SCAPULAR NOTCHING IN REVERSE TOTAL SHOULDER ARTHROPLASTY – THE INFLUENCE OF IMPLANT-CONFIGURATION AND SCAPULA-ANATOMY

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Introduction

The reverse shoulder prostheses are mainly used for the surgical treatment of patients with arthrosis of the glenohumeral joint associated with a rotator cuff disfunction. Due to this concept, a conflict between the humeral cup and the scapular pillar exists during adduction of the arm [Lévigne, 2008]. The implications range from limitations of mobility to localized bone loss at the inferior scapular neck region (so called scapular notching). Aim of the study is to investigate the influence of the scapular anatomy, metaglene position, glenosphere size and humeral cup depth.

Methods

Thirteen cadaver shoulder specimens were provided with an established reverse shoulder prosthesis (Delta Xtend, DePuy Synthes, Warsaw, USA). The scapula of a dissected specimen was fixed to a mounting tower and the distal part of the humerus was attached to a force-torque controlled robot (KR15, KUKA Roboter GmbH, Augsburg, Germany), [Dedy, 2011]. Due to an adduction movement of the arm performed by the robot, a humeral onlay collision with the scapula could be provoked and the maximum adduction angle (notching-angle) be recorded (Figure 1).

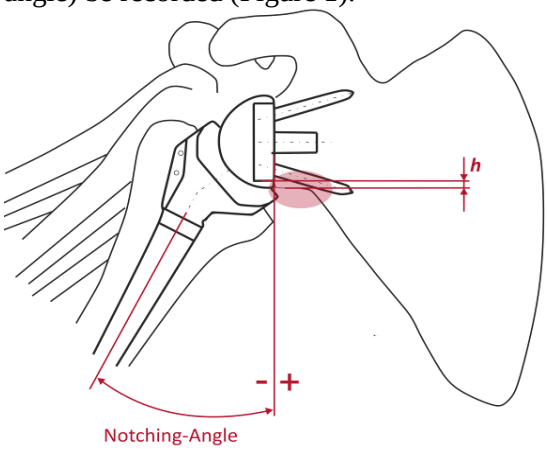

Figure 1: Shoulder joint with an implanted reverse shoulder prosthesis. The notching-angle, metaglene height (h) and the notching area (red area) are shown.

Contact between implant and bone was detected by a tactile pressure sensor (K-Scan, Savecomp Megascan GmbH, Hannover, Germany), which was attached to the scapular neck. The notching-angle was recorded for all glenosphere and onlay configurations of the implant, each in 0° and 20° internal rotation of the upper arm. Afterwards, 3D CT scans of the specimens were performed to collect information about implantation height and anatomical situation.

Results

The implant configuration with a glenosphere diameter of 42 mm in eccentric make (Ø42ecc) in combination with a High Mobility Onlay (HMO) results in the maximum average notching-angle of 7.6 ± 11.7° (Mean±SD). The minimum average notching-angle of -10.0 ± 15.0° was reached with a combination of a 38 mm glenosphere diameter in centric make (Ø38) with a Standard Onlay (SO). With a change of the glenosphere from Ø38 to Ø38ecc the notching-angle increased by 8.9 ± 4.8°. The change of the onlay from SO to HMO results in a decrease of the notching-angle by 7.7 ± 1.3°. Scapulae with a metaglene implantation hight (*h*) up to 1.6 mm showed a notching-angle of 5 ± 10.4° (*N*=8). With a value of *h* between 1.7 and 5.5 mm the notching-angle reached 9.8 ± 9° (*N*=5).

Discussion

In summary, it can be stated that the implant configurations show a strong influence on the notching-angle. With the use of HMOs favourable together with eccentric glenospheres, the greatest positive effects on the notching-angle can be achieved. A high implanted metaglene worsenes the adductability of the arm.

References

Lévigne *et al*, J Shoulder Elbow Surg, 17:925-935, 2008.

Dedy *et al*, Int orthop, 35:549-554, 2011.