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Photoelastic analysis of stresses in implant-retained obturator prosthesis on tilted implants with different systems

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As an alternative to atrophic ridges of maxillectomized patients, the installation of implants with distal inclination in greatest bone density areas has been indicated in order to improve the geometric arrangement of the joint prosthesis/implant. However, the biomechanical function of the implant is still uncertain. This study aimed to evaluate the stress distribution of implant retained palatal obturator prosthesis with tilted implant and different attachment systems by using the photoelastic analysis images. Two photoelastic models of the maxilla with oral-sinus nasal communication were fabricated. One model received three implants on the left side of the alveolar ridge with two parallel implants (incisive, canine) and one tilted implant (distal angulation of 17° in first molar region) and the other model did not receive implants. Afterwards, a conventional palatal obturator prosthesis (control) and four implant-retained palatal obturator prostheses with different attachment systems (o’ring; two o’rings placed over the bar, bar-clip and bar-clip with two distally placed o’rings) were constructed. Models were placed in a circular polariscope and a 100-N axial load was applied in three different regions (incisive, canine and first molar regions) by using a universal testing machine. The results were photographed and analyzed qualitatively using software (AdobePhotoshop). The bar-clip system exhibited the highest stress concentration followed by the bar-clip system with two-distally placed o’rings, bar with two o’rings placed over the bar, o’ring system and conventional denture. The greatest stress concentration was observed on the apex of the implants. The attachment system affected the stress distribution of implant-retained palatal obturator prosthesis. The tilted implant exhibited a biomechanical behavior similar to the parallel implants.

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