

Effect of Acetabular Labral Tears on Proprioceptive Parameters of the Human Hip Joint

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1. Introduction

Acetabular labral cartilage tears are a common cause of hip pain in younger, athletic individuals and are associated with the development of hip joint arthritis. The pain of labral tears negatively affects patients' daily activities and athletic goals.¹ These labral tears are difficult to diagnose despite the availability of advanced technology such as MRI scanning. Due to limited diagnostic tests, arthroscopic hip surgery is often used to confirm cartilage tears of the hip joint. As surgery is invasive, improved non-invasive diagnostic tools for this condition are needed.² We propose proprioceptive balance testing as a noninvasive and cost-effective method to assess patients with hip pain. This study is the first known scientific investigation into differences in balance between patients with hip labral cartilage tears and healthy controls.

2. Hypothesis

Patients with labral tears will have decreased hip joint proprioception, as quantified by established balance measurements.³

3. Methods

Thirteen individuals (8 healthy controls, 5 patients with labral tears) were recruited from the orthopaedic patient population and the area surrounding the Medical School. Measures were taken to match age and weight between the two cohorts. Study participants completed 20 seconds of single leg squats to develop fatigue, then immediately proceeded with 60 second static single leg postural sway test assessed using a force plate (Figure 1). Trials alternated between sides, and were separated by at least 1 minute of rest. The initial testing side for each participant

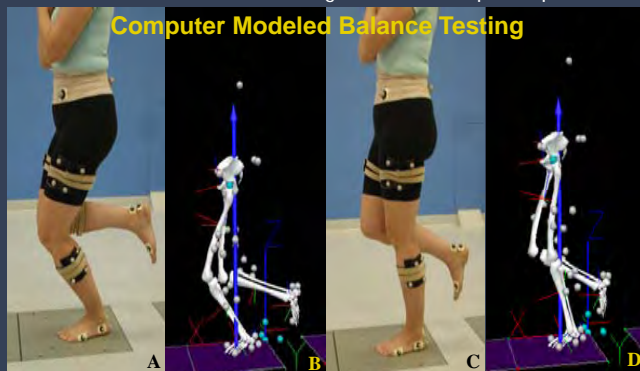


Figure 1: SUBJECT TESTING, A. Subject demonstrates a single leg squat, B. Computer generated model of single leg squat. C. Subject demonstrates single leg postural sway test, D. Computer generated model of single leg postural sway test.

(dominant or non-dominant for controls and pathologic or normal for patients) was randomized using a coin toss. A total of 7 trials were completed for each side, with the first trial on each leg counting as "practice," and not included in final analyses. The force plate measured Center of Pressure (COP) deviations (Figure 2), and these data were recorded and subsequently processed using custom MATLAB code. Measurements included the area of an ellipse that enveloped 95% of the data points (COP_EA, measured in mm²) and the path length of the COP (measured in mm). *Increased values in these measurements are associated with decreased balance and proprioception.*

4. Results

The labral tear patient cohort had increased COP_EA (mean=1151.6 mm²) and path velocity (mean=162.6 mm) overall than did the control group (1056.3 mm² and 134.5 mm, respectively). When compared with the patients' pathologic side only, these differences were increased (COP_EA = 1271.8 mm², path velocity = 168 mm). Both graphs in Figure 3 demonstrate the trend toward decreased balance seen in the patients' labral tear leg (blue) as compared to healthy controls (red) and patients' normal leg (green). Statistical significance was reached between the COP_EA of patient normal leg (green) and patient labral tear leg (blue).

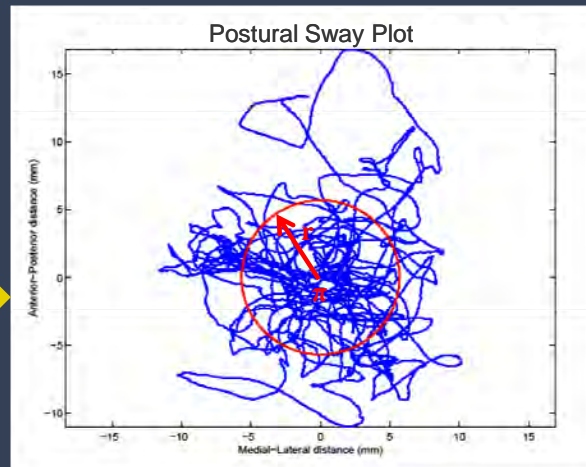


Figure 2: DATA CAPTURE, Sample postural sway plot, or "spaghetti plot," showing the Center of Pressure (π) deviation in the X and Y directions. The average deviation from the Center of Pressure (π) is extended out from the center as a radius, forming the red circle shown.

5. Conclusions

Based on our limited data set, two concepts can be drawn from our early results. First, computer based balance analysis (a noninvasive test) can successfully differentiate normal subjects and symptomatic hip patients based on single leg balance. Second, patients with labral tears appear to have worse balance in the affected leg than the unaffected leg. In conclusion, we recommend continuation of this project as a means to establish proprioception balance testing as a noninvasive means to assess for hip labral cartilage tears.

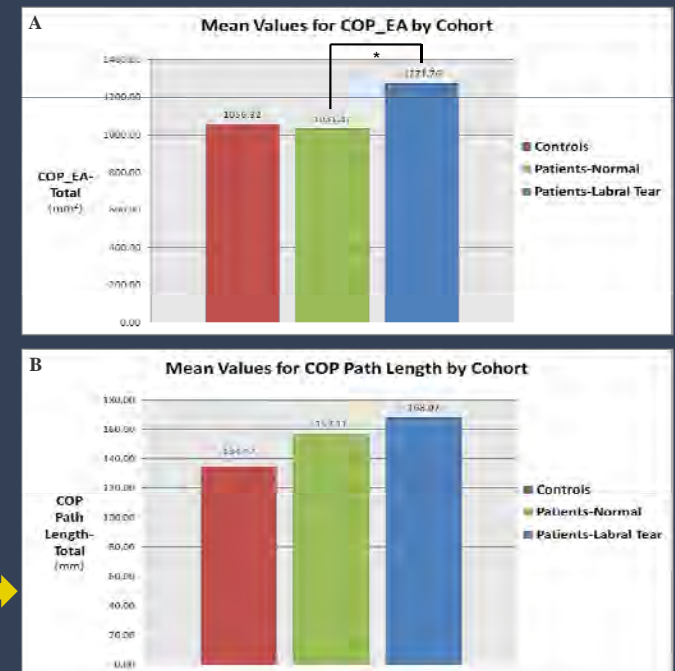


Figure 3: DATA ANALYSIS, A. Mean COP_EA values for Controls (red), Patient Normal Leg (green), and Patient Labral Tear Leg (blue). B. Mean COP Path Length values for Controls (red), Patient Normal Leg (green), and Patient Labral Tear Leg (blue).

*p=0.05

6. References

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