

Effect for Stability after Modified L'Episcopo Procedure in Reverse Shoulder Arthroplasty by Biomechanical Study Using Fresh Frozen Cadaver

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INTRODUCTION:

Reverse shoulder arthroplasty (RSA) with tendon transfer, initially introduced by Boileau et al¹⁾ as the modified L'Episcopo procedure, has emerged as a viable option for patients with cuff tear arthropathy and concomitant loss of active elevation and external rotation. While postoperative instability has been reported following the modified L'Episcopo procedure, the underlying relationship between the modified L'Episcopo procedure and shoulder stability is not clarified.

METHODS:

Eight fresh-frozen cadavers with dissected scapula region, to investigate the stability effects of the modified L'Episcopo procedure in RSA, were enrolled in this study. The cohort consisted of male individuals, with an average age of 86.3±11 years. Each cadaveric specimen comprised the complete scapula, clavicle, and shoulder complex, with the humerus sectioned 5 cm proximal to the humeral epicondyle. During the procedure, utmost care was taken to preserve the surrounding shoulder musculature, except for the supraspinatus, infraspinatus, and teres minor tendons. One manufacturer's reversed shoulder prosthesis was implanted. A deltopectoral approach was employed to dissect and detach the subscapularis tendon from the humeral head, while ensuring preservation of the pectoralis major muscles. The subsequent steps involved the transfer of the latissimus dorsi and teres major tendons, which were sutured using a #2 strong suture. The location of tendon transfer was at three different axial plane positions: 45°, 90°, and 135° posterior to the bicipital groove. Furthermore, two distinct heights were targeted: the attachment of the teres minor muscle and the middle level of the latissimus dorsi muscle. To assess the outcomes of stability, an anterior dislocation force (N) measurement was conducted utilizing a traction system at the glenohumeral joint. This assessment encompassed six distinct conditions: 30° and 60° of abduction at the glenohumeral joint, 30° of internal rotation, 0° of internal and external rotation, and 30° of external rotation, with and without subscapularis loading (Figure 1). To ensure accuracy and reliability, each test was performed randomly, with two trials conducted for each condition, and the resulting measurements were averaged. For statistical analysis, the Student-Newman-Keuls test was employed. A predetermined significance level of $P < 0.05$ was applied to determine the statistical significance of the findings.

RESULTS:

Specifically, it was observed that the anterior dislocation force was significantly higher when the tendon transfer was performed at the attachment of the teres minor muscle compared to the middle level of the latissimus dorsi muscle, regardless of the axial plane ($p < 0.05$, Figure 2,3). In addition, the results demonstrated that when the subscapularis tendon was repaired, the anterior dislocation force was significantly higher across all transition and postural positions ($p < 0.05$, Figure 4). This finding suggests that the repair of the subscapularis muscle plays a crucial role in enhancing anterior stability and reducing the susceptibility to anterior dislocation.

DISCUSSION AND CONCLUSION:

The insightful findings of our study shed light on the biomechanical aspects underlying the effect of the stability after the RSA with the modified L'Episcopo procedure. Our results demonstrated that the transition at the height of the teres minor muscle insertion significantly increased the lever arm of the transfer tendon which contribute to provide stability in the shoulder joint. Furthermore, our results indicate that repairing the subscapularis muscle, when feasible, further enhances stability. Based on our results, we concluded that RSA with the modified L'Episcopo procedure offers stability benefits by transferring the tendon to the insertion of the teres minor muscle and, whenever possible, repairing the subscapularis muscle. These surgical considerations provide valuable insights into optimizing stability outcomes and minimizing the risk of anterior dislocation in patients undergoing the RSA with the modified L'Episcopo procedure.

References

1. Pascal Boileau, et al. Modified latissimus dorsi and teres major transfer through a single delto-pectoral approach for external rotation deficit of the shoulder. *J Shoulder Elbow Surg.* 2007; 12: 671-682. DOI: 10.1016/j.jse.2007.02.127.