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AN APPROACH ON ARTHRITICS HIP SURFACE RESHAOING USING FINITE ELEMENT METHOD

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ABSTRACT

The study will be carried out to perform biomechanical evaluation of differences in contact pressure between normal and arthritis hip joints. The aim of study is to achieve a better understanding on the contact stress of a reshaped hip joint. In the study, it will be described how hip joint bone structure is converted into FEA model from a medical CT scan. After that, the non linear FEA method is used to give the details analysis on the contact stress of the arthritics hip reshaping.

Keywords: biomechanics, contact stresses, hip joint, arthritis, FEM.

INTRODUCTION

Finite element analysis (FEA) has been used in the biomechanical study of hip implant and periacetabular osteotomy, but not in the hip reshaping of arthritis. In this paper, the 3D FEA models of normal and arthritis hip joints will be created for comparison on the contact stress.

The hip joint problem is very common, in which the most common of problem is arthritics. Due to social effects like social life, hobbies, occupation, there are many younger arthritics patients previously.

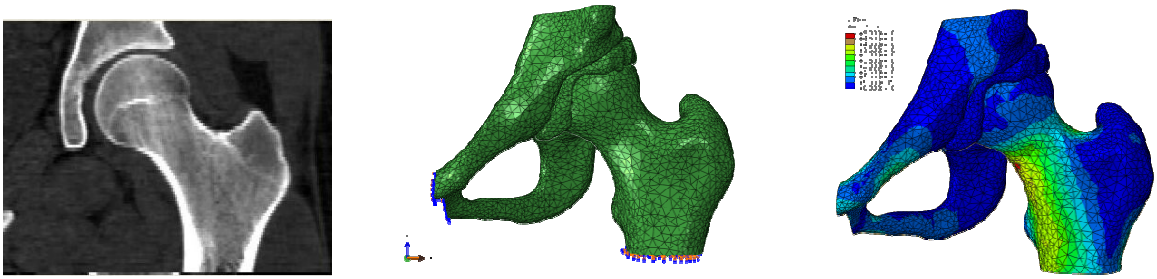
Hip implant is a successful method for the old and serious patients. However, there is growing consensus that most hip arthritis is due to impingement of the ball and socket of the hip due to shape abnormalities, collectively called femoroacetabular impingement (FAI). The ball does not fit accurately into the socket, leading to premature wear, and then destructive arthritis (Arbabi et al, 2010 and Camomilla et al, 2006). In this case, it is not necessary to replace the whole hip joint.

Newly developed surgical techniques depend on accurately reshaping the bones to relieve impingement and reduce wear, and have been shown to be effective. This surgery can be performed with a conventional open approach, or be arthroscopic (keyhole) surgery. It would be better to reshape bones to suit each individual patient.

The FEA is a method which might be used to help and lead the surgery more accurate. The study will be carried out to perform biomechanical evaluation of differences in contact pressure between normal and arthritis hip joints. The aim of study is to achieve a better understanding on the contact stress of a reshaped hip joint. In the study, it will be described how hip joint bone structure is converted into FEA model from a medical CT scan. After that, the non linear FEA method is used to give the details analysis on the contact stress of the arthritics hip reshaping.

RESULTS AND CONCLUSIONS

The present research work will concentrate on the effect of impingement of the ball and socket of the hip due to shape abnormalities, collectively called femoroacetabular impingement (FAI). The advanced non-linear Finite Element Method will be employed to the research work to understand the ball and socket contact stresses and deformations. The initial results show the surface shape effect on the ball and socket contact stress is significant, as shown in Fig.1.



(a) CT image (b) FEA model (c) Stress distributions

Fig. 1 - Hip contact stresses

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