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A comparative evaluation of the stress distribution in a tooth - implant supported prosthesis (TISP) as a function of implant angulation, design and bone quality using finite element analysis

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Abstract

Purpose: The success of implant prosthodontics in clinical practice is influenced significantly by the design of the implant threads. The choice of thread design is crucial in determining treatment outcomes. This study was conducted to analyze how stress is distributed in tooth-implant supported prosthesis (tisp) in cortical and cancellous bone using finite element analysis, with the aim of identifying the specific areas that bear the highest loads for each design. Materials and Methods: Three implants were studied, each featuring distinct thread designs: V-thread, buttress, and reverse buttress. The dimensions of these implants were standardized. The study focused on the mandibular and maxillary molar regions, assuming cortical and cancellous bone to be isotropic and homogeneous. Implant modeling was performed using HyperMesh 11 software. Vertical loads of 100N were applied, and stresses were evaluated based on the Von Mises stress criterion Results: The present study concludes that the overall stress was highest in buttress thread design, also the distribution of stress was also found to be better in buttress thread design than reverse buttress and V thread design. Stress on implant and abutment was also found less in buttress thread design due to better distribution of stress in dental bridge. Conclusion: Therefore, considering the constraints of this study, the findings can be used in clinical practice to guide the selection of implant thread designs for achieving reliable success in implant therapy. Key Words: Finite element analysis, implant, thread designs, tooth-impant supported prosthesis, Stress Distribution, Load-bearing Areas, Comparative Analysis

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