Original Article

Study of Variation of Knee Joint Space in Relation with Age using the Radiographs

Aditya M[1], Mohammed Awais Ahmed[2], Anitha T[3]

[1,2] Asst. Professor
[2] Professor & HOD
Department of Anatomy
Chalmeda Anand Rao Institute of Medical Sciences
Karimnagar-505001
Telangana, India.

CORRESPONDENCE:

[1] Dr .Mohammed Awais Ahmed
MD (Anatomy)
Assistant Professor
Department of Anatomy
Chalmeda Anand Rao Institute of Medical Sciences
Karimnagar-505001
Telangana, India.
Email: dr.mdawais@gmail.com

ABSTRACT

Background: Knee joint is a compound joint having two condylar joints between the femur and tibia and a sellar (saddle) joint between patella and femur.

Aim / Objectives:

1. To measure the joint space width of the medial and lateral joint spaces in knee joint radiographs

2. To study the variations of joint space width in relation with age

Materials and Methods: The present study was conducted at Chalmeda Ananda Rao Institute of Medical Sciences, Karimanagar from October 2017 to October 2018 on radiographs of both the knees of 150 individuals.

Results: The mean medial joint space width of the right and left knee was 4.87±0.44 and 4.89±0.30 respectively. The mean lateral joint space width of the right and left knee was 5.87±0.43 and 5.87±0.30 respectively

Conclusion: The medial and lateral joint space widths were studied, in relation with age. The values were found to decrease with increasing age.

Keywords: Knee joint, medial joint space width, lateral joint space width, osteoarthritis

INTRODUCTION

Knee joint is largest synovial joint, modified hinge type of joint. [1] Knee joint is a compound joint having two condylar joints between the femur and tibia and a sellar (saddle) joint between patella and femur. The condylar joints are divided by the medial and lateral menisci, which are fibrocartilagenous discs.

The menisci divide the knee joint into upper meniscofemoral and lower meniscotibial compartments. The meniscofemoral compartment allows flexion and extension type of movements and meniscotibial compartment allows rotation type of movements. [2]

The knee joint space can be seen in radiographs of knee joint in antero-posterior and lateral view. According to Ismail anas et al there were changes in the joint space width as result of wear and tear over time. [3] One of the earliest sign of osteoarthritis is narrowing of medial compartment of joint. Ismail anas et al did digital radiograph measurements of knee joint space in normal persons and analyzed the relationship of joint space width with age.

According to Dacre et al, joint space loss is a characteristic feature of osteoarthritis and it cannot be fully evaluated without knowledge of normal variability of joint space size.[4]

The purpose of study was to measure the joint space width of the medial and lateral joint spaces in knee joint radiographs and to study the variations of joint space width in relation with age.

MATERIALS AND METHODS

The study design was a cross sectional study which was carried out on the X rays of knee joint in AP view at Department of Anatomy and Radiology at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar.

The study duration is from October 2017 to October 2018. Digital X-rays of 150 knee joints were studied using instarad viewer 1.7, and the joint space was measured.

The subjects considered for this study are in the age group of 20 to 60 years. The subjects who had congenital disorders, who underwent knee surgeries and who had fractures were excluded.

The joint space width was defined as the interbone distance between the distal margin of femoral condyle and the corresponding tibial condyle. The joint space width was measured by the distance between the midpoint of medial and lateral femoral condyle to the corresponding tibial plateau.

STATISTICAL ANALYSIS

The data was analyzed by the SPSS software and to calculate the mean medial and lateral joint space width for right and left knees. P value of <0.05 was considered statistically significant.

RESULTS

The present study was on the anatomy of knee joint in normal healthy subjects. Data was collected and analyzed from a total of 150 individuals of different age groups. In the study medial joint space width and lateral joint space width of the right and left knee were measured among the age groups.

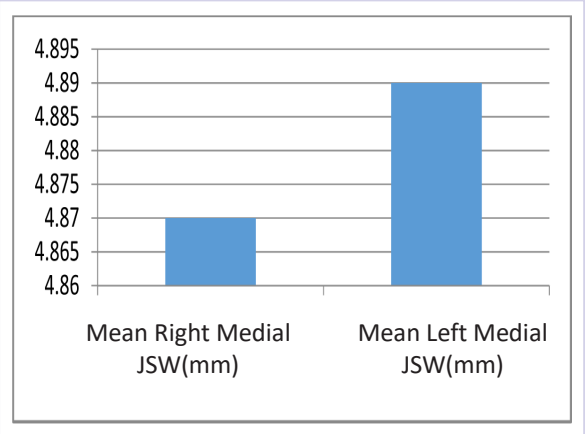
Mean joint space in the study

In the study of 150 subjects the joint space width was measured and mean medial JSW was calculated on the right and left. They are as follows 4.87±0.44 mm and 4.89±0.30mm respectively.

The mean lateral JSW for the right and left knee are 5.87± 0.43 and 5.87±0.30 respectively. The joint space decreased as the age increased.

Table 1: Mean medial joint space width in the study

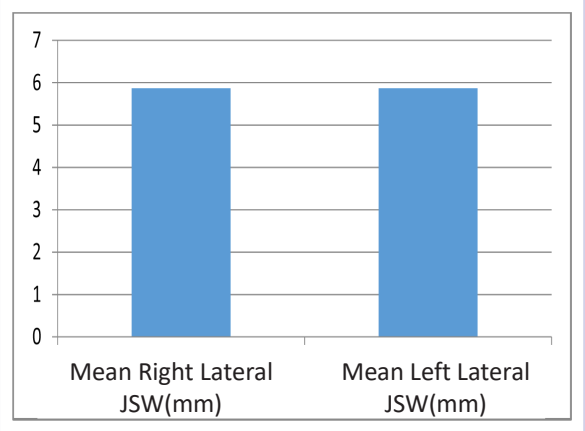
Mean right medial JSW(mm)	Mean left medial JSW(mm)
4.87 ± 0.44	4.89 ± 0.30



Graph 1: Mean medial joint space width in study.

Table 2: Mean lateral joint space width in the study

Mean right lateral JSW(mm)	Mean left lateral JSW(mm)
5.87±0.43	5.87 ± 0.30



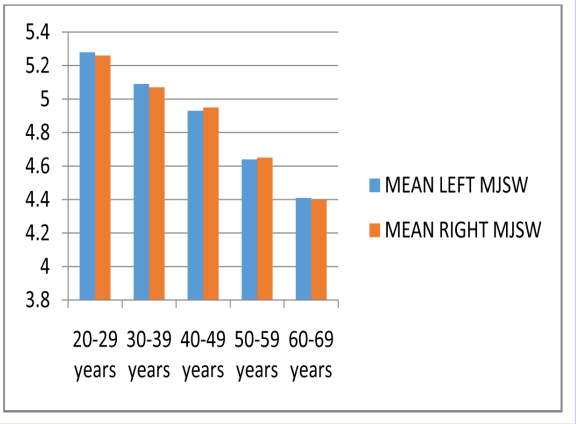
Graph 2: Mean lateral joint space width in study.

Mean medial JSW in different age groups:

The mean medial JSW in different age groups is as follows for the age group 20-29 years 5.28±0.41 mm and 5.26±0.4 mm, for the age group 30-39 years 5.09±0.33 mm and 5.07±0.35 mm, for the age group 40-49 years 4.93±0.27 mm and 4.95±0.26 mm, for the age group 50-59 years 4.64±0.46 mm and 4.65±0.47mm, for the age group 60-69 years 4.41±0.29 mm and 4.40±0.28 mm for right and left side respectively.

Table 3: Mean medial JSW in different age groups

Age group	Mean left MJSW	Mean right MJSW
20-29 years	5.28±0.41mm	5.26±0.4mm
30-39 years	5.09±0.33mm	5.07±0.35mm
40-49 years	4.93±0.27mm	4.95±0.26mm
50-59 years	4.64±0.46mm	4.65±0.47mm
60-69 years	4.41±0.29mm	4.40±0.28mm



Graph 3: Mean medial JSW in different age groups.

Mean lateral JSW in different age groups:

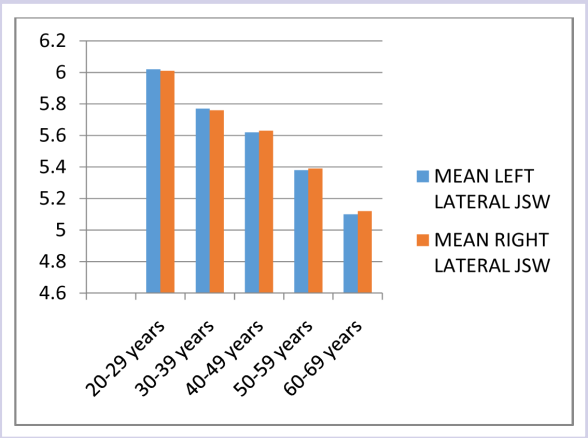
The mean medial JSW in different age groups is as follows for the age group 20-29 years is 6.02±0.39 mm and 6.01±0.37 mm, for the age group 30-39 years is 5.77±0.33 mm and 5.76±0.33 mm, for the age group 40-49 years is 5.62±0.26mm and 5.63±0.24 mm, for the age group 50 - 59 years is 5.38±0.38 mm and 5.39±0.37 mm, for the age group 60-69 years is 5.10±0.36 mm and 5.12±0.36 mm for right and left side respectively.

Table 4: Mean lateral JSW in different age groups

Age group	Left lateral JSW	Right lateral JSW
20-29 years	6.02±0.39 mm	6.01±0.37mm
30-39 years	5.77±0.33 mm	5.76±0.33 mm
40-49 years	5.62±0.26 mm	5.63±0.24 mm
50-59 years	5.38±0.38 mm	5.39±0.37 mm
60-69 years	5.10±0.36 mm	5.12±0.36 mm

DISCUSSION

A healthy reference of the joint space width is needed in order to determine how these relationships change under osteoarthritic conditions. The present study was on the dimensional anatomy of the knee joint in normal healthy



Graph 4: Mean lateral JSW in different age groups

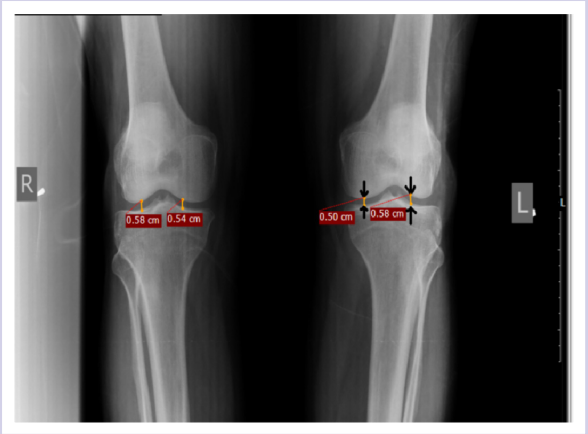


Figure 1: AP view of right and left knee joint.

subjects. Data was collected and analysed from a total of 150 individuals of different age groups at CAIMS, Karimnagar, Telangana.

Dacre JE et al studied joint space size using digital image analysis of the x rays of 685 radiologically normal individuals attending casuality. According to their study in radiologically normal population, men have larger joint spaces than women and there is a steady decline in joint space size with age. [4]

Buckland J C et al measured JSW from weight bearing plain film macroradiographs. The study said Joint space width (JSW) measurement a major criterion in the diagnosis of osteoarthritis (OA) from radiographs and for monitoring progression of the disease. [5]

Sargon M F et al studied joint space by magnetic resonance imaging in anatomically normal knees. The medial and lateral knee joint spaces of 184 patients who

had anatomically normal knees were measured by using magnetic resonance imaging (MRI) method. The findings were compared according to age, sex, height, and body mass index changes of the individuals and the mean values of medial and lateral knee joint spaces were calculated in every group. The results show that in an anatomically normal population, all the individuals have larger lateral knee joint spaces than medial knee joint spaces. The patients lose knee joint space regularly with increasing age. [6]

Deep K. et al did radiographic measurement of joint space height in non-osteoarthritic tibiofemoral joints. The study found that there may be a difference of up to 2 mm in the measurement of the joint space of the medial and lateral tibiofemoral joints. [7]

Ding C study showed the effect of sex and age on rate of change in knee cartilage volume in 325 subjects. The study results states that knee cartilage volume declines at a faster rate with increasing age. Women have substantially higher knee cartilage loss than men, and these sex differences first appear at age of 40 and become more marked with increasing age, which has implications for prevention of cartilage loss from middle age. [8]

Beattie K A et al studied on minimum joint space width and tibial cartilage morphology in the knees of healthy individuals. According to the study investigating the knees of healthy individuals suggested that joint space width measured from plain radiographs remained relatively constant through the third to seventh decades of life. The study also suggested that joint space width values may be helpful for comparisons with those suspected of having knee Osteoarthritis. [9]

Gensburger D et al did radiologic assessment of age-related knee joint space changes in women: The study found a significant decrease in JSW with age.[10] Ismail Anas et al, did digital radiographic measurement of normal knee joint space in adults. The study showed a steady increase in JSW with an increase in age up to 34 years. Overweight persons tend to have narrower JSW compared to normal and underweight individuals. [3]

According to Lawrence et al in the knee joint, osteoarthritic features visible on radiographs include joint space narrowing, osteophytosis, subchondral osteosclerosis and subchondral cysts.[11]

Relationship of joint space width with age

The most consistent knee structural changes with increasing age are increase in cartilage defect severity and prevalence, cartilage thinning and increase in bone size with inconsistent change in cartilage volume.[8] Joint space loss is a characteristic feature of rheumatoid arthritis and osteoarthritis. It cannot be fully evaluated, however, without knowledge of the normal variability of joint space size.

Hudelmaier M et al proposed that knee cartilage becomes thinner during aging, in the absence of cartilage disease, but that the amount of reduction differs between sexes and between compartments of the knee joint. [12]

Deborah Gensburger et al did a cross sectional study on age related knee joint space changes in 606 volunteers, cross-sectional analysis of a cohort of 606 healthy female volunteers; they found a significant decrease in JSW with age. [10] Ismail Anas et al study shows that the measured knee JSW showed initial increase with increasing age up to 34 years; thereafter, there is a gradual reduction with advancing age especially in the medial compartments. [3]

In the present study the joint space width measurements of medial and lateral space of the knee joint were measured. The measurements were analyzed into different age groups. The mean right medial joint space in the age groups 20- 29 yeas, 30-39 years, 40-49 years, 50-59 years , 60-69 years is 5.26±0.4 mm, 5.07±0.35 mm, 4.95±0.26 mm, 4.65±0.47 mm, 4.40±0.28 mm respectively. As the age is increasing the joint space is decreasing.

The mean left medial joint space in the age groups 20-29 years, 30- 39 years, 40-49 years, 50-59 years, 60-69 years is 5.28±0.41 mm, 5.09±0.33 mm, 4.93±0.27 mm, 4.64±0.46 mm, 4.41±0.29 mm respectively. As the age is increasing the joint space is decreasing. The mean right lateral joint space in the age groups 20-29 yeas, 30-39 years, 40-49 years, 50-59 years , 60-69 years is 6.01±0.37 mm, 5.76±0.33 mm, 5.63±0.24 mm, 5.39±0.37 mm, 5.12±0.36 mm respectively.

The mean left lateral joint space in the age groups 20-29 yeas, 30-39 years, 40-49 years, 50-59 years , 60-69 years is 6.02±0.39 mm, 5.77±0.33 mm, 5.62±0.26 mm, 5.38±0.38 mm, 5.10±0.36 mm respectively.

There is no difference in the measurements of right and left side joint spaces. According to the measurements of the study there is decrease in the joint space width as the age is progressing. This observation in the present study is supported by Post Hoc tests which had a p-value of 0.05 and the ANOVA analysis which showed significance between the different age groups.

The decrease of joint space width with progress of age may be result of wear and tear over time and due to degenerative disease like osteoarthritis. The observation that joint space width, cartilage volume and thickness decreased with ageing in females may support the role of estrogen in cartilage physiology, although the exact mechanism remains unknown.

CONCLUSION

The mean right medial joint space is maximum, 5.26±0.4mm in the age groups 20-29 years and minimum, 4.40±0.28mm in age group 60–69 years. The mean left medial joint space is maximum, 5.28±0.41mm, in the age groups 20- 29 years and minimum, 4.41±0.29 mm in age group 60-69 years. The mean right lateral joint space is maximum, 6.01±0.37mm in the age groups 20-29 years and minimum, 5.12±0.36 mm in age group 60 – 69 years. The mean left lateral joint space is maximum, 6.02±0.39 mm in the age groups 20- 29 years and minimum, 5.10±0.36 mm in age group 60-69 years.

The joint space width was decreasing with progress of age; this may be due to wear and tear of cartilage. The medial joint space width in both sexes is smaller than the lateral joint space width; this may be due to thick cartilage on the lateral side and medial side is weight bearing side of knee joint.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

FUNDING: None

REFERENCES

1. Susan Standring. Gray's Anatomy. *The Anatomical Basis of Clinical Practice.* 40th ed, London, Elsevier : 2008.

2. Chummy Sinnatamby. Last's Anatomy: *Regional and Applied.* 12th Edition, London, Elsevier: 2011.

3. Ismail Anas, Tabari Abdulkdir Musa, Isyaku Kabiru , Abdulkadir Adekunle Yisau, Idris Sulaiman Kazaure, Suwaid Muhammad Abba, Saleh Muhammad Kabir. Digital radiographic measurement of normal knee joint space in adults at Kano, Nigeria. *Egyptian J Radiol Nuclear Med.* 2013; 44:253-258.

4. Dacre JE, Scott DL, Da Silva JAP, Welsh G, Huskisson EC. Joint space in radiologically normal knees. *Rheumatol.* 1991; 30:426-8.

5. Buckland-Wright JC, Macfarlane DG, Williams SA, Ward RJ. Accuracy and precision of joint space width measurements in standard and macroradiographs of osteoarthritic knees. *Annals Rheumatic Dis.* 1995; 54:872-880.

6. Sargon MF, Taner D, Altinta K. Examination of joint space by magnetic resonance imaging in anatomically normal knees. *Clin Anatomy.* 1998; 9:386-90.

7. Deep K, Norris M, Smart C, Senior C. Radiographic measurement of joint space height in non-osteoarthritic tibiofemoral joints: A comparison of weight-bearing extension and 30 degrees flexion views. *J Bone and Joint Surg Br.* 2003; 85(7):980-2.

8. Ding C, Cicuttini F, Blizzard L, Scott F, Jones G. A longitudinal study of the effect of sex and age on rate of change in knee cartilage volume in adults. *Rheumatology (Oxford).* 2007; 46(2):273-9.

9. 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 Musculoskeletal Disorders.* 2008; 9:119–26.

10. Gensburger D, Arlot M, Sornay-Rendu E, Roux J, Delmas P. Radiologic assessment of age-related knee joint space changes in women: a 4-year longitudinal study. *Arthritis & Rheumatism.* 2009; 61:336-43.

11. Kellgren J, Lawrence J. Radiological assessment of osteoarthritis. *Annals Rheumatic Dis.* 1957; 16:494-501.

12. Hudelmaier M, Glaser C, Hohe J, Englmeier KH, Reiser M, Putz R, Eckstein F. Age-related changes in the morphology and deformational behavior of knee joint cartilage. *Arthritis Rheum.* 2001; 44(11):2556-61.