RELIABILITY OF NOVEL ULTRASOUND MEASUREMENT FOR DETERMINING PATELLA POSITION

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Background: Patellar dislocations are common among youth athletes. A detailed understanding of patellofemoral anatomy is critical to determine patient prognosis and guide treatment and decision making. Recent literature suggests that measures of patella position relative to the trochlear groove may help identify individuals at risk of repetitive dislocations. While these measures were described using MRI, it is plausible that ultrasound imaging can be utilized to provide similar information in a more cost-effective and time-efficient manner.

Purpose: To determine intra and inter-rater reliability of two newly described ultrasound-based measures of patella positioning within two novice examiners.

Methods: Subjects were seated with the limb supported in full knee extension and neutral rotation. (Figure 1a) The examiners independently gathered all images and were blinded to each other’s measures for the duration of the study. The transducer was positioned transversely, on the anterior aspect of the knee such that the lateral trochlear ridge, center of trochlear groove, and proximal portion of the patellar tendon were all visible in cross-section. (Figure 1b) Two linear measures were obtained, representing the distance from midpoint of the patellar tendon to a) the center of trochlear groove (MPT-CTG) and b) the lateral trochlear ridge (MPT-LTR). Reliability was assessed using intraclass correlation coefficients (ICC). The average of two measures were used for data analysis. There was a minimum of 1 week between assessments for those subjects with repeated testing.

Results: A total of 11 subjects (mean age 15.3) without history of knee pathology were included. There were no significant differences (p>0.05) in either measurement between limbs with MPT-CTG and MPT-LTR values (mean±sd) as follows: MPT-CTG right 8.4mm ± 3.0, left 8.4mm ± 3.3; MPT-LTR right 12.2mm ± 2.7, left 11.6mm ± 2.3. For reliability analysis, each knee served as a discrete variable, yielding a total of 22 data points for evaluation. Inter-rater reliability (n=22) was moderate to good for both measures, with ICC values of 0.724 and 0.814 for MPT-CTG and MPT-LTR, respectively. Intra-rater reliability (n=10) was good to excellent with ICC values of 0.913 and 0.794 for MPT-CTG and MPT-LTR, respectively. (Table 1)

Conclusions: This new measure of patella positioning demonstrated moderate to excellent reliability and may be a practical, cost-effective alternative to MRI. While it is encouraging that the subjects in this sample demonstrated no side-to-side differences in either measure, future research should focus on establishing criterion validity and reliability amongst individuals with patellar instability.
Figure 1. Patient position and ultrasound probe orientation for data collection (A). An example of the ultrasound image used for data collection. Examiners captured the trochlear groove (yellow arrow), the lateral trochlear ridge (red arrow) and proximal portion patella tendon (blue oval) in a single image. Linear measurements were taken from the deepest part of the trochlear groove to the midpoint of the patellar tendon (MPT-CTG) (orange dashed line) and from the midpoint of the patellar tendon to the peak of the lateral trochlear ridge (MPT-LTR) (orange solid line).
Table 1

|                      | ICC (3,2) | 95% CI       | SD (mm) | SEM (mm) | MDC (mm) |
|----------------------|-----------|--------------|---------|----------|----------|
| **Inter-rater Reliability (N=22)** |           |              |         |          |          |
| MPT-CTG Linear       | 0.724     | 0.335-0.885  | 3.14    | 1.65     | 4.57     |
| MPT-LTR Linear       | 0.814     | 0.552-0.923  | 2.52    | 1.09     | 3.02     |
| **Intra-rater Reliability (N=10)** |           |              |         |          |          |
| MPT-CTG Linear       | 0.913     | 0.651-0.978  | 4.51    | 1.33     | 3.68     |
| MPT-LTR Linear       | 0.794     | 0.171-0.949  | 2.76    | 1.25     | 3.48     |