

The Effect of Middle Trapezius Transfer on Humeral Head Translation and Subacromial Pressure in Irreparable Supraspinatus Tears- a dynamic biomechanical investigation

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Abstract

Background

Despite advancements in the treatment of rotator cuff tears, irreparable supraspinatus (SSP) tears remain difficult to manage. Middle trapezius transfer (MTT) has been introduced to restore function; however, biomechanical data on its efficacy is lacking.

Purpose

To assess the effects of MTT on superior humeral head translation and subacromial pressure in the setting of an irreparable SSP tear. It was hypothesized that a SSP tear would increase superior humeral head translation and subacromial pressure, and that MTT would reduce superior humeral head translation and subacromial pressure.

Study design: Controlled laboratory study.

Methods

Ten fresh-frozen cadaveric shoulders were mounted to a 6-degree of freedom robotic arm and underwent biomechanical testing in three states: (1) intact, (2) simulated irreparable SSP tear, (3) MTT. Each shoulder was brought to 30°, 45°, 60°, 75°, and 90° of abduction, and 60 N of superior force was applied to the humerus at each position. Superior humeral displacement was measured by the robot and subacromial contact area and peak contact pressure were measured using a pressure sensor.

Results

Cutting the supraspinatus caused increased superior humeral head translation (+1.6 to +3.8 mm, $p < 0.001$), increased peak pressure for abduction $< 90^\circ$ (+0.48 to +0.55 MPA, $p < 0.05$) and decreased contact area for abduction $> 30^\circ$ (-15 to -40 mm², $p < 0.05$). The MTT significantly reduced superior humeral head translation compared to supraspinatus cut but remained significantly increased from native at all angles (+0.89 to +2.3 mm, $p < 0.05$). MTT restored native contact pressure at all angles and contact area except at 60° and 90° .

Conclusion

Isolated irreparable SSP tears significantly increased superior glenohumeral translation and subacromial peak pressure, while decreasing the subacromial contact area. MTT restored shoulder kinematics towards physiological conditions by significantly reducing superior humeral head translation and subacromial peak pressure and increasing subacromial contact area. Combining its unique advantage of addressing both static and dynamic components, this transfer partially restored shoulder kinematics to native conditions in the presence of an irreparable SSP tear.

Clinical Relevance

The results of this study can inform clinical decision making regarding the use of middle trapezius transfer in clinical practice.