The Validity of a New Device (“THE QUAD RULE”) That Aims to Increase the Accuracy of Determining the Center of the Patella

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ABSTRACT

Objective: The current study was designed to evaluate the validity and reliability of finding the center of the patella utilizing manual palpation versus a specialized tool.

Methods: The researchers positioned a cadaver in supine position with hips in minimal external rotation and knees in relative full extension. The researchers measured each patella with a caliper and placed a dot at the center of each with a fluorescent pen. The examiners then used a die to determine which method (“The Quad Rule” or manual palpation) they would utilize. The examiner measured the distance from the found center of the patella to the fluorescent dot. The process was repeated on the opposite knee with the second method. After the data were collected, the researchers drilled a hole through the fluorescent dot and the patella were dissected. The data were adjusted to correct for discrepancies between the drilled hole and the dissected center of the patella.

Results: Nineteen subjects participated day one (14 physical therapy students and 5 physical therapists) and 13 subjects on day two (13 PT students). The entire sample was on average 7.53mm closer to the actual center vertically when using the quad rule (students: 9.42mm; PTs: 3.25mm) as compared to manual palpation technique. The entire sample was on average 7.60mm closer horizontally when using manual palpation (students: 8.66mm; PTs: 4.6mm) than the actual center. Significant differences were noted in r-Tests between the device and palpation, and between SI and ML measurements within the same method.

Conclusions: Utilizing a measuring device to palpate the center of the patella may be a viable alternative to manual palpation. Further research is necessary to validate and rule out possible systematic errors that occurred due to the position of the cadaver and plasticity of the embalmed tissue.

INTRODUCTION

• The q-angle is an important measurement that quantifies the alignment of the quadriceps femoris muscle in relation to the pelvis, femur, and tibia.

• Due to the patella being the fulcrum for the measurement of the q-angle, errors in palpation can cause large deviations in the measurement.

• An individual’s patella is deviated medially or laterally, this could cause abnormal loading patterns on the patellofemoral and hipabdominal joint, as well as mechanical disadvantages of the quadriceps femoris muscle.

• Previous studies have noted that the exact center of the patella is difficult to palpate due to the bulky insertion of the quadriceps femoris muscle, adipose tissue, morphology, and experience of the examiner.

• While some studies have researched the affects of accuracy during palpation, no current studies have attempted to decrease error when palpating the center of the patella.

• There are discrepancies in the research between what is the center of the patella (Figure 1).

METHODS

Subject

One cadaver under the regulation of the Anatomical Board of the state of Florida.

Examiners

Nineteen subjects between the ages of 18 & 65, that were either physical therapy students (SPT) or licensed physical therapists (PT). Fourteen SPTs participate day one, and thirteen day two. Five PTs participate on only day one.

Researchers

Two faculty members assisted with the data collection. A doctorate of physical therapy student, who had completed his second of three years in the program completed the program is the principal investigator, gave instructions to the examiners prior to entering the room, and made the original measurements to mark the center of the patellae with a fluorescent pen.

Equipment

Fluorescent pen, die, caliper, stylus, UV light, gloves, and graph paper

Procedure

The cadaver was placed in supine, nearly full hip & knee extension, and minimal external rotation. The patellae were dissected. The patellae were then measured, and then a fluorescent dot was placed at the hypothesized (pre-dissected) center of the patella. Examiners were then given an instruction sheet, and allowed to enter the room one at a time. Once in the room each examiner rolled a six-sided die in order to determine which method they would utilize first (odd = manual palpation; even = the quad rule). The examiner then utilized these determined method to find the center of the patella. Once the examiner was confident they had found the center of the patella, they were instructed to place the stylus at this point. The researchers then recorded the medial/lateral distance, and the superior inferior distance from the hypothesized center of the patella. This was then repeated on the opposite knee utilizing the same method of finding the center of the patella. Once all examiners had participated the patellae were then drilled through at the hypothesized mark, and then dissected. The patellae were then measured again, and the center of the dissected patellae was found. The data were adjusted to reflect the distance from the marks made through palpation and the found center of the dissected patellae.

RESULTS

The q-angle, shown to be a key indicator of alignment of the quadriceps femoris muscle in relation to the pelvis, femur, and tibia. The q-angle is known to have a significant association with patellar tendinopathy, patellofemoral pain syndrome (PFPS), and iliotibial band syndrome. It has been shown that abnormal q-angles can lead to abnormal loading patterns on the patellofemoral and tibiofemoral joint, as well as mechanical disadvantages of the quadriceps femoris muscle.

Previous studies have noted that the exact center of the patella is difficult to palpate due to the bulky insertion of the quadriceps femoris muscle, adipose tissue, morphology, and experience of the examiner. While some studies have researched the affects of accuracy during palpation, no current studies have attempted to decrease error when palpating the center of the patella. There are discrepancies in the research between what is the center of the patella (Figure 1).

CONCLUSION

• The quad rule shows potential to be able to reduce the amount of error associated with palpation.

• The quad rule may be able to compensate for a lack of experience for individuals who are not well versed in palpation techniques.

• Further research is necessary to validate these conclusions.