A 3-dimensional combined classification for degenerative glenohumeral arthritis based on humeroscapular alignment

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Introduction

• Seminal existing classifications describe either CTA in the AP/coronal plane or „primary“ OA in the axial plane\textsuperscript{1–2}

• In CTA the eccentricity develops due to tear(s) of the RC, but in eccentric OA (as described by the Walch-classification) A-P subluxation is also associated with fatty degeneration of the anterior or posterior RC, as shown by Siebert/Walker\textsuperscript{2–3}

• Biplanar eccentricity has been described in glenoid erosion patterns in the past few years and also in the HSA for cases with posterior subluxation\textsuperscript{4–8}

• **Aim:** To describe the humeroscapular alignment (HSA) of shoulder with CTA or OA in 3D CTs and develop a modern 3-dimensional classification
Methods

- 130 standardised CTs, of patients which received a shoulder prosthesis due to OA or CTA

- CT image 3-dimensional reconstruction of the scapular plane using the trigonum, glenoid centre and inferior angle of the scapula as landmarks. The scapula axis is the line passing from the trigonum through the glenoid centre in this plane.

- The alignment of the centre of rotation of the humeral head was then measured as the distance to the scapula axis in both the A-P and S-I directions and expressed relative to the radius of the humeral head.

- Erosion was classified into 3 grades

- A second observer repeated all measurements (ICC > 0.85)
A centred HSA was defined between -20% to +5% A-P and -5% to +20% S-I subluxation.

The yellow arrow marks the turning point to increasing posterior or superior subluxation. The red arrow marks the step to increased anterior or inferior subluxation.

The green arrow marks a severe increase of posterior decentration. This and static acetabularization were additionally described as extraposterior (XP) and extrasuperior (XS).
The HSA is described in terms of subluxation of the centre of rotation of the humeral head in both the A-P and S-I directions and categorized in combination. Additionally, the erosion grade is illustrated (bottom right). Erosion is graded from 1 – 3, where 1 is no significant bony erosion, 2 is a focal erosion forming a crater or biconcavity of the glenoid (in any location) and 3 is a severe glenoid erosion involving the entire glenoid surface in any one plane (central or eccentric).
Discussion

• Our results confirm those from recent 3D CT studies and provide clinical transferability.³⁻¹⁰

• The clinical significance of biplanar eccentricity is yet unknown and requires further research.

• Results for Walch B2 are inconsistent¹¹, possibly because the complexity of the disease is not understood and is compared in an undifferentiated manner in the literature.

• The S-I axis can be evaluated in lying CT as all are lying so comparable, plus may be more sensitive than standing x-ray, where gravity compensates.

• 3D classification is more effort but could be facilitated by software algorithms in the future.
Schlussfolgerung

- Biplanar eccentricity is common (around ¼)
- Existing classifications therefore do not describe the pathologie comprehensively
- A 3D classification based on the HSA is comprehensive and quantifiable and should be used for research and clinical evaluation
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