Measurement of glenohumeral instability in traumatic anterior shoulder instability

A systematic review of the literature

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Purpose

Shoulder joint dislocation or subluxation can cause pathologic instability, and lead to decreased shoulder and upper limb function. Patients with symptomatic instability due to traumatic event(s) have affected shoulder biomechanics, including the humerus' glide in relation to the glenoid cavity – referred to as ***glenohumeral translation***.

In this systematic review, we investigated anterior-posterior glenohumeral translation in patients with traumatic anterior shoulder instability.

Conclusion

Anterior-posterior translation was seen in both unstable and stable shoulders. **There is no clear evidence that traumatic anterior shoulder instability increases the glenohumeral translation.**

The examination methods were inconsistent, and it seems that **measurements depend on the applied imaging technique and joint position/motion tasks.**

Laxity tests might not be sufficient to guide surgeons in treatment choice, but should be used in reflection of patients' symptoms.

Results

We included 10 good quality studies. Nine of these were case-control studies, one was a prospective cohort study (with a control group). The number of patients in the studies varied from eight to twenty. In all studies, the majority of patients were male. The mean age of the patients was 22.5-31 years.

Six studies performed the measurements under static conditions; four studies performed the measurements under dynamic conditions.

The most frequently tested joint position or motion task overall was **abduction and external rotation**, used in six of the studies.

Anterior-posterior translation in unstable shoulders (mm) Total no. measurements (incl. all positions/motion task): 31				
Range	0.0 (SD 0.8) - 21.1 (SD 8)			
Mean	4.19			
Median	3			
Δ Translation unstable-stable Total no. comparisons: 33	**Significance**			
	S	**NS**	**N/A**	**Total**
Larger translation in unstable	6	10	3	**19**
Larger translation in stable	4	3	6	**13**
No difference	-	-	-	**0**
Unspecified	1	-	-	**1**

Table 1. Summary of findings.
S: significant, NS: non-significant, N/A: not available

Study **Imaging technique**	**Joint position** (static) **/motion task** (dynamic)	**Translation (mm±SD)** Positive= anterior Negative= posterior		**Δ Translation unstable-stable**			
		Unstable	**Stable**	**Δ mm**	**Δ %**	**↑/↓**	**Significance**
Static measurements							
Howell (1988) Group with and without translation, respectively **Radiography**	90° abduction max. external rotation max. horizontal extension	**3.3 ±0.6,** **0.2 ±0.7**	-3.9 ±0.8	-0.6, -3.7	-15.4, -94.9	↓, ↓	N/A
	90° abduction max. external rotation	**3.6 ±0.7,** **0.0 ±0.8**	-0.1 ±0.5	3.5, -0.1	3500, -100	↑, ↓	
von Eisenhart-Rothe (2002) **open MRI***	90° abduction max. external rotation	**3.0 ±1.1**	0.2 ±1.1	2.8	1400	↑	S
	90° abduction max. external rotation +external force	**-1.1 ±0.5**	-0.3 ±0.6	0.8	266.7	↑	NS
Dynamic measurements							
Kim (2017) **3D-2D model (biplane x-ray and CT)**	90° abduction external-to-internal rotation	**-1.7**	-2.1	-0.4	-19.0	↓	NS
	Abduction external rotation +external force	**-0.27 ±0.429**	-0.246 ±0.206	0.024	9.8	↑	NS
Matsumura (2019) **Dynamic 4D CT**	90° abduction 40° external rotation	**-0.1**	-2.1	-2	-95.2	↓	S
	90° abduction 60° external rotation	**-0.7**	-2.8	-2.1	-75	↓	S
	90° abduction max. external rotation NB ROM patients<controls	**-0.8**	-3.4	-2.6	-76.5	↓	S
Lädermann (2016) **Motion capture with skin-markers**	90° abduction external rotation	**7.9 ±2.1**	7.6 ±1.9	0.3	3.9	↑	NS
Lippitt (1994) **Electromagnetic motion tracking with bone-pins**	Fulcrum test (90° abduction, external rotation, extension) NB patients anaesthetized	**-11.1 ±4.1**	-8.9 ±6.4	2.2	24.7	↑	NS

Table 2. Measured anterior-posterior translation in abduction and external rotation.
S: significant, NS: non-significant, N/A: not available
*reference position: shoulder abduction 30° +neutral rotation

Methods

Design

Systematic review.
The study protocol was registered in the PROSPERO register. The PRISMA guidelines were followed throughout the review process.

Data Sources and Search Strategy

A systematic search of three major medical databases was performed in September 2020. The search strategy was developed in collaboration with a medical librarian and included Medical Subject Headings (MeSH terms) and keywords related to our eligibility criteria.

Study Quality Assessment

The Newcastle-Ottawa Scale was used to assess the quality of the included studies.

Population

Patients >15-years-old with anterior shoulder instability after traumatic dislocation or subluxation.

Outcome

The primary outcome was the measurement of anterior-posterior glenohumeral translation.

Analysis

Narrative, due to study heterogeneity.

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