The metal base zirconia abutment behavior on implant-abutment interface under cyclic loading

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Objectives: The effect of the metal base zirconia abutment on wear/stability of the implant-abutment assembly under cyclic loading is unclear. The purpose of this in vitro study was to evaluate the detorque and wear of internal connections caused by metal base zirconia abutments upon cyclic loading.

Experimental Methods: 20 morse taper 4.3 x 11.5mm implants and 10 internal hexagon 4,0 × 11.5mm connection implants were divided into 3 groups with 10 specimens in each. The abutments included: RP (morse taper), MI (morse taper) and AR (internal hexagon). Abutments provided by the manufacturer were fixed to the implants with 30-Ncm (MI and RP) and 20-Ncm (AR) torque using an analog torque wrench. 30 zirconia crowns were manufactured using CAD/CAM technology and bonded with U200 cement. The detorque was evaluated after cyclic loading. Wear of the implants connections was analyzed with scanning electron microscopy (SEM) at magnification ×120. A 1-way ANOVA test was used for wear and detorque values. Significant differences were resolved using the Tukey HSD test (α=.05).

Results: The MI (24.931 ± 0.534 N) and RP (24.136 ± 0.616 N) groups showed significantly more detorque than AR (14.415 ± 0.389 N) group ($P < 0.05$) after the cyclic loading. After cyclic loading, tension side and compression side showed significantly higher wear rate on all implants. Despite significantly increased wear in all groups, on the tension side, all groups, AR (121.0 ± 8.808), MI (68.0 ±5.322), RP (82.5 ± 7.680), showed significantly higher wear rate than compression side AR (112.583 ± 10.243), MI (65.250 ± 5.619), RP (76.417 ± 7.544) after cyclic loading.

Conclusion. Despite different connection systems, the implant-abutment joint lost torque after cyclic loading. Additionally, the cyclic loading aggravated the wear, regardless of connection system. Less wear on the implant positively predicts implant success. The connection system may indicate long-term stability at the implant-abutment interface.

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