SCAPULAR KINEMATICS IN ADULTS AND CHILDREN

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INTRODUCTION

During humeral elevation, the mobile scapula acts as a stable base on which glenohumeral motion occurs (Paine & Voight, 1993). Appropriate motion of the scapula is important for dynamic positioning of the glenoid and three-dimensional scapular kinematics plays an important role in shoulder motion.

A number of studies have described scapular kinematics during humeral elevation in adults in both healthy individuals as well as those with shoulder pathologies (McClure et al., 2001, Graichen et al., 2000, Ludewig et al., 1996). The typical patterns of scapular movement in adults are documented in these studies. However, children and adults have morphological and physical differences. To our knowledge, no study has been performed examining scapular kinematics in children with either typical or atypical development. Consequently the influence of age and development on scapular motion is currently unknown. The aim of this study was to describe and compare the kinematic patterns of the scapula during humeral elevation in children with typical development and healthy adults.

METHODS

Kinematics Kinematic data were collected using a magnetic tracking device (Polhemus 3Space ® Fastrak, Colchester, VT), with a 3-dimensional motion sensor on the lateral humerus, T3 spine and the top of the acromion. The sensors for the thorax and scapula were attached with double sided tape, while the humeral sensor was placed at the deltoid tuberosity using an elastic band around the arm. The acromial method, with the sensor stuck directly over the flat acromion was used for the scapular sensor (Karduna et al., 2001).

Protocol Fifteen adults (7 F/ 8 M), 25-37 years of age, and fourteen children (8 F/ 6 M), 4-9 years of age, participated in this study. The independent variables were age and humeral elevation. The dependent variables were scapular angles of upward rotation, posterior tilt, and external rotation. Three trials of humeral elevation in the scapular plane were collected and averaged across the trials. The data were pooled in each of the groups and the maximum range that was common among all the subjects was selected (25º-125º of humeral elevation). The data were divided into three divisions within each group: 25º-60°, 60° - 90°, and 90°-125º of humeral elevation. For each of the scapular variables, an ANOVA was used to test significance (α=0.05). Also, glenohumeral (gh): scapulothoracic (st) ratios were determined.

RESULTS

Significant differences were observed between adults and children for all three

scapular variables. During humeral elevation, both adults and children demonstrated the expected patterns of upward rotation, posterior tilt. In addition the adults showed decreasing external rotation, while the children showed increasing external rotation. During scapular plane rotation from 25º-125º, children showed greater upward rotation (43.9º ±6.39º) than adults (29.1º ±10.1º). The mean glenohumeral to scapulothoracic ratio was 2.4:1 for adults and 1.3:1 for children.

DISCUSSION

The present study demonstrated that there are significant differences in scapular kinematics between children with typical development and healthy adults. These results suggest that age and development might influence scapular kinematics. Children seem to have a greater contribution from the scapulothoracic joint, specifically upward rotation during humeral elevation. The clinical importance of these results is the incorporation of the scapulothoracic joint during exercises for a child, for improving shoulder function.

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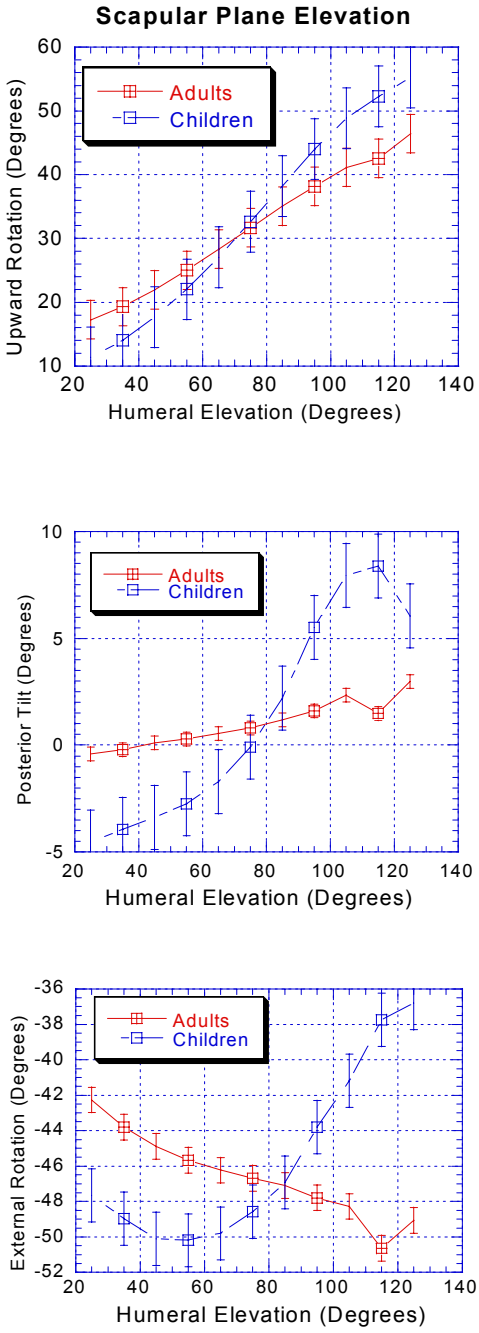

Figure 1 Scapular rotations of upward rotation, posterior tilt and external rotation during scapular plane elevation, in children and adults (means ± sem).