

CINARTRO: MEASUREMENT OF QUADRICEPS MOMENT ARM TO ASSESS KNEE KINEMATICS

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Introduction

The prevalence of knee injuries has a great impact on the quality of life of a growing number of sportsmen and less active citizens. Usual clinical assessment consists of a manual maneuver (KT1000 & KT2000) along with a questionnaire asking the patient to evaluate discomfort on a subjective basis. Imaging is also used, albeit at a greater cost. We studied the physics of knee articulation rotation to develop a simple quantification instrument to act as clinical evidence of knee function. The “Rouleaux Method” determines the centre of rotation (COR) for every pair of consecutive images. The first application of the instrument and its software, **CINARTRO**, shows the migration of the COR with enough accuracy to assess the anterior cruciate ligaments (ACL) during post operative rehabilitation follow up [1] [2].

Methods

The moment arm is the distance between the fulcrum and the force action line. **CINARTRO** allows the user to process videofluoroscopic (VFC) images and for every image to mark it anatomically with contextual help which suggests the position of the tibia based on the previous image, thus saving operator time. Once the fiducial points have been recorded on the series of 30 VFC images, taken by the c-arm during extension, **CINARTRO** determines the instantaneous COR (Fig. 1) as the intersection of bisectors. After selecting the patellar tendon insertion point and the lower patella, **CINARTRO** draws the moment arm of quadriceps.

The calculations are shown on screen and as Electronic Clinical Record in the Clinical Document Architecture (CDA) format. Figure 2 shows an example of **CINARTRO** used on an otherwise healthy subject. The quantitative follow up information is thus available.

Results

Ten subjects have been selected and signed an informed consent. Figure 2 shows the interactive screen of **CINARTRO** while calculating the knee kinematics parameters. Pre-surgery, ACL-reconstructed and contralateral knee data are available as follow up starting point.

Discussion

Our previous development of **CINARTRO** used the Tibiofemoral Contact Point [1] method, while we are introducing here the more engineering concept of the instantaneous COR. Future work will also include a fourth quantitative evaluation after rehabilitation.

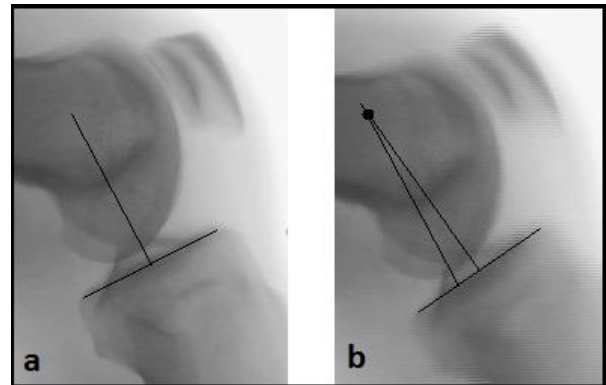


Figure 1: Successive videofluoroscopic images of the knee joint taken by **CINARTRO**. a) Tibial plateau and its bisector. b) Tibial plateau and its bisector, along with bisector of a). The intersection of the bisectors is the centre of rotation after Rouleaux [3]

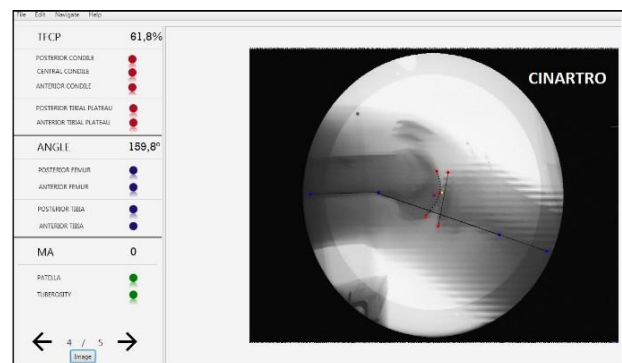


Figure 2: **CINARTRO** screen allows the user to define interactively the points of interest, taken by the software to determine the moment arm and the centre of rotation

References

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