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## FINITE ELEMENT ANALYSIS OF DIFFERENT PHYSICAL ACTIVITIES TO OPTIMISE THE CENTRE EDGE ANGLE IN A VIRTUAL GANZ PERIACETABULAR OSTEOTOMY

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### INTRODUCTION

Developmental dysplasia of the hip (DDH) may be corrected by a Ganz periacetabular osteotomy (PAO) [1]. This surgery corrects the position of the acetabulum in order to get better coverage of the femoral head [2]. The main aim of this research was to perform virtual Ganz PAO surgery by using a finite element model and determine the best position of the centre edge (CE) angle, evaluating different physical activities.

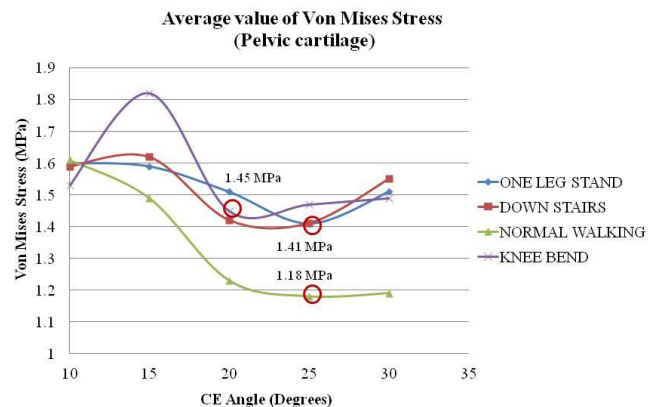
### METHODS

Finite element models from real DDH patient were first developed using computed tomography (CT) data. Four dysplastic hips with different dysplastic severity were modelled. A virtual PAO was then performed on the models. The acetabulum was rotated in the anterolateral direction in 5 degree increments from the original CE angle until the optimal position of the acetabulum is reached.

Finite element analysis was carried out to investigate the contact area, the contact pressure and the Von Mises stress in the cartilages of the hip. The activities evaluated were one leg stance, normal walking, descending stairs and knee bend.

### RESULTS AND DISCUSSION

The contact area, contact pressure and Von Mises stress in the cartilage vary accordingly to the increments of the CE angle. The contact area depends strongly on the individual joint conformation. The variation trends are similar in one leg stance, normal walking and descending stairs. However the optimal CE angle slightly varies between different activities (Figure 1). The optimal position of the CE angle is achieved, when the contact pressure and Von Mises stress descend to a minimum value and the contact area reach a maximum value.



**Figure 1:** Effect of CE angle on the average Von Mises stress of a patient with an original CE angle of 10 degrees. Red circles highlight the lowest stresses for each activity.

### CONCLUSIONS

It is possible to establish an optimum position of the acetabulum for patients suffering DDH, which reduces the Von Mises stress and the contact pressure in the cartilages. The optimal position of the acetabulum is patient dependent and can be determined by using 3D-computed models and finite element analysis. The information generated will improve pre-operative planning of the PAO.

### ACKNOWLEDGEMENTS

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