

Shoulder Kinematics and Impingement

Dynamic Radiostereometric analysis of the shoulder

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Avhandlingen baseras på följande delarbeten:

1: Shoulder Kinematics in 25 Patients with Impingement and 12 Controls,

E Hallström and J Kärrholm. *Clinical Orthopaedics and Related Research, Number 448, pp. 22-27, 2006*

2: Kinematic evaluation of the Hawkins and Neer sign,

E Hallström and J Kärrholm. *J Shoulder Elbow Surg, Volume 17, Number 15, pp. 40-47, January/February, 2008*

3: Shoulder Rhythm in Patients and Controls, Dynamic RSA during active and passive abduction.

E Hallström and J Kärrholm. *ACTA Orthop Scand, Accepted for publication*

4: Shoulder Kinematics in 19 patients with impingement after arthroscopic surgery, open surgery and physiotherapy.

E Hallström, T Andrén, A Apelman, A-L Olsson, E Varas, L Virta, Å Öhlund, J Kärrholm
Submitted.

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Abstract This study aimed to evaluate the three-dimensional kinematics of the shoulder joint in patients with shoulder impingement and controls with focus on three well known diagnostic tests; painful arc test (active abduction), Neer sign (passive elevation) and Hawkins sign. The shoulder rhythm, the speed of motion and if successful treatment of impingement could be associated with changes of the shoulder kinematics were studied

Dynamic radiostereometry (RSA) is feasible method to study rotations and translations of the glenohumeral joint because of its high precision. In all studies the relative motions of the glenohumeral joint was analyzed. In one of them the contribution of the motions in this joint to the absolute or global motions of the shoulder (the shoulder rhythm) was delineated. The median age of the patients and controls varied between 49-51 and 30-36 years in the different studies.

25 patients and 12 controls without shoulder symptoms were studied during active abduction (painful arc test). The humeral centre displaced medially, proximally, and anteriorly. In the patient group, slightly more (1–1.5 mm) proximal translation was observed in the early phase of the arc of motion.

18 patients and 11 controls were tested at Neer sign and Hawkins sign. At Hawkins sign the centre of the humeral head was positioned more laterally and superiorly in the patients than in the controls.

30 patients and 11 controls were studied during active and 21 patients and 9 controls during passive abduction to evaluate the relative and absolute motion in order to analyze the shoulder rhythm and the speed of motion at active abduction. The patient group showed more scapular and trunk motions ($p=0.04$) and especially up to 40° . The distribution of motion between the glenohumeral joint and the trunk in both controls and patients with impingement was less than or equal to 1:1.

19 patients were randomized to three treatment options, physiotherapy ($n=7$), open surgery ($n=7$) or arthroscopic surgery ($n=5$). RSA studies and clinical evaluation were done before and median 29 and 24 months later.

According to Constant-75 patients treated with surgery improved significantly more than those treated with physiotherapy ($p<0.05$). In the total material there was a tendency to increasing Constant score with increasing medial and posterior position of the humeral head center at test of Hawkins sign.

In conclusion the patients showed at painful arc test an increased proximal translation and at Hawkins sign a more laterally and posterior position of the humeral head center. The glenohumeral-thoracoscapular ratio was less than or equal to 1:1 in patients and controls, where the patients had reduced glenohumeral motions in the early phase of active abduction. Correlation between changed humeral head translation after treatment during test of Hawkins sign and improvement of the Constant-75 score in the total patient material might represent causal relationship, but this findings needs to be further studied in larger patient groups.

Keywords

Shoulder kinematics, radiostereometry, Impingement, open surgery, arthroscopic surgery, physiotherapy, clinical outcome