Comparison of Clinical and Radiological Outcomes of Freehand Patellar Resection Technique Versus Cutting Guide Technique in Total Knee Arthroplasty.

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ABSTRACT

Objective: To compare the clinical and radiological outcomes of freehand patellar resection technique versus cutting guide technique in primary total knee arthroplasty.

Methods: This randomized controlled trial was conducted in the Institute of Orthopaedics and Surgery Karachi from 1st February 2019 to 1st July 2020. All patients with primary total knee arthroplasty (TKA) fulfilling the inclusion criteria were divided randomly into patellar resection with freehand technique(group A) and cutting guide technique(group B).The post operative clinical and radiological parameters were compared in both groups and *P* value was calculated with Chi-square test for statistical significance. *P* value< 0.05 was considered significant.

Results: The total number of patients in our study were 114 divided equally into group A and group B with 57 patients each. In group A male patients were 24(42, 1%) and female 33(57.8%). In group B male patients were 21(36.8%) and female 36(63.1%).The mean age of group A patients was 57.00 ± 5.60 and group B 57.65 ± 5.55 years. Post operatively slightly lesser frequency of patients had positive patellar glide test, patellar grind test, patellar edge tenderness and anterior knee pain in group A than in group B(P>0.05). No statistically significant difference in the mean values of lateral patellar tilt(LPT), lateral patellar displacement(LPD), Insall-Salvati (IS) index and hip knee ankle(HKA) angle and their outliers in both the groups were noted.(P>0.05).

Conclusion: Identical clinical and radiological results were achieved by both free hand patellar resection technique and cutting guide technique. Freehand patellar resection technique however had slightly lower but not significant positive patellofemoral tests and anterior knee pain than cutting guide technique.

Keywords: Osteoarthritis, Resection, Resurfacing, Patella, Total Knee Arthroplasty.

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INTRODUCTION

Routine patellar resurfacing in total knee arthroplasty is although somewhat controversial patients with symmetric resurfacing and replacement have lower incidence of anterior knee pain, patellar instability and lower revision rates than those without patellar replacement.[1-5.] It has been reported that incorrect patellar resection occurs in 10% of total knee arthroplasties even by experienced surgeons causing anterior knee pain, impingement and decrease range of motion post operatively. [6-10] A symmetric patellar cut causes anterior knee pain in 15% of patients while rising from the chair in comparison to 44% of asymmetric patellar cut.[8] Patellar cut is considered symmetric if it is parallel to the anterior (front) of the patella [8,11,12] however the existing cutting guides

have no contact with the front surface of the patella as a result the guide can tilt due to low or high surface points. [13,14] The newly introduced Computer-Assisted Arthroplasty tried to resolve this issue by inserting a screw on to the anterior surface of patella as reference but the system is invasive and complicated. [14,15] Currently three techniques are used for patellar resection: the free hand technique with a saw, cutting guide technique and resurfacing with a reamer.[14] Each technique has its own merits and demerits and the choice depends upon individual surgeon experience and preference.[16]

The objective of our study was to compare the clinical and radiological outcomes of freehand patellar resection technique versus cutting guide technique in primary total knee arthroplasty. Our hypothesis was that free hand technique had lower incidence of clinical and radiological abnormalities than cutting guide technique. To our knowledge this was the first study on this topic in Pakistani population and we hoped that our findings will be used for formulating standard guidelines regarding patellar resurfacing techniques in total knee arthroplasty in our country.

METHODS

We conducted this randomized controlled trial in the Institute of Orthopaedics and Surgery, Karachi from 1st February 2019 to 1st July 2020.Patients of either gender and age with primary osteoarthritis of the knee (failure to resolve symptoms with conservative treatment for 3 months, Ahlback grade≥ 2), varus less than 20 degrees and valgus less than 15 degrees were included in our study. Patients with bilateral osteoarthritis, previous knee surgery, patella alta, patella fracture, inflammatory arthritis, patellofemoral instability and flexion contracture were excluded. Ethical approval was obtained from the Ethical Review Committee of the Hospital and patients were included after taking informed written consent. In the included subjects complete history, clinical examination and relevant investigations were advised. Patients were randomly assigned to group A (freehand group) and group B (cutting guide group) using simple lottery method.

Surgical Technique

All total knee arthroplasties were performed under general or spinal anaesthesia and tourniquet control. The same surgical team performed all the surgeries using all cemented components Nexgen Legacy Posterior Stabilized-flex Prosthesis(Zimmer, USA).A uniform quadriceps sparing approach with knee flexion at 30 ^{0} and a medial curvilinear skin incision was made extending to the medial edge of tibial tubercle. The thickness of the patella was measured with the help of a caliper. Patellar resection was done using freehand technique with oscillating saw and surgeon assessed the symmetry with haptic feedback and measurement of thickness from center of patella. Repeated resections were conducted as needed till targeted symmetry and thickness was achieved. In cutting guide technique, cutting guide was adjusted to the required resection level and managed in symmetrical manner employing articular and anterior surfaces. After removal of the guide cemented, three peg, round patella was employed to increase bone coverage. To reduce peripatellar scars and crepitation, loose synovium and osteophytes were removed and 7.5 mm patellar component was used. Post-operative supervised physiotherapy was started on the first post operative day. All patients were followed in OPD on 2nd week and 4th week initially and then monthly till 6 months. In each visit clinical outcomes such as patellar glide test(lateral and medial translation), Patellar grind test(Patella was immobilize with extended knee and asking the patient to do isometric contraction of the quadriceps and thus pushing the patella in the trochlear groove), patellar edge tenderness(Pressing upon the immobilized patella from edges while the knee was extended and patient was contracting quadriceps isometrically) and anterior knee pain on walking was assessed by a senior Orthopaedic surgeon who was not part of the study team. Radiographic measurement of lateral patellar tilt (LPT) and lateral patellar displacement (LPD) [17,18] was done on sunrise radiograph with knee in 30 to 40 degree flexion. Hip Knee Ankle (HKA) angle was measured on full length weight bearing AP radiograph. Insall-Salvati(IS) ratio was calculated for patella baja.[19] A standard was set for outliers measured radio graphically to be assessed clinically if LPT > 10 degrees, LPD > 4mm, IS< 0.8 or >1.2 and hip knee ankle angle<87 degrees or >93 degrees.[17] The clinical and radiographic outcome at 6th month was recorded for comparison in each group.

Statistical Package for Social Sciences (SPSS version 22) was used for data entry and analysis. Mean and standard deviation was calculated for age, BMI, lateral patellar tilt, lateral patellar displacement, hip-knee-ankle angle and Insall-Salvati Index. Categorical variables like gender, diabetes, hypertension, obesity, grind test, glide test, anterior knee pain and patellar edge tenderness were represented as frequency and percentage. The post-operative clinical and radiological parameters were

compared in both groups and *P* value was calculated with Chi-square test for statistical significance. (*P* value< 0.05 was considered significant). Data presented in table and flow chart where necessary. We conducted and reported our study as per CONSORT guidelines.[20]

RESULTS

In this randomized controlled trial 129 total knee arthroplasty patients were assessed for eligibility and 114 patients were enrolled and randomized into two equal groups namely group A(free hand patellar resection technique) and group B(cutting guide resection technique) as per CONSORT flow diagram.(fig I)The base line demographic characteristics of both groups were identical(Table I).At 6th months post-operative follow up patellar glide test was painful in 5(8.8%) patients in group A and 6(10.5%) in group B(*P*=0.99).Patellar grind test was positive in 2(3.5%) patients in each group A and B. Patellar edge tenderness was positive in 2(3.5%) and 4(7%) and patients in group A and B respectively. Anterior knee pain was noted in 3(5.3%) patients in group A and 5(8.8%) in group B (*P*=0.71). Radiographic assessment revealed that mean lateral patellar tilt (LPT) was 3.16 ± 1.60^0 in group A and 3.42 ± 2.290 in group B (*P*=0.48). Frequency of outliers were 2 (3.5%) patients in free hand technique and 1(1.7%) patient in cutting guide technique (P=0.8). Mean lateral patellar displacement (LPD) in group A was - 2.84 ± 0.941 mm and - 2.88 ± 0.983 in group B.(*P*=0.84) with outliers 1(1.7%) in each group.(P=0.3) Mean Insall-Salvati (IS) Index was 1.09 ± 0.11 in group A and 1.05 ± 0.124 in group B (*P*=0.87) and the frequency of outliers were 3(5.2%)) in group A and 5(8,7%) in group B(*P*=0.9) Mean hip knee ankle angle in group A was 2.63 ± 0.91 and 2.54 ± 0.82 in group A and B respectively (*P*= 0.59) and the outliers were 2(3.5%) in group A and 3(5.2%) in group B(P=0.5). No significant difference in clinical and radiological outcome in terms of gender, side, obese patients, diabetics and hypertensive patients were noted in both groups. No patient was lost to follow up. No major complication or revision was noted in either group.

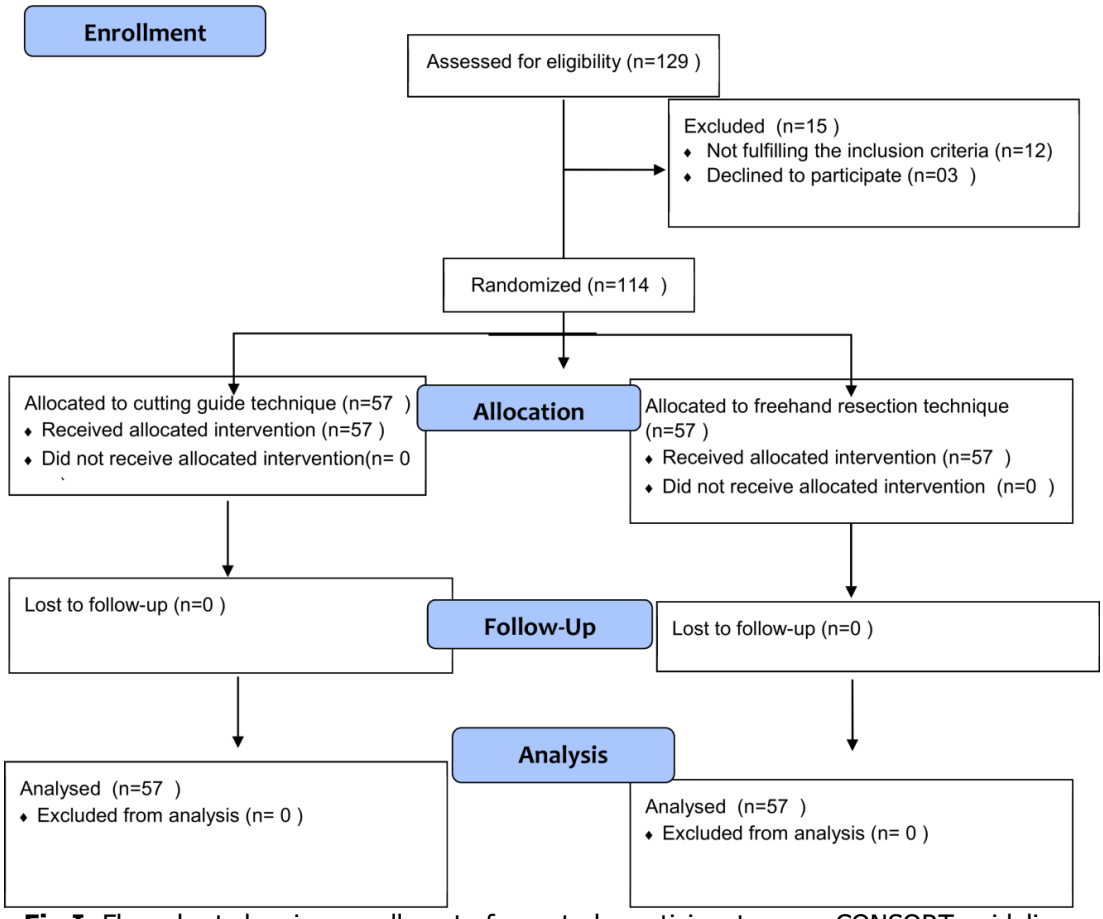

Fig I: Flow chart showing enrollment of our study participant as per CONSORT guidelines

Table 1: Comparison of baseline demographics details of both groups.

Demographic Detail	Group A Free hand cutting technique (n=57)	Group B Cutting Guide technique (n=57)	*P* value
Age(years)±SD	57.00 ± 5.60	57.65 ± 5.55	
Mean follow up(months)	8.3±3.2	8.5±4	
Gender			
Male	24	21	0.70
Female	33	36	0.52
TKA side			
Right	25	27	0.72
Left	32	30	0.85
Obesity(BMI>30)	22	25	0.70
Hypertension	20	17	0.68
Diabetes Mellitus	18	20	0.32

DISCUSSION

In our study radiographic assessment revealed that mean lateral patellar tilt(LPT) was 3.16 ± 1.60^0 in group A and 3.42 ± 2.29^0 in group B(*P*=0.48) while the frequency of outliers were 2(3.5%)patients in free hand technique and 1(1.7%) patient in cutting guide technique(*P*=0.8). Contrary to our findings Yuan[21] noted in his series that LPT was 3.90^0 in the free hand versus 3.00^0 in the cutting guide technique(*P*=0.35) but the outliers were 10(22.7%) versus 2(4.5%) and was statistical significant(*P*=0.03) indicating superiority of cutting guide over free hand technique.

We had noted anterior knee pain in 5.3% patients in group A and 8.8% in group B (*P*=0.71).Yuan [21] documented anterior knee pain in 9.0% in free hand versus 7.1% in cutting guide group(P=0.74).Yuan was of the opinion that age, gender, height ,weight, BMI, Pre-operative knee range of motion and pre op knee society score were not predictors of anterior knee pain.We were not able to estimate predictors of anterior knee pain in our study. The causes of anterior knee pain besides patellar resurfacing can be attributed to the type TKA prosthesis,[22] design of femoral component[23] and thigh and hip muscles weakness.[24]

One limitation of our study was that we could not evaluate the functional scores of knee in both groups. Yuan[21] reported significance improvement in Knee Society Score(KSS) and Westerin Ontario and McMaster Universities Arthritis Index(WOMAC) score in both groups but the difference was not statistically significant(P > 0.05).Various other studies however had indicated that patellar resurfacing or its techniques had no relationship with knee scores.[1, 25-27]

When we searched the literature for optimum patellar resurfacing we could not find a consensus on one reference point of patellar resection. [12,13,15,28-30] Surgeon can use either free hand or cutting guide technique for patellar resection but the resection must be symmetrical and adequate with restoration of patellar height and the patellofemoral joint must not be overstuffed. [9,29]

Camp and Martin[29] conducted an interesting study by comparing free hand technique of patellar resurfacing with cutting guide and novel four quadrant technique. They treated 90 patients of TKA randomly with either technique and noted that free hand technique resulted in the most accurate and desired patellar thickness followed by four quadrant technique and cutting guide technique. Moreover patellar cutting guide technique resulted in significant patellar asymmetry than the other two techniques. The free hand technique was considered an efficient technique without compromising the functional capacity of patellofemoral joint by arthroplasty surgeons with vast experience of more than 500 TKA.[21]

There were few limitations of our study. First our sample size was small. Second our follow up was short. Third we were not able to document patient satisfaction. Further studies are therefore recommended to address all these limitations and verify our results.

CONCLUSION

Identical clinical and radiological results were achieved by both free hand patellar resection technique and cutting guide technique. Freehand patellar resection technique however had slightly

lower but not significant positive patellofemoral tests and anterior knee pain than cutting guide technique.

Conflict of Interest: None

Grants/Funding: None

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