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Effect of lubricant on the reliability of dental implant abutment screw joint: an in vitro laboratory and three-dimension finite element analysis

TRACK OR CATEGORY

Wear, Lubrication

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INTRODUCTION

Biomechanical factors hold the key to successful dental implantation. Single tooth implants generally show joint instability, screw loosening and fracture due to fatigue [1]. Implants restoring with single molar or premolar crowns are associated with abutment screw loosening up to 7% [2]. The estimated rate of loose abutment or screw was 12.7%~43% [3,4]. In another study, 26% of the screws required tightening again during the first year [5]. The screw fracture rate was 3.5% in a clinical study over 15 years [6].

ABSTRACT

This study investigated the effect of lubricants on the stability of dental implant-abutment connection. As lubricants, graphite and Vaseline were coated on the abutment screw surface respectively, and a blank without lubricant served as the control. The total friction coefficient (μ_{tot}), clamping force, fatigue behavior and detorque of the joint combined with dynamic cyclic loading were measured under different lubricating conditions. Further, a three-dimensional finite element analysis was used to investigate stress distribution, in conjunction with experimental images. The results showed that the lubricant reduced μ_{tot}, which in turn led to an increase in clamping force. Decrease in loading increased the fatigue life of the screw. However, use of lubricant at high load reduced the fatigue

life. Ductile fracture at the first thread of the screw was the chief failure mode, which was due to maximum von Mises stress. Higher stress levels occurred in the lubricant groups. Lubricated screws resulted in lower detoque which made the joint easier to loosen. In conclusion, the lubricant cannot effectively improve the reliability of dental implant-screw uncontaminated and strengthening the surface of the screw may be recommend for clinical operation and future design.

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KEYWORDS

Dental implant, lubricant, fatigue, finite element analysis, loosening