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Effects of bone atrophy degree and implant type in peri-implant bone stress of mandible: All-on-four treatment concept

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Objective: Recently, All-on-Four implant restoration concept is very popular in Taiwan for elderly patient; however, this restoration concept has some biomechanical issues. The purpose of this study was to evaluate the biomechanical effects of bone atrophy degree and implant type for All-on-Four treatment concept in peri-implant bone stress/strain of mandible.

Methods: Two kinds of atrophy degrees of edentulous artificial mandibles, including mild atrophy edentulous mandible (#8571, Synbone AG, Malans, Switzerland) and moderate atrophy edentulous mandible (#8570, Synbone AG, Malans, Switzerland) were used with two types of implant systems including Nobel Active and Nobel Speedy (Nobel Bio care AB, Göteborg, Sweden) to create the three-dimensional (3D) finite element (FE) models for analyses. A vertical force of 155 N was applied to posterior region of the framework nearby the first molar as loading condition. The maximum von-Mises stress of bone around the implant were selected and quantified for comparison.

Results & Conclusions: Jaw bone atrophy increases the bone stress around the implant of the All-on-Four treatment concept. In addition, the effect of fixture design (Noble Active implant vs. Noble Speedy implant) in peri-implant bone stress is not absolute. Noble Speedy implant used in the mild atrophy of jawbone bring a lower bone stress as compared to that with Noble Active implant, but in the model of moderate atrophy of the jaw bone the use of Noble Active implant resulted in a lower bone stress value.

Future Works: The analyses combined with the other important parameters including implant length, and implantation positions and angulations of two dental implants in the incisor area will be carried out in the future works.

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