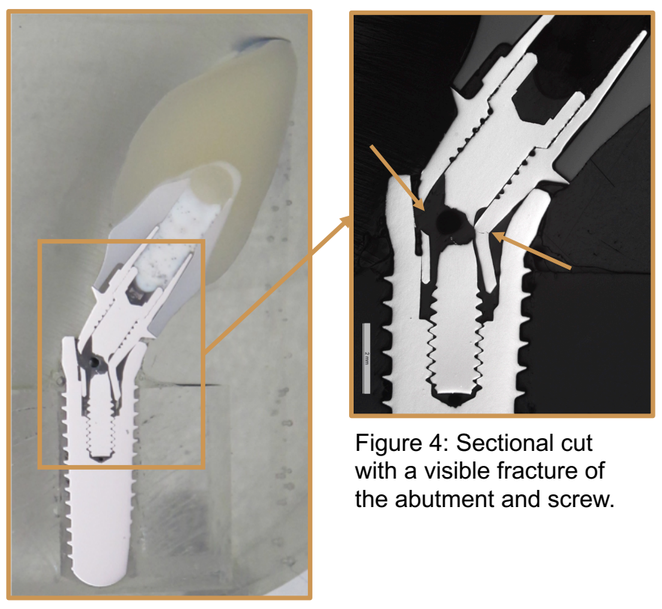


Figure 4: Sectional cut with a visible fracture of the abutment and screw.

→ In all groups, failures occurred due to **fracture of the abutment and screw** head in the internal connection of the implants after bending of the abutments and implants.

Conclusions

The use of zirconia mesio-abutments bonded to titanium bonding-bases showed to be a stable combination when compared to the customized titanium abutments. Regarding the crown material, monolithic zirconia revealed to be mechanically superior than the other crown materials.

References

1. Mühlemann et al. Bending moments of zirconia and titanium implant abutments supporting all-ceramic crowns after aging. Clin Oral Impla Res. 2014; 25(1):74-81.

2. Sailer et al. In vitro study of the influence of the type of connection on the fracutre load of zirconia abutments with internal and external implant-abutment connections. Int J Oral Maxillofac Implants. 2009;24:850-8.

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