Original Research Article

Morphometric study of patella to assess the feasiblity of patellar resurfacing in patients undergoing total knee replacement

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ABSTRACT

Aims & Objective: We aimed at determining about the suitability of implants available for Indian population by assessing the intra op measurement of patella in all its dimensions viz anteroposterior, superioinferior and mediolateral diameter in Indian patients.

Also, we aimed at proving that whether any co-relation exists between radiological and intraoperative morphometry of patella. We also wanted to study whether any correlation exists between patellar size and anthropometric parameters like height and age.

Materials and Methods: 55 patients of grade 4 OA knee were selected for this study and pre op x-rays were obtained, AP View, Lat View, Skyline view and Merchant view. Preop Morphometery of patella was recorded on x-ray findings. All patients were operated by standard midline incision with medial parapatellar arthrotomy.

Intra op measurement of patella was done via Vernier caliper and measurements were recorded.

Study Design: Prospective cohort study.

Results: The smallest available patellar implant in India is about 8 mm in size which is not suitable for Indian patient.most of the patients were having patellar morphometery lower than the expected size for patellar resurfacement. Hence, patellar resurfacement was not an option for many of the patients because of unavailability of patellar implants of appropriate size.

Conclusion: Hence in this study we conclude that there is a need of better designed implants for Indian patients as the presently available implants are mainly designed for western population making it unfeasible to resurface patella for Indian surgeons.

1. Introduction

Total knee Arthroplasty (T.K.A.) is a highly successful procedure that can reduce pain and improve range of motion and function by correcting angular deformities and restoring the integrity of the articulating surfaces. Nowadays, joint replacement surgeries are performed very commonly for various arthritis of knee joint and it can be stated that T.K.A is one of the major surgical advances in twentieth century.

Initially patella was not resurfaced in TKA but the thrust to resurface patella was started by the reports suggesting that 24-50% of patients suffer from anterior knee pain in un-resurfaced patella after TKA.

To reduce the incidence of patellar fracture it was found in various studies that increased patellar strains occurred when patellar osteotomy resulted in residual bony patellar thickness of less than 15mm.[1–6]

However, to achieve a residual patellar thickness of more than 15mm after resection, the native patellar thickness should be at least 24-25mm as the smallest available

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implant is 8mm thick. Also, patella-implant composite thickness should be at least 1-2mm less than the native patella thickness for better outcomes. Increased patellar thickness during resurfacing may lead to anterior knee pain and decreased range of motion and conversely diminished patellar thickness may led to an increased incidence of patellar fractures.

It is a well-known fact that various anatomic parameters vary among people from different races and gender, hence it can be safely assumed that difference should exist between morphometry of patella. But all the patellar component available in India are designed for Caucasian population and are therefore not suitable for a large number of Asians especially female gender. Therefore, there is a need for patellar implants suitable for Indian population.

Thus, we have embarked upon this study to assess the radiological and intra op morphometric analysis of patella in relation to gender and anthropometric measurements like height, among Indian population to find out whether a good correlation exist between morphometric analysis (intraoperative and radiological) and gender as well as anthropometric parameters like height. This will help in planning and informing the patients preoperatively regarding his or her suitability for patellar resurfacing if it is needed. It will also help in designing a suitable patellar prosthesis for Indian population.

2. Materials and Methods

Patients meeting inclusion criteria were enrolled for study after taking prior consent in orthopedics department by the investigator.

Radiographic evaluation was done of all the patients in terms of merchant view, lateral view, full length standing view. The radiological morphometery of patella was recorded pre operatively. All the patient were subjected to detailed pre anesthetic check-up. Pre-op antibiotics was given half an hour before incision.

Patients were operated in supine position and tourniquet was applied. Standard operating techniques was used, TKR was performed by Ant. Midline incision.

In our study a total of 55 knees underwent primary total knee arthroplasty and morphometric analysis of patella was done for all the patients both preoperatively (radiological analysis) and intraoperatively with the aim

1. To do a pre-operative(radiological) and intra operative morphometric study of patella of patients of Total Knee Replacement (T.K.R.).
2. To study if any correlation exists between radiological and intra operative morphometric study.
3. To study if any correlation exists between intra operative morphometric measurement and a) Anthropometric measurement b) Gender.

4. To study the feasibility of patellar resurfacing in patient undergoing TKR so as to study the feasibility of doing patellar resurfacing in Indian population with the implants available.

Intra op patellar morphometry was measured with the help of vernier caliper and was recorded. Stastical analysis of the recorded parameter were done to establish whether any co-relation exists between radiological and intraoperative morphometry of patella. We also wanted to study whether any correlation exists between patellar size and anthropometric parameters like height, age, gender, race.

3. Observation

Table 1: Preoperative radiological patellar morphometery

	Mean
Patellar Morphometry (AP)	25.05mm
Patellar Morphometry (ML)	50.58mm
Patellar Morphometry (SI)	36.57mm

Table 2: Intra operative patellar morphometery

	Mean
Patellar Morphometry (AP)	23.18mm
Patellar Morphometry (ML)	44.71mm
Patellar Morphometry (SI)	34.09mm

4. Results

We have found statistically significant relation between intra operative patellar morphometry and anthropometry of the patient.

We observed that as the height of the patient increases the patellar size increases too with the mean height of less than or equal to164.66cm has patellar thickness less than 23mm, and the mean height of greater than or equal to 175.17cm has patellar thickness greater than or equal to 23 mm. however, it is indeed noteworthy that only the patellar thickness varies with height and the other parameters of patellar morphometry like its superioinferior, mediolateral diameter has no correlation with height.

In the above study we also established that 100% of females in the study group, because of their short stature was having patellar thickness less than or equal to 23mm and hence was not suited to undergo patellar replacement due to lack of small size patellar implant. About 56% of the male population were also having patellar size less than or equal to 23mm and patellar resurfacement was not done in them too. It is an important development as Indian population especially females are short statured and are not fit for patellar resurfacement with the available implant, designed mainly for caucasian population.

Table 3: Correlation between intra-operaive patellar

Morphometery and radiological morphometry of patella

Correlation table 1

		Radiological morphometry (AP)
Intra-op	Correlation coefficient	0.922
Patellar Morphometry (AP)	P value	<0.0001
		55

Correlation table 2

		Radiological morphometry (SI)
Intra-op	Correlation Coefficient	0.853
Patellar Morphometry (SI)	P value	<0.0001

Correlation table 3

		Radiological morphometry (ML)
	Correlation Coefficient	0.926
Patellar Morphometry intra op (ML)	P value	<0.0001
		55

Table 4: Relationship between patellar morphometry with height

	Sample size	Mean ± Stdev	Median	Min-Max
Height in cm	55	171.54 ± 10.7 cm	167.54 cm	155.45-192.24 cm
Patellar Morphometry (AP)	55	23.18 ± 1.48 mm	23 mm	20-26 mm
Patellar Morphometry (ML)	55	44.71 ± 3.63 mm	45 mm	34-50 mm
Patellar Morphometry (SI)	55	34.09 ± 5.39 mm	33 mm	20-50 mm

Table 5:

Correlation table		**Height in cm**
	Correlation Coefficient	0.68
Patellar Morphometry (Anteroposterior)	P value	<0.0001
		55
	Correlation Coefficient	0.077
Patellar Morphometry (Mediolateral)	P value	0.5766
		55
	Correlation Coefficient	0.038
Patellar Morphometry (Superioinferior)	P value	0.7842
		55

In our study we have also established that patellar morphometry (intra-operative) and radiological patellar morphometry are correlated. This will help us at informing the patients pre operatively about their need for patellar resurfacement and size of the implant required as well as proper planning to avoid unnecessary chaos in the operation theatre.

5. Conclusion

Total knee Arthroplasty (T.K.A.) is a highly successful procedure that can reduce the morbidity of the patient and enhance the quality of life. We aimed at this study to understand the feasibility of patellar resurfacement in Indian population. With constant research happening to give better outcomes in TKR, many surgeons advise the need of patellar resurfacement to reduce the incidence of anterior knee pain.

The smallest available patellar implant in India is about 8 mm in size which is not suitable for Indian patient. Hence, in this study we conclude that there is a need of better designed implants for Indian patients as the presently available implants are mainly designed for western population making it unfeasible to resurface patella for Indian surgeons. In the study we also conclude that the thickness of the patella (anteroposterior diameter) varies with height of the patient but the other dimensions of patella viz mediolateral and superioinferior diameter remains same.

We also conclude that there is strong correlation between the intraoperative patellar morphometry and preoperative

radiological patellar morphometry. Hence, we can inform the patients priory about the tentative size of implant they will need and also whether or not they can undergo patellar resufacement.

We also conclude that the patellar size varies with the demography and females have smaller patella than males.

6. Source of Funding

None.

7. Conflict of Interest

None.

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