# EasyAngle - Overview of clinical studies


## Summary

So far, four clinical studies have been completed. These have examined the reliability and validity of EasyAngle for measurement of the hip, knee and cervical spine. The studies show that the EasyAngle, in general, has an excellent reliability and validity (vs. a traditional goniometer and the CROM device) for hip, knee and rotation in the cervical spine and that EasyAngle is superior with regards to usability.


## Completed studies

### Measuring the knee joint range of motion with a digital goniometer (2015)

**Author:** Veronika Lind, Swedish School of Sports and Health Sciences (GIH)
**Number of subjects:** 18 with no indications.
**Objective:** Investigate intra-rater reliability and validity of the EasyAngle for measurement of active and passive flexion and extension in the knee.
**Method:** Intra-rater reliability was measured with a test-retest procedure, while validity was tested through measurements by an experienced PT measuring the same joint angles during the same occasion using both the EasyAngle and a traditional goniometer.
**Results:** The study showed excellent reliability except for active extension that was showed only fair reliability due to a software flaw. Validity proved to be good. This study was done on a prototype of EasyAngle and the software flaw has been fixed.
**Other:** The study has been presented as a poster at the WCPT congress in 2017.

### The effect of dynamic stretching on muscle extensibility in female horse riders (2015)

**Authors:** Emelie Brinkeback and Emma Lundqvist, Karolinska Institute.
**Number of subjects:** 9 with no indications.
**Objective:** Investigate intra- and inter-rater reliability of EasyAngle for measurement of passive straight leg raise to estimate the length of the hamstring muscle and to evaluate the effect of a new dynamic stretching programme.
**Method:** Measurements with EasyAngle was done before after the intervention to evaluate effect. Two physiotherapy students performed measurements and intra-rater reliability of EasyAngle was investigated by comparing measurement results from the two physiotherapists for the same measurement. Intra-rater reliability was investigated by having each physiotherapist do three measurements on the same patient on each occasion and comparing results.
**Result:** The study showed excellent inter-rater reliability as well as excellent intra-rater reliability.

## Validity and interrater reliability of EasyAngle for measurement of hip mobility (2016)

**Author:** Karin Fröjd, University of Uppsala, Institution for neuroscience, physiotherapy.
**Number of subjects:** 35 with hip osteoarthritis.
**Objective:** Investigate inter-rater reliability and validity of EasyAngle vs. a traditional goniometer for measurement of passive and active flexion, abduction, internal rotation and external rotation of the hip.
**Method:** Inter-rater reliability was tested by having two experienced physio therapists perform the same measurement on the same patient during the same occasion. Validity was tested by having one physio therapist perform the same measurements using both EasyAngle and a traditional goniometer.
**Result:** Validity of EasyAngle proved to be excellent, inter-rater reliability was good for active abduction and active external rotation and excellent for all other movements.

## Accordance and practicality of the new medical device EasyAngle in comparison to the current gold standard CROM and the iPhone App Compass for measuring the cervical spine rotation in healthy participants (2017)

**Author:** Sebastian Köcker, Universitätsklinikum Freiburg
**Number of subjects:** 67 with no indications
**Objective:** Compare EasyAngle, the iPhone app Compass and the gold standard, CROM for measurement of cervical rotation with regard to both accordance and practicality.
**Method:** The participants were randomized into three groups. The first group made measurements with all three devices. The results were evaluated in Bland-Altman plots using the CROM device as reference. The second and third group used either the EasyAngle or the iPhone app. The results of these groups were used to determine the standard deviation of each measuring device.
The practicality of the three devices was evaluated by the participants using an assessment form.
**Results:** For the EasyAngle device, the study showed a standard deviation of 3.3° compared to 9.9° for the iPhone and 3.8° for the CROM device. The assessment of the Bland-Altman plot shows a very close correlation with measurements done with the CROM device. At a confidence interval of 95%, the measurements fall within the concordance limits of 10-11°. In the practicality evaluation, the EasyAngle was assessed by 82% of the participants as “very practical” compared to 1.5% for the iPhone app and 0% for the CROM device.

## Intra-rater reliability of shoulder range of motion using the universal goniometer, EasyAngle and the Ratefast goniometer application (2018)

**Author:** Higor Melquiades, Universidade federal de Juiz de Fora - UFJF
**Number of subjects:** 67 with no indications
**Objective:** To evaluate the intra-examiner reliability of measures of flexion, extension, abduction and horizontal shoulder adduction of healthy individuals with the Universal Goniometer, the EasyAngle® and the Smartphone Application RateFast Goniometer®.
**Method:** This is a methodological study, approved by the Research Ethics Committee of UFJF (opinion 2,518,078). Sample selection was for convenience. Healthy individuals aged 18 to 59 years without gender restriction were included. Participants with an allergic complaint that made collection unfeasible were excluded. The movements evaluated were flexion, extension, abduction and horizontal shoulder adduction with standard distances for each movement. The relative reliability of the measurements was determined by calculating the Intraclass Correlation Coefficient (ICC), Two Way Random model, absolute agreement.

**Results:** 33 subjects participated in the study. The reliability of measurements using EasyAngle was found to be ICC 0,41-0,73, the Ratefast app ICC 0.28-0.66 and universal goniometer ICC 0,15-0,59. A usability study was also done showing that EasyAngle have superior usability.

## Measurement of knee joint ROM with a digital goniometer - A reliability study (2018)

**Author:** Melanie Svensson, Karolinska Institute
**Number of subjects:** 20 with no indications
**Objective:** To investigate the intra- and inter-rater reliability of EasyAngle for measurements of the knee joint ROM.
**Method:** Intra-rater and inter-rater reliability was tested between a novice and an experienced assessor for measurements of knee joint ROM in 20 subjects and a total of 40 knee joints. Intraclass Correlations Coefficient, Standard Error Measurement, Smallest Detectable Difference and Bland Altman plots were used to present the result.
**Results:** The result showed very good intra-rater (ICC 1.0, SEM 1.15–1.48, SDD 3.19–4.09, LoA -3.36– 3.04, -4.66 – 4.09) and inter-rater reliability (ICC 0.99, SEM 2.11, SDD 5.85, LoA -4.75–6.95) for measurements of knee joint ROM. No difference between a novice and an experienced assessor was detected.

## The universal tool EasyAngle can replace CROM in measurement of ROM in patients with spondarthritis (2018)

**Author:** Julia Karlström, Uppsala university
**Number of subjects:** 19 patients with spondarthritis (BASMI score 0,6 to 6,6)
**Objective:** To examine the current validity, inter-tester and intra-tester reliability of EasyAngle and CROM for the measurement of active cervical range of motion among patients with spondarthritis.
**Method:** The concurrent validity was evaluated by comparing Easy Angle to the CROM. Intra- and inter-tester reliability was evaluated by test-retest procedure. Estimates of validity and reliability were then established using the Spearman correlation coefficient and Interclass correlation coefficient. The concurrent validity was concluded with Spearman's correlation (rs) and intra- and inter-tester reliability was calculated using Interclass correlation (ICC).
**Results:** This study found high to very high concurrent validity (rs 0.86–0.95), almost perfect intra-tester reliability in both Easy Angle (ICC 0,90–0,98) and Myrin (ICC 0,95–0,98) and a very high inter-tester reliability for Easy Angle (ICC 0,95–0,98) and Myrin (ICC 0,92–0,98). The study found no significant differences between the Myrin and Easy Angle, indicating that Myrin and Easy Angle are interchangeable. However, the benefit of Easy Angle is that more joints can be measured with the same instrument, that it is not sensitive to movement and that it is more hygienic.

## Ongoing or planned studies

The following studies are ongoing or planned (scope and time of completion may change):

- Neurophysiologic influences on Hamstring and Pectoralis major flexibility - knowledge about the relative contribution of neural, muscular and joint components to facilitate new techniques in the rehabilitation of groin and shoulder pain. Examination of relative stiffness and muscle length by measuring joint angles using the EasyAngle. Umeå University, Sweden (expected done 2019).
- Investigation of inter- and intraexaminer reliability for measuring range of motions in the elbow joint by using the EasyAngle digital goniometer in healthy individuals. Umeå University, Sweden (expected done 2019)
- Metrological properties study of the hip and knee range of motion measurement using the EasyAngle. CRF La Châtaigneraie, France (expected done 2018)
- Investigation of validity and reliability of the EasyAngle for measurement of cervical rotation during flexion. multicenter study (University Hospital Hamburg-Eppendorf, City University of Applied Sciences Bremen and multiple private practices in Germany and Austria.), Germany (expected done 2019)
- Manual therapy for the treatment of cervicogenic headache, City University of Applied Sciences, Bremen (expected done 2019)
- The effect of non-invasive treatment methods on neuromuscular function in healthy people and in stroke patients. Ankle ROM is measured using the EasyAngle and a qualitative reliability investigation will be included in the study. University of Jyväskylä, Finland. (expected done 2019)
- Understanding the status of goniometry in UK and how it can be improved by the EasyAngle - a survey study. South Tees Hospitals NHS Foundation Trust, UK (expected done 2019)
- Investigation of validity and reliability of the EasyAngle for measurement of shoulder rotation and elevation. UZ Gent, Belgium (expected done 2019)
- Assessment of shoulder range of motion in wheelchair athletes using the Easy Angle. UZ Gent, Belgium (expected done 2019)
- Investigation of relationship between hamstring, gastrocnemius and rectus femoris muscle length and static and dynamic feet pressures in children with cerebral palsy. University of Juiz de Fora, Brazil (expected done 2019)
- Intra-examiner reliability of the active motion amplitude measures of the shoulder with the use of the universal goniometer, EasyAngle digital goniometer and ratefast goniometer application. University of Juiz de Fora, Brazil (expected done 2018)
- Investigation in feasibility of using the EasyAngle for children/infants with torticollis and inter and inter rater reliability for measurement of cervical spine and shoulder. Cindy Miles & Associates, USA (expected done 2018)
- Comparing clinical measurements to three-dimensional kinematic measures of scapular motion in order to validate clinical measures of scapular motion and establish inter- and intra-rater reliability of scapular measurements, University of Kentucky, Lexington, USA (expected done 2019)
- Investigation of how ROM changes 6-8 weeks after botox injection in patients with spasticity. Centre for Neurological Rehabilitation and Neuropsychiatry, UK (expected done 2020)