

# INDICATION FOR CLAVICLE FRACTURE OSTEOSYNTHESIS BASED ON SHORTENING: HOW TO MEASURE IT?

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## Aim

To compare three previously described clavicle fracture shortening measurements on 2D radiographs with measurements on CT 3D reconstruction and to assess impact of fracture pattern on shortening.

## Background

Indication for midshaft clavicle fracture surgery relies on shortening evaluated by 2D radiographs. This method may not be reliable.

## Methods

We created five synthetic fractured bone models and acquired standard radiographs and CT. Shortening was compared between caliper measurements of the models and CT 3D reconstruction. Twenty patients were then retrieved with midshaft clavicle fractures imaged by standard radiographs and CT. Shortening was measured by a musculoskeletal radiologist and an orthopedic surgeon according to three methods (Jeray, Silva and Smekal et al.). Measures were compared with CT 3D reconstruction. The effect of fragments displacement according to 6 degrees of freedom on shortening was finally correlated to shortening in order to assess impact of fracture pattern.

## Results

Mean difference in shortening between caliper and CT was 0.7 mm [-2.5; 4.0] ( $p=0.56$ ). Inter-observer reliability was 0.99 for Jeray, 0.97 for Silva and 0.97 for Smekal. Mean difference between CT and standard radiographs was 11.7 mm [7.1; 16.4] for Jeray, -1.2 mm [-5.9; 3.4] for Silva and 9.1 mm [4.5; 13.7] for Smekal. The results based on a mixed linear model didn't show significant difference between Silva and CT measurements ( $p=0.51$ ). The only component of fracture pattern significantly associated with shortening was the translation about the axis (z).

## Conclusions

Clavicle fracture shortening measured on CT has an accuracy of 2-4 mm when compared to direct measures. Radiographic measurement according to Silva et al. achieved good inter-observer reliability and an accuracy of 4 to 6 mm. We recommend its use for further studies. Fracture pattern according to six degrees of freedom did not influence shortening in this model. We cannot recommend its assessment for indication to therapeutic modality.