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Properties of Axially Loaded Implant-
Abutment Assemblies Using Digital
Holographic Interferometry Analysis”*

Juraj Brozović, Nazif Demoli, Nina Farkaš, Mato Sušić,
Željko Alar, Dragana Gabrić Pandurić

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¹ Juraj Brozović
² Nazif Demoli
³ Nina Farkaš
⁴ Mato Sušić
⁵ Željko Alar
⁴ Dragana Gabrić Pandurić

“Properties of Axially Loaded Implant-Abutment Assemblies Using Digital Holographic Interferometry Analysis”

SUMMARY.

Objective

The aim of this study was to (i) obtain the force-related interferometric patterns of loaded dental implant–abutment assemblies differing in diameter and brand using digital holographic interferometry (DHI) and (ii) determine the influence of implant diameter on the extent of load-induced implant deformation by quantifying and comparing the obtained interferometric data.

Methods

Experiments included five implant brands (Ankylos, Astra Tech, blueSKY, MIS (C1) and Straumann), each represented by a narrow and a wide diameter implant connected to a corresponding abutment. A quasi-Fourier setup with a 25mW helium–neon laser was used for interferometric measurements in the cervical 5 mm of the implants. Holograms were recorded in two conditions per measurement: a 10N preloaded and a measuring-force loaded assembly, resulting with an interferogram. This procedure was repeated throughout the whole process of incremental axial loading, from 20N to 120N. Each measurement series was repeated three times for each assembly, with complete dismantling of the implant-loading device in between. Additional software analyses calculated deformation data. Deformations were presented as mean values \pm standard deviations. Statistical analysis was performed using linear mixed effects modeling in R's lme4 package.

Results

Implants exhibited linear deformation patterns. The wide diameter group had lower mean deformation values than the narrow diameter group. The diameter significantly affected the deformation throughout loading sessions.

Significance

This study gained in vitro implant performance data, compared the deformations in implant bodies and numerically stated the biomechanical benefits of wider diameter implants.

Authors' affiliations

¹ Private dental office, Split, Croatia.
² Institute of Physics, Zagreb, Croatia.
³ Private dental office, Zagreb, Croatia.
⁴ Department of Oral Surgery, School of Dental Medicine, Zagreb, Croatia.
⁵ Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia.