BIOMECHANICAL DETERMINANTS OF CHONDROLABRAL COMPLEX LESIONS IN FEMOROACETABULAR IMPINGEMENT

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Introduction

The frequency of the chondrolabral complex lesions due to femoroacetabular impingement (FAI) in the study of cadaveric material is 93% [1,2]. As a biomechanically determined factor it can be subject to hip destruction and early osteoarthritis in Pincer-type impingement [3,4]. Work objective is to study the biomechanism and stress-strain behavior of the chondrolabral complex lesions in Pincer-type impingement during daily activity motions.

Methods

The SolidWorks package was used to build a 3D pelvis model with normal ratios in the femoroacetabular (FA) region and with Pincer-type impingement. Finite element analysis (FEA) of the stress-strain state (SSS) in ANSYS was performed to determine the von Mises stress, strain and total deformations for the isotropic pelvis model during 90° hip flexion and 15° internal rotation in daily motions.

Results

The maximum stress-strain values increased 2-3.4 times in the bone structure along the anterior upper acetabular rim, the femoral neck, and the acetabular labrum at the Pincer osteophyte contact area compared to the normal ratio in the FA model.

Discussion

The stress-strain increasing in contact area on the Pincer osteophyte and femoral neck can be a factor of the Cam-type osteophyte formation and the progression of acetabular rim ossification. Daily activity can lead to an increase in the maximum stress, as a factor of chondral delamination and destruction of the acetabular labrum. Early surgery is needed to avoid progression of the osteoarthritis in the Pincer-type impingement.

Figure and Tables

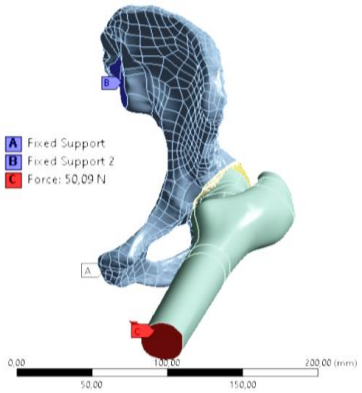

Figure 1: FEM of the femoroacetabular area with boundary conditions

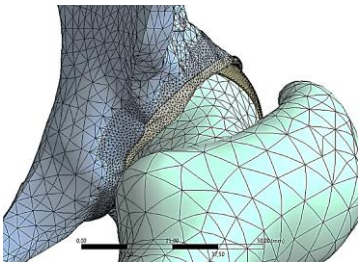

Figure 2: Finite element mesh

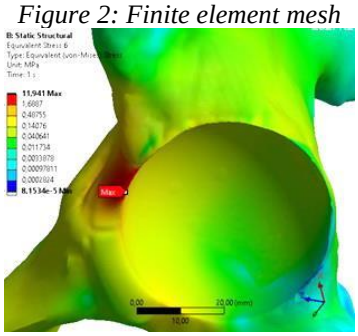

Figure 3: Graphic representation of stress at the acetabulum in the model with pincer-type FAI

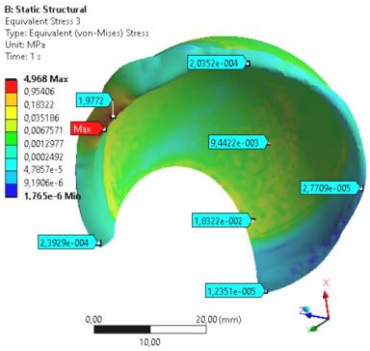

Figure 3: Graphic representation of stress at the chondrolabral complex in the model with pincer-type FAI

Model Element	FE model with Pincer-type FAI	FE model with normal ratio in FA area
Acetabulum	11.9	5.7
Labrum and cartilage	5.0	3.5
Femoral neck	1.4	0.4

Table 1: Stress on the model elements

References

1. McCarthy J et al., Clin Orth Rel Res. 406:38-47, 2003.
2. Kelly BT et al., Arthroscopy. 21(12):1496-504, 2005.
3. Ganz R et al., Clin Orth Rel Res. 417:112-20, 2003.
4. Abramson SB & Attur M. Arthritis Res Ther. 11(3):227, 2009.