

Inter- and Intraobserver Agreement of Visual Estimation, Goniometric and Radiographic Measurement of Passive Thumb Metacarpophalangeal Joint Hyperextension

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BACKGROUND

- Symptomatic basilar thumb arthritis is often associated with a "collapse deformity" of the thumb ray. With disease progression patients may develop flexion and adduction of the thumb metacarpal with compensatory hyperextension at the metacarpophalangeal joint (MCPJ).
- Visual estimation or goniometric measurements are often utilized to quantify this, but little information exists about the accuracy and reproducibility of these modalities for measuring thumb MCPJ hyperextension.

PURPOSE

- We hypothesized that visual and goniometric measurements of thumb metacarpophalangeal joint (MCPJ) hyperextension vary greater than 10 degrees from radiographic measurements, and between observers.

METHODS

- Twenty-six fresh-frozen hands were measured separately by a senior orthopaedic surgery resident (rater A) and a fellowship trained hand surgeon (rater B).
- Passive thumb MCPJ hyperextension was measured by visual estimation, goniometry, and axis measurement on a lateral thumb radiograph. Raters were blinded to each other's and their own prior measurements.
- Descriptive statistics were recorded for measurement type and inter-observer agreement using a two-way intra-class correlation (ICC).
- Intra-observer agreement was calculated using concordance correlation coefficient (CCC).
- Bland-Altman plots identified trends, systemic differences, or potential outliers.



Figures 1 and 2 display samples of clinical goniometric and fluoroscopic measurement, respectively.

Table 1

Method	Mean	SD	Range	ICC (Rho)	95% CI (lower)	95% CI (upper)	SEM
Visual estimate	13.12	7.97	-5-30	0.25	-0.16	0.58	6.89
Goniometer	13.92	9.08	-5-35	0.39	-0.08	0.71	7.09
Radiographic measurement	23.34	8.89	7-43	0.92	0.83	0.96	2.51

Table 1 displays interrater reliability as determined by the two-way intra-class correlation coefficient (ICC).

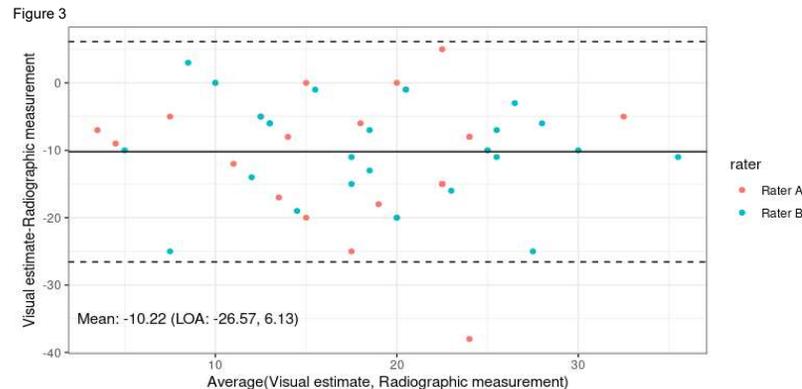


Figure 3 gives the Bland-Altman plot for visual estimate and radiographic measurement by rater. The average difference between the two measurements is -10 degrees, suggesting that the visual estimate tends to be lower by 10 degrees than the radiographic measurement.

RESULTS

- Mean measurements for both raters were similar for visual estimations and radiographic measurements. Mean goniometric measurements were twice as high for the fellowship trained hand surgeon (rater B), and closer to radiographic measurements.
- For both raters, radiographic measurements were at least 10 degrees greater than the other two methods. For inter-rater agreement, measurements were within 10 degrees most frequently with radiographic measurement, then visual estimates, followed by goniometric measurements.
- Rater B had higher agreement comparing visual and goniometric measurements to radiographic measurements.

DISCUSSION / CONCLUSIONS

- Radiographic assessment exhibits the highest interobserver agreement when assessing thumb MCPJ hyperextension. Rater experience improves precision, but there is still poor agreement between visual estimates and goniometric measurements compared to radiographic measurements, as the former two underestimate hyperextension by at least 10 degrees.
- Intraoperative stress radiographs are the most precise method for measuring passive thumb MCPJ hyperextension if considering adjunct corrective procedures when performing a soft-tissue basal joint arthroplasty.

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