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Digital radiographic measurement of tibial and femoral condylar articular surface asymmetry and knee joint space

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Abstract

Introduction: Knee joint is a major weight bearing synovial joint. In frontal radiograph we can see asymmetrical joint spaces between femoral and tibial components due to asymmetric wear and tear. Articular surfaces of tibial and femoral condyles are also asymmetrical. In frontal radiograph, the tibial condylar articular surface can be seen projected outside laterally or medially with respect to lateral or medial femoral condyle.

Objectives: To measure tibial and femoral articular surface asymmetry. Measurement of tibial and femoral joint space.

Materials and Methods: This epidemiological study was conducted in Orthopaedic outpatient department (OPD) of Ramakrishna Mission Seva Pratishthan Kolkata. Total 350 patients were selected. Frontal standing radiograph of both knees with 100% magnification were obtained. Tibial condylar asymmetry and joint spaces were measured with calliper. Height and weight measurements were also done. Statistical analysis was done.

Results: In right knee 96% patients lateral tibial condyle was projected outside with respect to femoral condyle. In 9.3% patients' medial tibial condyle was outside. In left knee 92.6% patients lateral tibial condyle was outside and 15.7% patients' medial tibial condyle was outside. In right knee lateral joint space was mean \pm sd= 4.45 \pm 1.06, medial joint space mean \pm sd= 1.70 \pm 0.94. In left knee lateral joint space was mean \pm sd= 4.59 \pm 1.00, medial joint space was mean \pm sd= 1.76 \pm 1.00.

Conclusion: In this study, in most of the patients we found tibial and femoral articular surface asymmetry mainly in lateral side. In joint space measurement, we found that medial joint space was less than lateral joint space in both knees.

Keywords: knee joint, femoral and tibial condylar asymmetry, lateral tibial condyle, joint space

1. Introduction

Knee joint is a weight bearing synovial hinged joint. It has two components, femoral and tibial condylar articulation, femoral and patellar articulation. Articular surfaces of both femoral and tibial condyles are covered with hyaline cartilage. Both articular surfaces are separated from each other by medial and lateral meniscus. In frontal radiograph, there is a radiolucent gap between femoral and tibial condyles known as knee joint space, is due to the articular cartilage and menisci [1-3]. In frontal radiograph two components of knee joint can be seen, medial (between medial femoral and tibial condyle) and lateral (between lateral femoral and tibial condyle). Due to unequal wear and tear of articular cartilages medial and lateral joint spaces can be asymmetrical [4, 5].

In frontal radiograph, lateral and medial tibial condylar articular surface can be seen projected outside laterally or medially with respect to the lateral and medial femoral condylar articular surface. From surgical point of view this asymmetry of femoral and tibial condylar articular surfaces is an important finding.

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2. Objectives

1. To measure asymmetry of tibial and femoral condylar articular surfaces.
2. Its relationship with age, sex, weight and height.
3. To measure medial and lateral joint spaces.
4. Relationship of joint space with age, sex, weight and height.

3. Materials and Methods

3.1 Study Settings

This epidemiological study was carried out in Orthopaedics outpatient department (OPD) of Ramakrishna Mission Seva Pratishthan (RKMSPT) a tertiary care hospital in Kolkata from January 2017 to December 2019.

3.2 Subjects

Adult patients attending Orthopaedics OPD, requiring knee radiography were selected for the study. Patients with any bony injury around knee and knee dislocation or subluxation were excluded from the study. Patients with past history of knee surgery were also excluded.

Total 350 patients were selected.

3.3 Methods

Frontal standing radiograph of both knees with true size were obtained for each patient. Height and weight measurement was also done. Tibial and femoral condylar articular surface asymmetry and joint space measurements were done with calliper.

- A. Lateral tibial condyle projected outside with respect to femoral condyle.
- B. Lateral joint space.
- C. Medial joint space.

3.4 Statistical Analysis

Statistical Analysis was performed with help of Epi Info (TM) 7.2.2.2 EPI INFO is a trademark of the Centers for Disease Control and Prevention (CDC). Descriptive statistical analysis was performed to calculate the means with corresponding standard deviations (s.d.). Test of proportion was used to find the Standard Normal Deviate (Z) to compare the difference proportions and Chi-square (χ^2) test was performed to find the associations. t-test was used to compare two means. $p < 0.05$ was taken to be statistically significant.

Table 1: Age of the patients

Age (in years)	Number	%
<20	2	0.6%
20 - 34	29	8.3%
35 - 49	131	37.4%
50 - 64	158	45.1%
65 - 79	29	8.3%
≥80	1	0.3%
Total	350	100.0%
Mean ± s.d.	49.68±11.02	
Median	50	
Range	18 - 80	

Most of the patients (53.7%) were with age ≥50 years which was significantly higher ($Z=3.43; p < 0.0001$).

Table-2: Gender of the patients

Gender	Number	%
Male	134	38.3%
Female	216	61.7%
Total	350	100.0%
Male: Female	1.0:1.6	

The ratio of male and female (Male: Female) was 1.0:1.6. Test of proportion showed that proportion of females (61.7%) was significantly higher than that of males (38.3%) ($Z=4.88; p < 0.0001$).

Table 3: BMI of the patients

BMI (kg/m ²)	Number	%
<18.50	23	6.6%
18.50 - 24.99	154	44.0%
25.00 - 29.99	120	34.3%
≥30.00	53	15.1%
Total	350	100.0%
Mean ± s.d.	25.25±4.46	
Median	24.95	
Range	14.57 - 40.43	

49.4% of the patients were obese but it was not significantly higher ($Z=$).

Table 4: Right lateral Tibial Condyle Outside of the patients

Right lateral Tibial Condyle Outside	Number	%
0	14	4.0%
1	13	3.7%
2	65	18.6%
3	76	21.7%
4	67	19.1%
5	60	17.1%
6	33	9.4%
7	14	4.0%
8	4	1.1%
9	4	1.1%
Total	350	100.0%
Mean ± s.d.	3.72±1.80	
Median	4	
Range	0 - 9	

Table 5: Right medial Tibial Condyle Outside of the patients

Right medial Tibial Condyle Outside	Number	%
0	316	90.3%
1	9	2.6%
2	14	4.0%
3	5	1.4%
4	2	0.6%
5	3	0.9%
7	1	0.3%
Total	350	100.0%
Mean ± s.d.	0.23±0.84	
Median	0	
Range	0 - 7	

Table 6: Left lateral Tibial Condyle Outside of the patients

Left lateral Tibial Condyle Outside	Number	%
0	26	7.4%
1	25	7.1%
2	76	21.7%
3	70	20.0%
4	61	17.4%
5	50	14.3%
6	33	9.4%
7	5	1.4%
8	4	1.1%
Total	350	100.0%
Mean ± s.d.	3.28±1.79	
Median	3	
Range	0 - 8	

Table 7: Left medial Tibial Condyle Outside of the patients

Left medial Tibial Condyle Outside	Number	%
0	295	84.3%
1	9	2.6%
2	18	5.1%
3	16	4.6%
4	9	2.6%
5	2	0.6%
7	1	0.3%
Total	350	100.0%
Mean ± s.d.	0.42±1.08	
Median	0	
Range	0 - 7	

Table 8: Right lateral Joint space Outside of the patients

Right lateral Joint space Outside	Number	%
1	3	0.9%
2	10	2.9%
3	42	12.0%
4	123	35.1%
5	119	34.0%
6	50	14.3%
7	2	0.6%
8	1	0.3%
Total	350	100.0%
Mean ± s.d.	4.45±1.06	
Median	4	
Range	1 - 8	

Table 9: Right medial Joint space Outside of the patients

Right medial Joint space Outside	Number	%
0	23	6.6%
1	136	38.9%
2	130	37.1%
3	49	14.0%
4	9	2.6%
5	3	0.9%
Total	350	100.0%
Mean ± s.d.	1.70±0.94	
Median	2	
Range	0 - 5	

Table 10: Left lateral Joint space Outside of the patients

Left lateral Joint space Outside	Number	%
2	6	1.7%
3	40	11.4%
4	115	32.9%
5	122	34.9%
6	65	18.6%
7	1	0.3%
8	1	0.3%
Total	350	100.0%
Mean ± s.d.	4.59±1.00	
Median	5	
Range	02-08	

Table 11: Left medial Joint space Outside of the patients

Left medial Joint space Outside	Number	%
0	22	6.3%
1	136	39.0%
2	117	33.5%
3	55	15.8%
4	16	4.6%
5	3	0.9%
Total	350	100.0%
Mean ± s.d.	1.76±1.00	
Median	2	
Range	0 - 5	

Table 12: Correlation between different parameters with age and BMI of the patients

Parameter	Correlation	Age (Years)	BMI (Kg/m ²)
Tibial Condyle Outside (Right lateral)	r	-0.090	-0.011
	p-value	0.093 NS	0.843 NS
Tibial Condyle Outside (Right medial)	r	-0.135	0.030
	p-value	0.011 S	0.574 NS
Tibial Condyle Outside (Left lateral)	r	-0.112	-0.005
	p-value	0.037 S	0.921 NS
Tibial Condyle Outside (Left medial)	r	-0.127	0.049
	p-value	0.017 S	0.356 NS
Joint Space (Right lateral)	r	-0.024	0.118
	p-value	0.649 NS	0.027 S
Joint Space (Right medial)	r	-0.036	-0.063
	p-value	0.499 NS	0.243 NS
Joint Space (Left lateral)	r	-0.042	0.128
	p-value	0.430 NS	0.016 S
Joint Space (Left medial)	r	-0.060	-0.031
	p-value	0.265 NS	0.567

4. Conclusion

- A. Among 350 patients, total 162 patients (46.3%) were <50 years of age and 188 patients were ≥ years of age. 53.7% patients were ≥ 50 years of age which was significantly higher (Z= 3.43, p<0.0001).
- B. Total male patients were 134 and female patients 216. The ratio of male and female patients was 1.0:1.6. Proportion of female patients (61.7%) was significantly higher than male patients (38.3%) with a Z-score 4.88 and p-score <0.0001.
- C. Total 49.4% patients were obese (BMI≥ 25.00) which was not significantly higher.
- D. Tibial condyle projected outside with respect to femoral condyle-

A. Right Knee

- a. Only in 14 patients (4.0) lateral tibial condyle (right knee) was not projected outside with respect to the lateral femoral condyle. In 346 patients (96.0%) lateral tibial condyle was projected outside with respect to the lateral femoral condyle. Range of lateral tibial condyle projected outside was 0-9mm, median 4mm and mean±sd 3.72±1.80.
- b. Medial tibial condyle (right knee) in 316 patients (90.3%) was not projected outside with respect to the medial femoral condyle. Only in 34 patients medial tibial condyle was projected outside with respect to medial femoral condyle. The range was 0-7mm, median 0mm, mean±sd 0.23±0.84.

A. Left Knee

- a. In left knee only in 26 patients (7.4%) there was no lateral tibial condyle projected outside with respect to lateral femoral condyle. In 324 patients (92.6%) lateral tibial condyle was projected outside with respect to lateral femoral condyle. The range was 0-8mm, median 3mm, mean±sd 3.28±1.79.
- b. In left knee, in 295 patients (84.3%) there was no medial tibial condyle projected outside with respect to medial femoral condyle. Only in 55 patients (15.7%) medial tibial condyle was outside with respect to medial femoral condyle. Range of medial tibial condyle projected outside was 0-7mm, median 4mm, mean±sd 0.42±1.08.

Joint Space

A. Right Knee

- a. Right knee lateral joint space- range 1-8 mm, median 4mm, mean±sd 4.45±1.06.
- b. Right knee medial joint space- range 0-5 mm, median 2mm, mean±sd 1.70±0.94.

B. Left knee

- a. Left knee lateral joint space- range 0-8 mm, median 5mm, mean±sd 4.59±1.00.
- b. Left knee medial joint space- range 0-5 mm, median 2mm, mean±sd 1.76±1.00.

5. Discussion

In this preliminary study, we have observed in maximum number of knee joints tibial and femoral condylar articular surface asymmetry. Usually lateral tibial condylar articular surface was projected outside with respect to lateral femoral condylar articular surface. In proximal tibia fractures, usually we find lateral tibial condylar articular surface widening. After plating, in post-operative x-ray as well we find in most of the cases, lateral tibial articular surface projected outside with respect to lateral femoral condylar articular surface. In our study we have found that it is quite normal in most of the patients because tibial and femoral articular surfaces are usually asymmetric.

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7. References

1. Ryan S, Nicholas MM, Eustace S. The knee joint. In: Anatomy For Diagnostic Imaging. London: Elsevier Limited, 2004, 286-9.
2. Butler P, Mitchell PWM, Ellis H. The knee Joint. In: Applied Radiological Anatomy. Cambridge: Cambridge University Press 1999, 363-6.
3. Ellis H, editor. Knee joint clinical anatomy. Oxford, UK: Blackwell Scientific Publications, 2006, 229-33.
4. Sargon MF, Taner D, Altinta K. Examination of joint space by magnetic resonance imaging in anatomically normal knees. Clin Anat 1998;9:386-90.
5. Beattie KA, Duryea J, Pui M, O'Neill J, Boulos P, Webber CE *et al*. Minimum joint space width and tibial cartilage morphology in the knees of healthy individuals: a cross-sectional study. BMC Musculoskelet Disord 2008;9:119-26.