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[Image PDF (435K)] [References]

Nonlinear Stress Analysis of Titanium Implants by Finite Element Method

<u>Sakae NAGASAWA¹⁾²⁾, Keigo HAYANO¹⁾, Tooru NIINO¹⁾, Kazunori</u> <u>YAMAKURA¹⁾, Takamitsu YOSHIDA¹⁾³⁾, Toshihide MIZOGUCHI³⁾, Nobuyosi TERASHIMA¹⁾, Kaoru TAMURA²⁾, Michio ITO¹⁾²⁾, Hiroshi YAGASAKI²⁾³⁾, Osamu <u>KUBOTA⁴⁾ and Masayuki YOSHIMURA⁴⁾</u></u>

1) Department of Dental Materials, Matsumoto Dental University

2) Division of Biomaterials, Department of Hard Tissue Research, Graduate School of Oral Medicine, Matsumoto Dental University

3) Division of Implantology, Institute for Oral Science, Matsumoto Dental University4) Yoshioka Co. Ltd.

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Abstract:

With use of dental implants on the rise, there is also a tandem increase in the number of implant fracture reports. To the end of investigating the stress occurring in implants, elasticity and plasticity analyses were performed using the finite element method. The following results were obtained:

(1) With one-piece type of implants of 3.3 mm diameter, elasticity analysis showed that after applying 500 N in a 45-degree direction, stress exceeding 500 MPa—which is the proof stress of grade 4 pure titanium—occurred. This suggested the possibility of fatigue destruction due to abnormal occlusal force, such as during bruxism.

(2) With two-piece type of implants that can tolerate vertical loading of 5,000 N, plasticity analysis suggested the possibility of screw area fracture after applying 500 N in a 45-degree direction.

(3) On the combined use of an abutment and a fixture from different manufacturers, fracture destruction of even Ti-6Al-4V, which has a high degree of strength, was predicted.

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