

https://dspace.org/

Retention force and fatigue strength of mandibular singleimplant overdenture attachment systems

Van der Linde, Schalk Jacobus

2024

https://hdl.handle.net/10539/37541

Downloaded from a DSpace repository. https://dspace.org/

Abstract

Purpose

A single mandibular implant-retained overdenture is now recognised as a viable alternative to the more conventional two implant-retained overdenture. Historically, ball abutments and high performance synthetic polymers for the matrix have been used as the attachment system, but regular prosthetic maintenance can be a significant drawback. This *in-vitro* study aimed at determining the mechanical properties of a novel prototype matrix designed with ease of replacement in mind to reduce the prosthetic maintenance burden.

Method

Custom test bases with a simple holding device were made, to enable tensile and fatigue testing for the experimental prototype (OBZ abutment and a polyetheretherketone (PEEK) matrix) and control attachment system (OT-Equator® abutment with standard nylon matrix). Each assembled sample was subjected to 10 tensile pull tests to determine initial retention values. For fatigue testing samples were immersed in saline after which they were manually pulled apart and re-seated, whilst being re-immersed in the saline after a designated number of cycles. Tensile test values were measured until a pre-determined retention force value of 20 N was reached, representing clinical failure. Volunteers (five clinicians/technicians and five non-trained individuals) were recruited to replace both attachment systems, and the replacement time taken, and perceived ease of replacement were recorded for each participant.

Results

The prototype PEEK matrix system was significantly more retentive ($p < 000.1$) than the control system after initial tensile testing. Simulated fatigue testing following saline immersion revealed no significant difference ($p > 0.05$) after 100 cycles; saline immersion reduced the values in both attachment systems. There was no significant difference ($p > 0.05$) in mean retention force value at point of failure, but there was, however, a significant difference ($p \leq 0.05$) in failure point between the two attachment systems, with the OBZ abutment with prototype PEEK matrix failing much earlier. Participants found replacement of the prototype PEEK matrix significantly easier, regardless of their level of experience.

Conclusion

For a mandibular single implant-retained overdenture the clinically acceptable retention values of the OBZ abutment with prototype PEEK matrix, together with its ease of replacement, mean that it can be considered a viable alternative to the current OT-Equator® abutment with standard retention nylon matrix.