## DELTOPECTORAL VS DELTOID SPLIT APPROACH FOR PROXIMAL HUMERUS FRACTURE FIXATION WITH LOCKING PLATE: A PROSPECTIVE RANDOMIZED STUDY (HURA STUDY)

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**Aim:** The purpose of the present study (NCT-00612391) was to compare outcomes for the deltoid split (DS) approach and the classic deltopectoral (DP) approach in terms of function, quality of life, and complications in a prospective randomized multicenter study using consort guidelines.

**Background:** There are two options when choosing the surgical approach for locking plate fixation to treat proximal humerus fractures (PHF). The deltoid split (DS) approach, developed according to minimally invasive surgery principles, and the classic deltopectoral (DP) approach, believed to increase the risk of avascular necrosis and making access to the greater tuberosity more difficult.

**Methods:** From 2007 to 2016, all patients, from two University Trauma Centers, meeting the inclusion criteria (PHF Neer II/III, isolated injury, skeletal maturity, speaking French or English, available for follow-up (FU), ability to fill questionnaires) were invited to participate. Exclusion criteria were: Pre-existing pathology to the limb, patient-refusing or too ill to undergo surgery, patient needing another type of treatment (nail, arthroplasty), axillary nerve impairment, open fracture. After consent, patients were randomized to one of the two treatments using the dark envelope method. Pre-injury status was documented by questionnaires (SF12, Q-DASH, Constant score). Range of motion was assessed. Patients were followed at 2-6 weeks, 3-6-12-18-24 months. Power calculation was done with primary outcome: Q-DASH.

**Results:** A total of 83 patients were randomized; 44 to the DS and 39 to the DP approach with a mean age of 62 y.o. (+- 14) and 77% were females. Groups were equivalent in terms of age, gender, BMI, severity of fracture and pre-injury scores, Neer II (53%) and Neer III (47%). Minimum FU was 12 months, mean was 26 months. All clinical outcome measures were in favor of the deltopectoral approach. Primary outcome measure, Q-DASH, was better statistically and clinically in the DP group (12 vs 26, p=0,003). Patients with DP had less pain and better quality of life scores than with DS (VAS 1/10 vs 2/10 p=0,019 and SF12M 56 vs 51, p=0,049, respectively). Constant-Murley score was higher in the DP group (73 vs 60, p=0,014). However, active external rotation was better with the DS approach (45° vs 35°). There were more complications in DS patients, with four screw cut-outs vs zero, four avascular necrosis vs one, and five reoperations vs two. Calcar screws were used for a majority of DP fixations (57%) vs a minority of DS (27%) (p=0,012).

**Conclusions:** The primary hypothesis on the superiority of the deltoid split incision was rebutted. The added difficulty involved with the use of calcar screws and intramuscular dissection for the DS approach could be partly responsible for this difference. The DP approach should be used during Neer II and III PHF fixation.

## EFFECT OF CRITICAL SHOULDER ANGLE, GLENOID LATERALIZATION AND HUMERAL INCLINATION ON RANGE OF MOTION IN REVERSE SHOULDER ARTHROPLASTY

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**Aim:** The purpose was to evaluate the effects of lateralization of the center of rotation (COR) and neck shaft angle (NSA) on shoulder ROM after RSA in patients with different scapular morphologies.

**Background:** No study considered the impact of acromial morphology on shoulder range of motion (ROM).

**Methods:** 3D-computer models were constructed from computed tomography (CT) scans of 12 patients with critical shoulder angle (CSA) of 25°, 30°, 35° and 40°. For each model, shoulder ROM was evaluated at a NSA of 135° and 145° and lateralization of 0mm, 5mm and 10mm for 7 standardized motions: glenohumeral abduction, adduction, forward flexion, extension, internal rotation with the elbow at 90° of abduction, as well as external rotation with the arm at 10° and 90° of abduction.

**Results:** In all models, CSA did not seem to influence ROM, but greater lateralization achieved greater ROM for all motions in all configurations. Internal and external rotation at 90° of abduction were impossible in most configurations, except in models with 25° CSA.

**Conclusions:** Post-operative ROM following RSA depends on multiple patient and surgical factors. This study based on computer simulation suggests that there is no influence of CSA on ROM after RSA, while lateralization increases ROM in all configurations. Furthermore, increasing subacromial space is important to grant sufficient rotation at 90° of abduction. In summary, increased lateralization of the center of rotation and increased subacromial space improve range of motion in all CSA configurations.

## NECK SHAFT ANGLE AFTER REVERSE SHOULDER ARTHROPLASTY

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**Aim:** The aim of this study was to evaluate differences between expected and postoperative neck shaft angle (NSA) in reverse shoulder arthroplasty (RSA).

**Background:** Implant size and geometry, together with the humeral cut level and entry point, can all influence humeral stem alignment in RSA. It has been reported that lower NSA can reduce scapular notching, heterotopic ossification, and pain, while improving range of motion, notably in adduction. Short uncemented and convertible stems are gaining popularity as they preserve bone stock and facilitate revision surgery, though they remain more difficult to align than long stems that serve as intramedullary guides.

**Methods:** The authors retrospectively reviewed immediate postoperative radiographs of a consecutive series of 159 patients, comprising 57 men (36%) and 102 women (64%), who underwent RSA with a short uncemented convertible stem with constant NSA of 145°. The parameters measured included NSA, defined as the angle between the diaphyseal axis and the perpendicular to the reversed tray, and canal fill ratio (CFR), calculated by dividing the mediolateral width of the stem by that of the inner bone cortex, both measured perpendicular to the diaphyseal axis 1 cm below the medial calcar-prosthesis junction. The inter-observer agreement was excellent for both NSA and CFR (intraclass correlation coefficients of 0.85 and 0.81, respectively).

**Results:** The postoperative NSA was 149°±7.9° (range, 133.5°–176.5°) and CFR was 57.7%±8.2% (range, 38.6%–74.0%). The mean postoperative NSA was greater than expected by 4.0°±7.9° (range, -11.5°–31.5°), exceeding 5° of valgus in 71 shoulders (45%) and exceeding 5° varus in 15 shoulders (9%). Univariable linear regression revealed that absolute deviation between expected and postoperative NSA (misalignment) decreased significantly with CFR (beta, -13.1; p=0.023).

**Conclusions:** While short uncemented stems offer several advantages in RSA, they remain challenging to align within the humerus, particularly if undersized. Misalignment of 5° or more was observed in more than half this series, and surgeons should reduce such alignment errors that may compromise clinical and radiographic outcomes.

## ROBOTIC BIOMECHANICAL EVALUATION OF REVERSE SHOULDER IMPLANTS

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**Aim:** To investigate the impact of the implant design and the glenosphere size on the ROM and on the lowering and medialisation of the humerus with respect to the scapula in neutral position.

**Background:** Since its introduction, more than thirty brands of reversed shoulder prosthesis are available of the reverse polarity. All brands seem to behave well, resulting into the same functional outcome. However, in spite of positive clinical results, the range of motion (ROM) after implantation is not always satisfactory.

**Methods:** Six implant systems (Delta Xtend® centred epiphysis and eccentric epiphysis (Depuy syntheses), Comprehensive® (Biomet), Ascend Flex® (Tornier), Trabecular® (Zimmer), RSP® (DJO), Equinox® (Exactech))