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Fabrication of Low-Cost, Cementless Femoral Stem 316L Stainless Steel Using Investment Casting Technique (Article)

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Abstract

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Total hip arthroplasty is a flourishing orthopedic surgery, generating billions of dollars of revenue. The cost associated with the fabrication of implants has been increasing year by year, and this phenomenon has burdened the patient with extra charges. Consequently, this study will focus on designing an accurate implant via implementing the reverse engineering of three-dimensional morphological study based on a particular population. By using finite element analysis, this study will assist to predict the outcome and could become a useful tool for preclinical testing of newly designed implants. A prototype is then fabricated using 316L stainless steel by applying investment casting techniques that reduce manufacturing cost without jeopardizing implant quality. The finite element analysis showed that the maximum von Mises stress was 66.88MPa proximally with a safety factor of 2.39 against endosteal fracture, and micromotion was 4.73μm, which promotes osseointegration. This method offers a fabrication process of cementless femoral stems with lower cost, subsequently helping patients, particularly those from nondeveloped countries. © 2013 International Center for Artificial Organs and Transplantation and Wiley Periodicals, Inc.

Author keywords

Cementless hip Hip replacement Implant Investment casting

Indexed keywords

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MeSH: Arthroplasty, Replacement, Hip Finite Element Analysis Hip Prosthesis Humans Prosthesis Design Stainless Steel Stress, Mechanical