

# Validation of a Smartphone application for shoulder elevation evaluation

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## Introduction

Angle of arm elevation is of interest for mobility and function evaluation in shoulder pathologies. Though accelerometry can reliably measure arm elevation, the use of kinematic analysis has been limited in clinical practice up to now.

### A Smartphone application

(iPod Touch, Apple) has been developed to facilitate convenient and low cost use of kinematic arm elevation measurement.



The aim of this study is to compare the results of a Smartphone application to a validated kinematic measurement device (**Physilog II®**, BioAGM, CH)

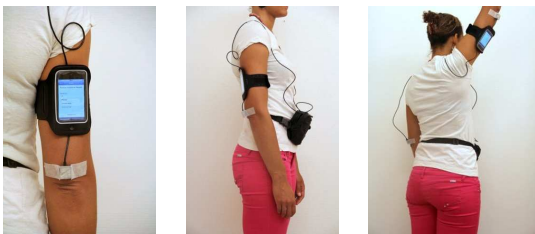
## Methods

**Eleven patients with shoulder conditions and 9 healthy participants** were included.

Measurements were performed using simultaneously a Physilog and a Smartphone.

The participants performed 3 arm elevation movements. They were measured twice alternatively by two evaluators.

Relations between devices and between movements for each device were calculated using ICC (intraclass coefficient of correlation), linear regression and 95% LOA (limits of agreement).



## References

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- Pichonnaz C., Martin E., Bassin J.-P., Duc C., Farron A., Aminian K., Jolles B.M., Gleeson N. 2012. Development of a kinematic functional shoulder test including only essential movements, *Physical Therapy* (submitted).

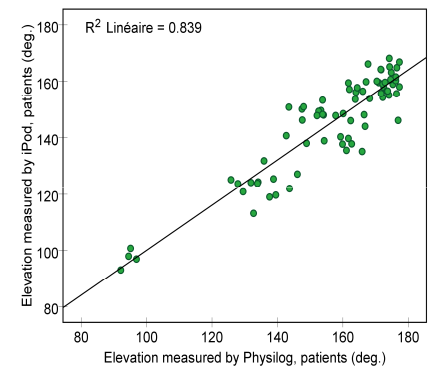
## Results

### Between devices

Overall mean difference in elevation :  $-7.6^\circ$  (SD $\pm$  9.2).

95% LOA for mean of 3 replications :  $-7.6^\circ \pm 18.1^\circ$

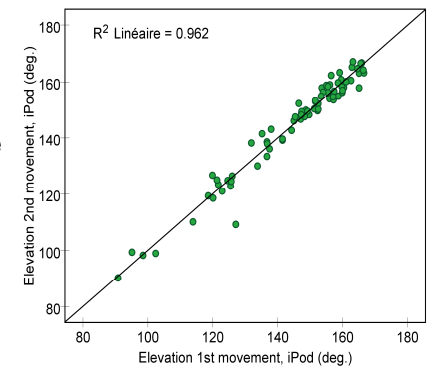
ICC :  
0.82 for mean of 3 replications  
0.76 to 0.81 for one movement



### Between movements

95% LOA  
 $-0.10^\circ \pm 6.1^\circ$  for Physilog  
 $-0.02^\circ \pm 7.0^\circ$  for Smartphone

ICC  
0.97 to 0.99 for Smartphone  
0.95 to 0.99 for Physilog



## Conclusion

Evaluation of shoulder elevation using a Smartphone is easily applicable and reliable.

An excellent reproducibility was observed when considering between movements results.

A high reproducibility was observed when considering between devices difference. However, systems are not interchangeable as clinically significant differences may be observed in some cases.

A study aiming at the extensive validation of the method is presently conducted on a larger sample size.