International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 12, No. 1, Jan-March 2023 Online ISSN: 2250-3137
Print ISSN: 2977-0122

**Original Research**

# Morphometric Evaluation of Knee cap: An Institutional Based Study

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Received: 15 February 2023 Accepted: 26 March 2023

**Abstract**
**Background:**The patella is situated beneath the fascia lata and the tendon of the rectus femoris, positioned anteriorly to the knee joint. The upper third of the patella serves as the point of attachment for both the rectus femoris and the vastus intermedius muscles. Hence; the present study was conducted for morphometric assessment of knee cap. Hence; the present study was conducted for morphometric evaluation of knee cap.
**Materials &Methods:** This research aimed to perform a morphometric analysis of the patella. A total of 50 dry patellae, comprising both right and left specimens from individuals of both sexes, were collected for the study. Specimens exhibiting fractures, the presence of pins and plates, significant erosion, or diminished bone density were excluded from consideration. Measurements taken included patellar height, width, thickness, and the widths of both the medial and lateral articular facets, which were recorded using a sliding vernier caliper. To determine if there were statistically significant differences between the right and left patellae, a Student's t-test was employed.
**Results:**Mean patella height was 38.95 mm while mean patella width was 39.75 mm. Mean patella thickness was 18.67 mm. Width of medial articular facet and Width of lateral articular facet were 23.12 mm and 19.08 mm respectively. While comparing the patella measurements between the left and right side, non-significant results were obtained.
**Conclusion:**It is proposed that the morphometric data provided in this study will be advantageous for orthopedic surgeons in the development of patellar implants for knee-related procedures.
**Key words:** Knee, Cap, Morphometric.



## INTRODUCTION

The patella is situated beneath the fascia lata and the tendon of the rectus femoris, positioned anteriorly to the knee joint. The upper third of the patella serves as the point of attachment for both the rectus femoris and the vastus intermedius muscles.[1, 2] Meanwhile, the vastus medialis and vastus lateralis muscles insert along the medial and lateral edges of the patella, respectively. The tendons of the quadriceps converge at their distal ends, traversing superficially across the anterior surface of the patella to create the deep fascia lata, which is anchored to the lateral condyle of the tibia. Additionally, the patellar ligament encases the lower third of the patella, connecting the bone to the tibial tuberosity.[3, 4] The patella, as a skeletal element, holds considerable significance in the field of anthropometrics. It plays a crucial role in various sitting and squatting postures, which are influenced by cultural and ethnic factors. Due to its subcutaneous location, the patella is susceptible to trauma and can be impacted by systemic skeletal disorders.[4, 5] The effectiveness of total knee arthroplasty or patellofemoral arthroplasty is contingent upon selecting an appropriately sized patellar implant. Despite its importance, there is a scarcity of research focused on the morphology of the patella. A comprehensive understanding of its morphology and

dimensions is essential for the design of prosthetic devices and the advancement of surgical methodologies.[6, 7]Hence; the present study was conducted for morphometric assessment of knee cap.

## MATERIALS & METHODS

This research aimed to perform a morphometric analysis of the patella. A total of 50 dry patellae, comprising both right and left specimens from individuals of both sexes, were collected for the study. Specimens exhibiting fractures, the presence of pins and plates, significant erosion, or diminished bone density were excluded from consideration. Measurements taken included patellar height, width, thickness, and the widths of both the medial and lateral articular facets, which were recorded using a sliding vernier caliper. To determine if there were statistically significant differences between the right and left patellae, a student's t-test was employed. The results, including mean values and standard deviations, were calculated and presented in tabular form.

## RESULTS

Mean patella height was 38.95 mm while mean patella width was 39.75 mm. Mean patella thickness was 18.67 mm. Width of medial articular facet and Width of lateral articular facet was 23.12 mm and 19.08 mm respectively. While comparing the patella measurements between the left and right side, non-significant results were obtained.

**Table 1: Description of measurements**

| Measurements | Mean | SD |
|---|---|---|
| **Patella height** | 38.95 | 3.12 |
| **Patella width** | 39.75 | 3.24 |
| **Patella thickness** | 18.67 | 1.82 |
| **Width of medial articular facet** | 23.12 | 2.18 |
| **Width of lateral articular facet** | 19.08 | 1.18 |

**Table 2: Comparison of measurements between right and left side**

| Measurements | t-value | p-value |
|---|---|---|
| **Patella height** | 1.71 | 0.16 |
| **Patella width** | 0.81 | 0.27 |
| **Patella thickness** | 0.36 | 0.55 |
| **Width of medial articular facet** | 0.91 | 0.29 |
| **Width of lateral articular facet** | 0.55 | 0.17 |

## DISCUSSION

The knee represents the largest joint within the human body. Functionally, it operates mainly as a hinge joint, facilitating the flexion and extension of the leg. While additional movements can occur, they are somewhat restricted. The knee comprises two primary articulations: the tibiofemoral and patellofemoral joints, classifying it as a compound synovial joint. These jointsplays a vital role in enabling efficient bipedal activities such as walking, running, and jumping. The most significant factor in stabilizing the knee is muscular support, and appropriate conditioning and training can mitigate the risk of sports-related injuries. A comprehensive understanding of its anatomical structure is essential for optimizing rehabilitation strategies for the lower limbs.[6- 9]Hence; the present study was conducted for morphometric assessment of knee cap.

Mean patella height was 38.95 mm while mean patella width was 39.75 mm. Mean patella thickness was 18.67 mm. Width of medial articular facet and Width of lateral articular facet was 23.12 mm and 19.08 mm respectively. While comparing the patella measurements between left and right side, non-significant results were obtained. Biswas S et alaimed at the morphometric and comparative analysis of patella in eastern part of India. 89 dry bones were collected from the students and the departmental bone bank. Measurements were taken by using Vernier Callipers. Bony features and abnormalities if any were noted. Classification of patella, based on the dimensions of the articular facets and dimensions of the patella and articular facets were also noted. This type of morphometric study on patella may help in implant designing and forensic measurements.[10]

Chhaparwal R et al assessed 50 dry human patellae. The various parameters were recorded and photographed. 82% patella are triangular. Mean of height, width and thickness of patella were 36.66, 38.66, 19.26 mm. Width of MAF and LAF is 20.69 mm, 23.35 mm. Surface area of medial and lateral articular facet of patella were 415 $mm^2$ / 526 $mm^2$. Average weight of the patella is about 7.9 gm. The study provided various morphometric parameters and original data in relation to the patellar facets.[11]Meghana H Joshi et al observed morphometric linear measurements of patella and

patellar ligament of knee joint in cadavers. Total ninety lower limb including both sexes dissected for morphometric analysis of patella and patellar ligament. Mean length, width, thickness of patella and patellar ligament, width of medial and lateral articular facet of patella were measured by digital vernier calliper and analyzed statistically. Mean length, width, thickness of patella measured 38.37, 48.95, 18.68mm on right sided and 37.40, 47.40, 18.40mm on left sided respectively. Mean Length, width and thickness of patellar ligament in proximal and distal part measured 59.82, 28.33, 4.044, 4.222mm on right sided respectively and 61.93, 28.95, 4.400, 3.977 on left sided respectively. The mean width of lateral and medial articular facet on right and left sided measured 27.00, 22.57, 27.00, 26.00mm respectively.The morphometric knowledge of patella, patellar ligament and their interrelationship can help to orthopaedic surgeons for knee arthroplasty procedure.[12]

## CONCLUSION

It is proposed that the morphometric data provided in this study will be advantageous for orthopedic surgeons in the development of patellar implants for knee-related procedures.

## REFERENCES

1. Fox AJ, Wanivenhaus F, Rodeo SA. The basic science of the patella: structure, composition, and function. J Knee Surg. 2012 May;25(2):127-41.
2. Loudon JK. Biomechanics and pathomechanics of the patellofemoral joint. Int J Sports Phys Ther. 2016 Dec;11(6):820-830.
3. Maralcan G, Kuru I, Issi S, Esmer AF, Tekdemir I, Evcik D. The innervation of patella: anatomical and clinical study. Surg Radiol Anat. 2005 Nov;27(4):331-5.
4. Barton RS, Ostrowski ML, Anderson TD, Ilahi OA, Heggeness MH. Intraosseous innervation of the human patella: a histologic study. Am J Sports Med. 2007 Feb;35(2):307-11.
5. Miller TT, Staron RB, Feldman F. Patellar height on sagittal MR imaging of the knee. AJR Am J Roentgenol. 1996;167: 339-41.
6. Peng S, Linan Z, Zengtao H, Xueling B, Xin Y, Zhaobin X, Xu H. Morphometric measurement of the patella on 3D model reconstructed from CT scan images for the southern Chinese population. Chin. Med. J. 2014;127: 96-101.
7. Denaro V, Forriol F, Di Martino A, Papalia R. Modifications of patellar articular cartilage and subchondral bone following immobilisation and denervation: a histologic and morphometric in vivo study. J Orthop Trauma. 2004; 5(1): 44-9
8. Kayalvizhi I, Arora S, Dang B, Bansal S, Narayan RK. Sex Determination by Applying Discriminant Functional Analysis on Patellar Morphometry. IJSR 2015; 4(11): 1511-15.
9. Potage D, Duparc F, D'Utruy A, Courage O, Roussignol X. Mapping the quadriceps tendon: An anatomic and morphometric study to guide tendon harvesting. Surg Radiol Anat. 2015; 37:1063-7
10. Biswas S et al. Morphometric Study of Patellar Measurement: An Overview from Eastern Zone of India.International Journal of Contemporary Medical Research. 2019; 6(3): C5-C9.
11. Chhaparwal R, Hiware S, Chhaparwal P, Chhaparwal N. Morphometric Study of Knee Cap (Patella). Ann. Int. Med. Den. Res. 2018; 4(6):AT05-AT09.
12. Meghana H Joshi, Vasant H Vaniya. Morphometric study of patella and patellar ligament of knee with its clinical significance. MedPulse International Journal of Anatomy. October 2021; 20(1): 44-49