INTRODUCTION

Rotator cuff ruptures that extend into the infraspinatus may cause shoulder dysfunction. The correlation between degree of infraspinatus disruption and shoulder function is unknown. Due to a large defect associated with muscle retraction, it is not possible for some rotator cuff ruptures to be repaired. The purpose of this study was to determine if a critical size of infraspinatus defect exists that produces a substantial decrease in abduction torque generation. The second aim was then to investigate if a patch graft can reconstruct the cuff to restore glenohumeral abduction force.

METHODS

Ten cadaver shoulders were obtained. With loads applied to the rotator cuff tendons and middle deltoid, abduction torque at the glenohumeral joint were measured in the hanging arm in a neutral rotation position. Experiments were conducted in two phases. In the first phase, the effects of rotator cuff tear on abduction torques were measured for following conditions: (a) Intact rotator cuff. Supraspinatus (SSP), infraspinatus (ISP), teres minor (TM), subscapularis (SSC), and middle deltoid loads were applied. (b) Supraspinatus was unloaded. (c) Supraspinatus tendon defect with muscle retraction. Supraspinatus tendon and muscle were resected. (d) Supraspinatus muscle retraction and infraspinatus detachment. Infraspinatus tendon was detached step-by-step in one-fifth increments (1/5, 2/5, 3/5, 4/5, 5/5). The abduction torque was then measured under patch graft conditions considering (1) the effect of reattachment to the greater tuberosity, (2) partial narrowing of the defect by using a smaller graft, and (3) suturing the graft anteriorly to the rotator interval tissue versus suturing to the subscapularis (Figure 1). At each condition three static measurements of abduction torque were collected and averaged. The abduction torques generated under the different conditions of the rotator defect and patch graft were normalized to the intact rotator cuff and expressed as percentages. In order to evaluate the effects of these factors of interest, the data were modeled using multi-factor ANOVA. When a significant interaction was identified, comparisons of all pairs with that factor were performed using paired t-tests. All statistical tests were two-sided and the threshold of significance was set at alpha = 0.05.

RESULTS AND DISCUSSION

Glenohumeral abduction torque progressively decreased with greater infraspinatus detachment. When detachment extended to three-fifths of the infraspinatus, abduction torque reduced to 52% of intact, significantly less than supraspinatus release alone (61%) (p<0.05). Compared to supraspinatus release, abduction torque significantly increased with a graft (Figure 2) between the infraspinatus and either the rotator interval (68%) (p<0.01) or the subscapularis (80%) (p<0.01). The optimum grafting technique for restoring abduction torque occurred with a patch of decreased size between the infraspinatus and subscapularis with a suture to the greater tuberosity.

SUMMARY

The entire infraspinatus, including the most inferior portion, contributes to abduction torque generation. This indicates that the inferior portion, which includes the rotator cable insertion, plays a role in transmitting the compression forces across the glenohumeral joint. In addition, the defect closure with a patch graft contributes to restoration of abduction function at the glenohumeral joint due to a tenodesis effect and provides a treatment for otherwise irreparable defects.

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