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## Research paper

# Biomechanical comparison of implant retained fixed partial dentures with fiber reinforced composite versus conventional metal frameworks: A 3D FEA study

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## ABSTRACT

Fiber reinforced composite (FRC) materials have been successfully used in a variety of commercial applications. These materials have also been widely used in dentistry. The use of fiber composite technology in implant prostheses has been previously presented, since they may solve many problems associated with metal alloy frameworks such as corrosion, complexity of fabrication and high cost. The hypothesis of this study was that an FRC framework with lower flexural modulus provides more even stress distribution throughout the implant retained fixed partial dentures (FPDs) than a metal framework does. A 3-dimensional finite element analysis was conducted to evaluate the stress distribution in bone, implant–abutment complex and prosthetic structures. Hence, two distinctly different models of implant retained 3-unit fixed partial dentures, composed of Cr–Co and porcelain (M-FPD model) or FRC and particulate composite (FRC-FPD model) were utilized. In separate load cases, 300 N vertical, 150 N oblique and 60 N horizontal forces were simulated. When the FRC-FPD and M-FPD models were compared, it was found that all investigated stress values in the M-FPD model were higher than the values in the FRC-FPD model except for the stress values in the implant–abutment complex.

It can be concluded that the implant supported FRC-FPD could eliminate the excessive stresses in the bone–implant interface and maintain normal physiological loading of the surrounding bone, therefore minimizing the risk of peri-implant bone loss due to stress-shielding.

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## 1. Introduction

In recent years, as a result of advances in oral implantology the osseointegrated dental implants have been shown to be predictable options for treatments ranging from the

replacement of a single tooth to complete arch restorations (Christensen, 2002; Pietrabissa et al., 2000). In the last decade, dental implants have been successfully used to support fixed partial dentures (FPD) (Naert et al., 2001).

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