

Effect of Arthroscopic Notching During Osteoplasty of Cam Lesions for the Treatment of Femoroacetabular Impingement: A Biomechanical Analysis

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Summary:

This study utilized 4th generation composite femur models to evaluate the biomechanical effect of notching of the femoral neck at different depths that may occur during arthroscopic resection of cam lesions.

Abstract:

Background:

The purpose of this study was to investigate the effect of notching depth of the femoral neck on the compressive load required to cause a femoral neck fracture.

Methods:

Thirty 4th generation composite femurs, with an alpha angle of 61°, were divided into 5 groups: 1) intact, 2) resection of the femoral head-neck junction, reducing the alpha angle to 45°, 3) as in group 2 with 2 mm notching depth achieved with a 5.5 mm diameter spherical burr 4) as in group 2 with 4 mm notching depth, 5) as in group 2 with 6 mm notching depth. The specimens were loaded in the position of mid-stance during gait and tested until failure using a dynamic tensile testing machine with loading applied under displacement control at a rate of 6 mm/min.

Results:

The energy absorption and ultimate load to failure required to fracture the femoral neck was significantly lower between specimens with 4 mm notching and specimens with 6 mm notching versus the intact state ($p < 0.05$). For both metrics, there was also a significant difference between specimens with 6 mm notching and a cam resection alone ($p < 0.05$). In the deeper notching groups, the fracture line occurred more lateral as compared to groups without notching, propagating through the notch in 50% (3/6) and 83% (5/6) specimens in the 4 mm and 6 mm groups, respectively.

Conclusion:

Notching of the femoral neck influences a change in fracture pattern as compared to the intact state. Notching depths of 4 and 6 mm have a significant impact on ultimate load to failure and energy absorption as compared to the intact state.

Clinical Relevance:

Our results indicate that notching of the femoral neck during an arthroscopic cam resection while treating FAI can lead to an increased risk of a femoral neck fracture. If notching occurs during arthroscopy, extra post-operative precaution should be considered to avoid excessive forces on the weakened bone structure with prolonged limited weightbearing.