Schwitalla AD; Abou-Emara M; Spintig T; Lackmann J; Müller WD. Finite element analysis of the biomechanical effects of PEEK dental implants on the peri-implant bone. Journal of biomechanics; VOL: 48 (1); p. 1-7 /20150102/

ABSTRACT: Dental implants are mostly fabricated of titanium. Potential problems associated with these implants are discussed in the literature, for example, overloading of the jawbone during mastication due to the significant difference in the elastic moduli of titanium (110 GPa) and bone (~~1-30 GPa). Therefore poly-ether-ether-ketone (PEEK) could represent an alternative biomaterial (elastic modulus 3-4 GPa). Endolign(®) represents an implantable carbon fiber reinforced (CFR)-PEEK including parallel oriented endless carbon fibers. According to the manufacturer it has an elastic modulus of 150 GPa. PEEK compounds filled with powders show an elastic modulus around 4 GPa. The aim of the present finite element analysis was to point out the differences in the biomechanical behavior of a dental implant of Endolign(®) and a commercial powder-filled PEEK. Titanium served as control. These three materials were used for a platform-switched dental implant-abutment assembly, whereas Type 1 completely consisted of titanium, Type 2 of a powder-filled PEEK and Type 3 of Endolign(®). A force of 100 N was applied vertically and of 30° to the implant axis. All types showed a minimum safety factor regarding the yield strength of cortical bone. However, within the limits of this study the Type 2 implant showed higher stresses within the adjacent cortical bone than Type 1 and Type 3. These implant assemblies showed similar stress distributions. Endless carbon fibers give PEEK a high stability. Further investigations are necessary to evaluate whether there is a distinct amount of endless carbon fibers causing an optimal stress distribution behavior of CFR-PEEK.

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