

Computer Aided Shoulder Prosthesis Design and Manufacturing

Authors : Didem Venus Yildiz, Murat Hocaoglu, Murat Dursun, Taner Akkan

Abstract : The shoulder joint is a more complex structure than the hip or knee joints. In addition to the overall complexity of the shoulder joint, two different factors influence the insufficient outcome of shoulder replacement: the shoulder prosthesis design is far from fully developed and it is difficult to place these shoulder prosthesis due to shoulder anatomy. The glenohumeral joint is the most complex joint of the human shoulder. There are various treatments for shoulder failures such as total shoulder arthroplasty, reverse total shoulder arthroplasty. Due to its reverse design than normal shoulder anatomy, reverse total shoulder arthroplasty has different physiological and biomechanical properties. Post-operative achievement of this arthroplasty is depend on improved design of reverse total shoulder prosthesis. Designation achievement can be increased by several biomechanical and computational analysis. In this study, data of human both shoulders with right side fracture was collected by 3D Computer Tomography (CT) machine in dicom format. This data transferred to 3D medical image processing software (Mimics Materilise, Leuven, Belgium) to reconstruct patient's left and right shoulders' bones geometry. Provided 3D geometry model of the fractured shoulder was used to constitute of reverse total shoulder prosthesis by 3-matic software. Finite element (FE) analysis was conducted for comparison of intact shoulder and prosthetic shoulder in terms of stress distribution and displacements. Body weight physiological reaction force of 800 N loads was applied. Resultant values of FE analysis was compared for both shoulders. The analysis of the performance of the reverse shoulder prosthesis could enhance the knowledge of the prosthetic design.

Keywords : reverse shoulder prosthesis, biomechanics, finite element analysis, 3D printing

Conference Title : ICAOBTE 2019 : International Conference on Artificial Organs, Biomaterials and Tissue Engineering

Conference Location : Rome, Italy

Conference Dates : December 12-13, 2019