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Anatomy

CORRELATION BETWEEN MORPHOMETRY OF PATELLAR LIGAMENT AND PATELLA-AN AID TO TOTAL KNEE ARTHROPLASTY

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ABSTRACT **Background:** Patellar ligament is of surgical importance in procedures pertaining to total knee arthroplasty. It is extensively used as an autogenous graft for endoscopic anterior cruciate ligament reconstruction. Patellar ligament is the most preferred autograft owing to sufficient load to failure strength and stiffness. **Purpose of the study:** Dimensions of patella have been shown to be of anthropometric importance and is also used for personal identification as the bone is resistant to postmortem changes. There is paucity of literature on studies correlating the dimensions of patellar ligament and patella bone in Indian population. This study is the first of its kind to provide data on the same. **Material and Methods:** 53 prosected lower limbs were used to study the morphometry of Patellar ligament and Patella using digital vernier calipers. The mean length, width and thickness values of Patellar ligament and bone were recorded. Pearson correlation coefficient was used to test the strength of association between the two variables. **Results:** It was seen that there was negative correlation between patella length and ligament length and thickness. There was positive correlation between patella length and ligament width. Patella width correlated positively with ligament length and ligament width but negatively with ligament thickness. Patella thickness correlated negatively with ligament length and thickness but positively with ligament width. **Conclusion-**This study will provide valuable anthropometric data and aid the orthopaedic surgeons performing knee surgeries.

KEYWORDS : Patella, Patellar ligament, Morphometry, Correlation ,Arthroplasty

INTRODUCTION

Ligamentum patellae is an extracapsular ligament of the knee joint. It is a thick and powerful ligament with a length of 8cm, width of 2-3 cm and thickness of 0.5 cm. It is derived from the tendon of quadriceps femoris and extends from the apex of patella to the upper part of the tubercle of tibia. The patellar ligament is used for pathological laxity of anterior cruciate ligament and the preferred treatment is endoscopic anterior cruciate ligament reconstruction with patellar tendon graft [1], [2].

Patellar tendon –bone graft (ligamentum patella graft) is preferred due to its high tensile strength. Patella and tibia plug provide rigid fixation of graft, also less post operative stiffness of graft is observed. Among the autogenous tissue currently available for all repairs the most commonly used is central one third patellar tendon.

Patella tendon – to – patella height ratio measurement is best perfomed radiologically. The patella tendon length should be equal or slightly longer than the height of the patella .If the ratio is greater than 15%-20% ,patella alta should be suspected .If the ratio is less than 15%-20% patella baja should be suspected.

Need for the study: There is still paucity of literature on the morphometry of patellar ligament and patella in south Indian population, hence this study was undertaken.

Aims and objectives:

i. To study the morphometry of the patellar ligament.
ii. To study the morphometry of the patella.
iii. Classify the patella based on its position into high lying or low lying patella (Patella alta/Patella baja)
iv. To study correlation between morphometric parameters of patellar ligament and morphometric parameters of patella.

MATERIALS AND METHODS

The study was undertaken in the Department of Anatomy of MVJMC&RH, Bangalore.53 lower limbs of cadavers (27R+26L) were taken for the study. The quadriceps tendon was dissected across immediately proximal to the patella. The incision was carried downwards to the tibial condyles passing 2-3 cm on either side of the ligamentum patellae. The patella was turned downwards and morphometric parameters of the patellar tendon and patella were noted. [3]

The measurements of the patellar tendon and patella were taken using digital vernier calipers to the nearest millimeter. Following parameters of patella tendon were recorded.

Patella ligament length was measured from apex of patella to its site of insertion at the tibial tuberosity. Maximum width of patella ligament was recorded at its mid point. Maximum thickness was recorded at its mid point.

Patella dimensions – following measurements were recorded using vernier calipers.

Patella height/length -The distance between superior border and apex. Patella width -The maximum distance between medial and lateral borders. Patella thickness -The thickness between anterior surface and median ridge on posterior surface.

Patella was classified as high lying/low lying (patella alta and patella baja) based on the ratio between patella tendon length and length of patella(Insall –salvati ratio) and accordingly patella was classified as patella alta and patella baja. Mean and standard deviation of the parameters of patellar ligament and patella were calculated using SPSS software. Pearson's correlation coefficient was used to test the strength of the association between patella ligament dimensions and patella dimensions.

Table 1-Showing the measurements of patella and patellar ligament

S. No.	Measurement	Right		Left		P-value	Combined	
		Mean	Standard deviation	Mean	Standard deviation		Mean	Standard deviation
1	Patella ligament length	45.78	10.76	48.0	13.87	0.47	45.10	10.27
2	Patella ligament width	29.39	3.99	27.91	6.59	0.19	27.58	4.03
3	Patella ligament thickness	4.96	1.11	2.98	1.94	0.17	4.57	1.11
4	Patella bone length	37.90	3.55	37.55	6.46	0.81	37.62	3.33

5	Patella bone width	42.33	4.71	42.51	2.66	0.83	42.40	2.64
6	Patella bone thickness	24.57	2.39	24.82	2.34	0.67	24.56	1.60

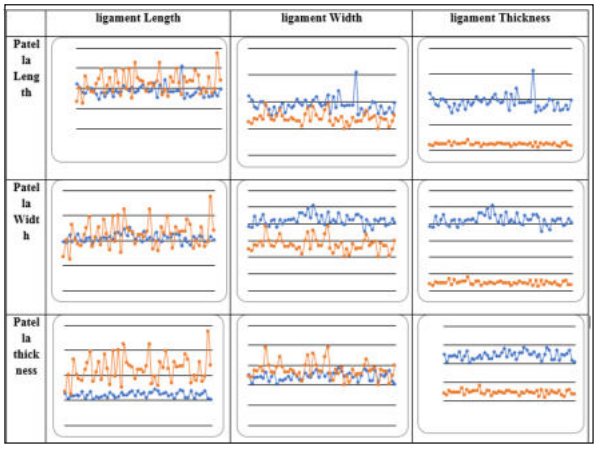
Table 2-Analysis of correlation between patella and patellar tendon dimensions

Variable	Ligament Length	Ligament Width	Ligament Thickness
Patella Length	-0.17	0.03	-0.29
Patella Width	0.09	0.17	-0.23
Patella thickness	-0.18	0.15	-0.06

The mean Patella ligament on right side was 45.78mm±10.76 while on the left side 48.0mm±13.87. The mean patella ligament width on the right side was 29.39mm±3.99 while on the left side 27.91mm±6.59. The mean Patella thickness on the right side was 4.96mm±1.10 while on the left side was 2.98±1.94. The mean Patella bone length was 37.90mm±3.55 on the right side and 37.55mm±6.46 on the left side. The mean Patella bone width was 42.33mm±4.71 on the right side and 42.51mm±2.66 on the left side. The mean Patella bone thickness was 24.57mm±2.39 on the right side and 24.82mm±2.34 on the left side. All the parameters did not show any significant difference between right and left side (P-value as shown in Table-1).

Analysis of correlation:

We also compared the strength of association between dimensions of patella with patella ligament dimensions. It was seen that there was negative correlation between patella length and ligament length and thickness. However this was a weak association. There was positive correlation between patella length and ligament width. Patella width correlated positively with ligament length and ligament width but negatively with ligament thickness. Patella thickness correlated negatively with ligament length and thickness but positively with ligament width.



Graph1:Correlation of length ,width and thickness of patella with that of patellar ligament.

DISCUSSION:

There is paucity of literature comparing the dimensions of patella with patella ligament. Previous studies mostly have limited themselves to MRI and CT measurements of patella and very few cadaveric studies have been done on the same. Ours is the first Indian study comparing the morphometric parameters of patella and patella ligament.

Study	Samples and subjects	Patella height (mean) mm	Patella width (mm)	Patella thickness (mm)	Patella ligament length (mm)	Patella ligament width(mm)	Patella ligament thickness (mm)
Schlenzka and Schweinger	50 fresh human adult cadaveric patellae	54.4	-	-	-	-	-
Oladiran	46 adult cadaveric patellae	43.7	-	23.9	69.74	32.31	-
Present study	53 fresh human adult cadaveric patellae	37.9	42.32	24.56	45.7	29.38	4.96

Previous cadaveric study by Schlenzka et. al on the morphometry of patella showed that the height of the patella was much more in western population (Finland) compared to our study[4]. However there was no data available on Patellar width and Patellar thickness in his study for our comparison. Study by Oladiran et.al. also confirms the higher values in western population(European)[5]. However thickness of patella was similar in both races (European and Indian). When the patella ligament dimension of our study was compared with the study of Oladiran et.al, it was observed that patella ligament height was much more in European race compared to Indian race (Table-4). There was not much difference in patella ligament width between European race and Indian race (Table-4). There was no data available on patella thickness in their study for our comparison.

There was a positive correlation between all the paired dimensions of patella in the study by Oladiran et.al. However, in our study there was a negative correlation between patellar ligament length with patella bone length. However there was a positive paired correlation between patella ligament width and thickness. This was similar to the observation by Oladrian et al.

There was a significant difference in the measurements of patella thickness and patella ligament width between right and left in the study by Oladiran et.al. Our study did not show any difference in the dimensions of patella and patella tendon between two sides. Insall-Salvati ratio in our study was found to be 1.2 which falls under the normal range The normal ratio is 1.02±0.13; values >1.2 are suggestive of patella alta and values less than 0.8 are suggestive of Patella Baja. [6]

CONCLUSION:

This study is the first of its kind in the Indian population and will serve as a reference point for anthropological records [7]. This will also be of use to orthopaedic surgeons who use ligamentum patella frequently as a graft for ACL tear. The data obtained from this study can be utilized for designing of implants and surgeries involving patellar resurfacing as in total knee arthroplasty.

Figure-1: showing measurements of length(Fig. 1a), width(Fig.1b) and thickness of ligamentum patella(Fig.1c).

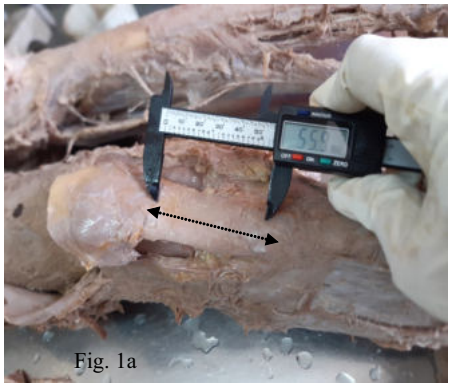


Fig. 1a

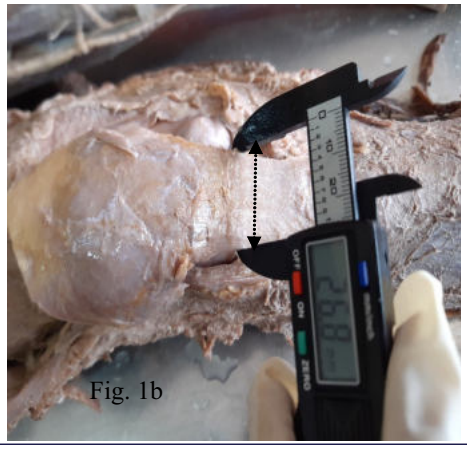


Fig. 1b

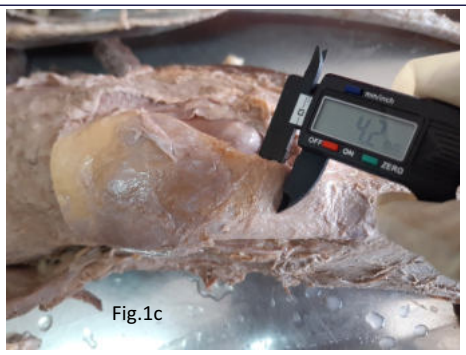
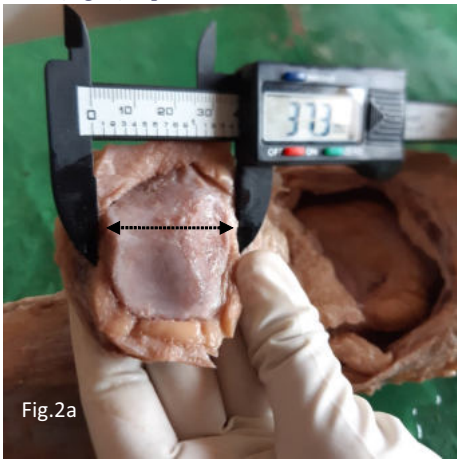
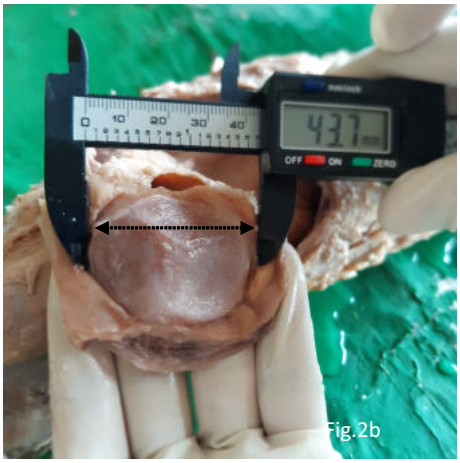


Figure-2: showing measurements of length(Fig.2a), width(Fig.2b) and thickness(Fig.2c) of patella





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