Reviewer's report

Title: Reproducibility of measurements of range of motion in patients with adhesive capsulitis

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Reviewer: Geert van der Heijden

Reviewer's report:

This paper reports on the reproducibility of shoulder ROM measurements of patients with adhesive capsulitis. The reproducibility was reported for combined active and combined passive ROM.

Reporting of several aspects of this study need further attention.

The title needs to be rephrased in a more informative manner; e.g. Reproducibility of... was poor.

Major Compulsory Revisions

1. In the first sentence of the background of the abstract the authors refer to measurement of ROM for diagnostic purposes but they do not touch on this any further. They should therefore change this sentence and exclude "diagnostic purposes".

2. Reproducibility is a signal to noise characteristic of measurements, which is associated with the location and spread of data. The following comments relate to location and spread of the data and therefore to the reported results.

- 2a. The authors have only included "patients with clinical signs of adhesive capsulitis." But they fail to define this clinical diagnosis further.

- 2b. They have excluded patients with excessive pain during movement. Given that this of course may primarily affect active movement, not so much passive movement, there was no good reason to exclude such patients. This may have an effect on the conclusions regarding homoscedasticity.

- 2c. Furthermore, they have selected patients based on a difference in passive ROM of >300 with the unaffected side for at least 2 of 3 evaluated movements. Thereby they have restricted their study to likely more serious afflicted patients, which may have impact on their results. In the light of their findings on the reproducibility of movements used for selection of patients the smallest difference in passive ROM may have been only 100.

- 2d. Reported are reproducibility of ROM for thoraco-scapulo-glenohumeral movements. That is, test positions and poor fixation of scapular movements may result in compensatory movements and thereby increased variation of measurements, in particular for active movements.

- 2e. Symmetrical movements may have an effect on active ROM measurements
and on the reproducibility. Was active ROM measured during symmetrical movements?

- 2f. In calculating the combined ROM the authors lump the ranges of 3 entirely different movements together. This does not reduce the random error for each movement. This of course stays the same. More so, combining the movements into 1 ROM may obscure important differences in different movements, both between patients and over time within patients. Combining the 3 movements may affect location and spread of the data. Moreover, a combined ROM is considered not very helpful in evaluation of changes in ROM over time.

3. Regarding the data-analysis the following aspects need attention.

- 3a. The authors do not seem to be familiar with the concept of regression to the mean, since they cannot think of a reason why their second measurements indicate less restriction of ROM.

- 3b. What is the reason to include the analysis reported in table 3? This is a not informative representation of the data. In this paper the intention is to estimate the accuracy of measurement, therefore there is no place for statistical testing and p-values. Neither should there be place to draw conclusions based on testing and p-values. The paragraph on the bottom of page 16 and on top of page 17 should therefore be deleted.

- 3c. Why do the authors draw conclusions from table 3 based on the absence of statistical significance? The absence of statistical significance does not imply absence of relevance.

- 3d. On page 17 the authors indicate that the reported measurement errors are larger than "acceptable". This may in particular seem the case for the combined ROM. But this is not a very helpful conclusion based on an informative prior regarding acceptability. Were 95% of the differences for pairs of measurement for either affected or on-affected side really larger than the SDD? Were they also for the separate ROM?

- 3e. The authors should revise their analyses so that the limits of agreements are included, that is they should report the differences between measurements for population quartiles or deciles. This then can be used for interpretation of the possibility of finding a value larger then a given differences between measurements. This may be helpful in evaluation of changes in ROM over time. They should report the limits of agreements for all ROM separately.

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: Yes, and I have assessed the statistics in my report.
Declaration of competing interests: I declare that I have no competing interests