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**Original research article**

# Comprehensive evaluation of Knee joint space width in plain radiographs of adult Kashmiri population and its clinical implications- A morphometric study

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## Abstract

**Background**: Knee joint, the largest and most complicated joint is the major weight bearing joint in the human body. It is prone to undergo degenerative changes with advancing age leading to Osteoarthritis. The Knee joint space width (JSW) measurements between the femoral and tibial condyles is an indirect way of measuring femoro-tibial cartilage thickness which is valuable in assessing knee cartilage pathologies. **Aim**: - The present study was aimed to determine the mean values of knee joint space width. **Material and methods**: - The present cross-sectional study was conducted in the department of Anatomy, Govt Medical College , Srinagar in collaboration within department of Radiodiagnosis GMC Srinagar. Normal plain radiographs of bilateral knees-AP view of males and females between the age group of 20-50 years were used for the study. A total of 200 X-rays (100male and 100 female) were included in the study. **Results**: The mean RMS and RLS in females in the age group of 21-30 years was 4.3 ± 0.4 mm and 4.5 ± 0.3 respectively and in the same age group the LMS and LLS were found to be 4.1 ± 0.2 mm and 4.2± 0.6 respectively. Similarly, the mean RMS and RLS in females in the age group of 31-40 years was 4.8± 0.5mm and 5.0± 0.6 mm respectively and in the same age group the LMS and LLS were found to be 4.2 ± 0.3 mm and 4.4± 0.8 respectively. Likewise, the mean RMS and RLS in females in the age group of 41-50 years was 4.7 ± 0.4 mm and 4.9 ± 0.3 respectively and in the same age group the LMS and LLS were found to be 4.0 ± 0.4mm and 4.3± 0.7 respectively. The mean RMS and RLS in males in the age group of 21-30 years was 4.4 ± 0.3mm and 4.6 ± 0.3 respectively and in the same age group the LMS and LLS were found to be 4.2 ± 0.3 mm and 4.3± 0.7 respectively. Similarly, the mean RMS and RLS in males in the age group of 31-40 years was 4.7± 0.5 mm and 4.9± 0.3 mm respectively and in the same age group the LMS and LLS were found to be 4.3 ± 0.6 mm and 4.4± 0.5 respectively. Likewise, the mean RMS and RLS in females in the age group of 41-50 years was 4.6 ± 0.3 mm and 4.7 ± 0.4 respectively and in the same age group the LMS and LLS were found to be 4.1 ± 0.9 mm and 4.2± 0.7mm respectively.**Conclusion**: The results calculated provides important information regarding gender and side variations of knee joint space width for orthopaedicians and radiologists. It will help Orthopaedicians in diagnosing and treating various clinical conditions like Osteoarthritis, which is commonest in knee joints.

**Key words:** Condyles, osteoarthritis, knee joint, space width, bilateral knee joints

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## Introduction

Knee joint is the largest and most complicated joint in the body[1]. It is synovial joint of modified hinge variety, modified as it undergoes some degree of conjunct rotation during flexion and extension of knees. It is a compound joint actually, consisting of 3 articulations; right and left condylar joints between the femur and tibia and one saddle joint between the femur and patella[1]. The articulation between femur and tibia are separated by articular cartilages and menisci which are seen on AP view of x-rays as a radiolucent area between femoral and tibial condyles.[2,3,4] The joint space width (JSW) is the distance between the distal femur and proximal tibia. It provides indirect way of measuring cartilage thickness. Normally JSW measures between 3 to 8 mm, lateral being wider than the medial. Males have wider knee JSW than females.[7]Narrowing of knee JSW is highly observed in a degenerative disease known as osteoarthritis (OA). OA is mostly observed in older people.[8,9] OA may be primary (idiopathic) or secondary to fractures or inflammation. Involvement of medial compartment of knee joint occurs early as compared to that of lateral compartment.[10] There is gradual reduction in knee JSW with advancing age because of wear and tear over the period of time.[11] The progression of knee degenerative conditions and evaluation of disease modifying therapies are monitored by measurements of knee JSW from standard radiographs.[12,13,14]

**Aim**: - The present study was aimed to determine the mean value of Knee JSW and its comparison in males and females on right and left side in lateral and medial compartments of knee joint.

**Material And Method**: - The present cross-sectional study was conducted in the department of Anatomy GMC Srinagar. Normal plain radiographs of both knees AP view between the age of 20-50 years were used for the study. A total of 200 x-rays (100 males &100 females) were included in the study.

**Inclusion Criteria:** -

- Patients complaining of pain in knee joint who had no joint pathology defined on the basis of radiological examinations.
- Patients of age group 20-50 years.
- Patients without deformity of knee joint.

**Exclusion Criteria**: -

- Patients having history of pathologies like OA, Tuberculosis, fractures around the knee joint.
- Patients having history of surgical interventions on distal femur, proximal tibia or patella.
- Patients who did not have the radiographs with appropriate technique.

**Technique of X-ray: -**

Radiological parameter measured in the present study were obtained from the standard knee radiographs. The AP view of the radiographs was used, while the patient was in the standing position in front of the cassette with the posterior thigh in contact with the cassette. Radiation was given in the horizontal direction.[15,16] The maximum joint space width in the mid portion of lateral and medial compartments of each knee in the radio lucent area between the radio opaque margins of tibio-fibular articular surfaces gave us the measurement of maximum joint space width in each compartment.[7]

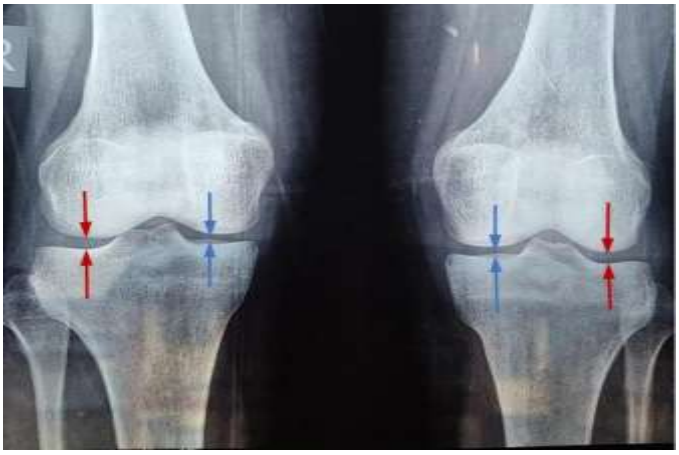

**Figure 1**: X ray of bilateral knee joints Antero Posterior View in standing position showing the reference points for measuring Medial and Lateral knee joint spaces widths (Red arrow showing lateral knee joint space and blue arrow showing medial knee joint. space).

**Results:**

The present study was conducted in the department of anatomy GMC Srinagar in collaboration with department of radiology GMC Srinagar. In present study the radiographs were taken in digital format the information was analyzed both separately and compared with other sides in both genders and summarized with in tables separately.

**Table 1:** Gender distribution of study population.

| Sex | Frequency | Percentage |
|---|---|---|
| **Female** | 100 | 50% |
| **Male** | 100 | 50% |
| **Total** | 200 | 100% |

Table 1 shows that the study population consists of 100 females and 100 males with the total of 200 participants. The percentages show that the gender distribution is evenly split with females comprising of 50% of the sample and the males also comprising 50% of the sample.

**Table 2**: Age distribution of study population

| Age in years | Frequency | Percent |
|---|---|---|
| **≤30** | 59 | 29.5 |
| **31-40** | 73 | 36.5 |
| **41-50** | 68 | 34 |
| **Total** | 200 | 100 |

Table 2 shows that all the 200 x-rays belonged to adult population, 20 – 50 years of age. there were 59 x-rays of age less than 30 contributing 29.5% of entire x rays. Similarly, from 31 to 40 years of age there were 73 x-rays making 36.5% of total x-rays. There were 68 x-rays with in the age group of 41-50 years making 34% of total x rays.

**Table 3**: knee joint space width (JSW) distribution of the female subjects based on their age group in millimeters.

| Females | RMS | RLS | LMS | LLS |
|---|---|---|---|---|
| **21-30 Age** | 4.3 ± 0.4 | 4.5 ± 0.3 | 4.1 ± 0.2 | 4.2± 0.6 |
| **31-40 Age** | 4.8± 0.5 | 5.0± 0.6 | 4.2 ± 0.3 | 4.4± 0.8 |
| **41-50 Age** | 4.7 ± 0.4 | 4.9 ± 0.3 | 4.0 ± 0.4 | 4.3± 0.7 |

**RMS-Right medial joint space, RLS- Right lateral joint space, LMS- Left medial joint space, LLS-Left lateral joint space.**

The above table shows that the mean RMS and RLS in females in the age group of 21-30 years was 4.3 ± 0.4 mm and 4.5 ± 0.3 respectively and in the same age group the LMS and LLS were found to be 4.1 ± 0.2 mm and 4.2± 0.6 respectively. Similarly, the mean RMS and RLS in females in the age group of 31-40 years was 4.8± 0.5mm and 5.0± 0.6 mm respectively and in the same age group the LMS and LLS were found to be 4.2 ± 0.3 mm and 4.4± 0.8 respectively. Likewise, the mean RMS and RLS in females in the age group of 41-50 years was 4.7 ± 0.4 mm and 4.9 ± 0.3 respectively and in the same age group the LMS and LLS were found to be 4.0 ± 0.4mm and 4.3± 0.7 respectively.

**Table 4**: knee joint space width (JSW) distribution of the male subjects based on their age group in millimeters

| Males | RMS | RLS | LMS | LLS |
|---|---|---|---|---|
| **21-30 Age** | 4.4 ± 0.3 | 4.6 ± 0.3 | 4.2 ± 0.3 | 4.3± 0.7 |
| **31-40 Age** | 4.7 ± 0.5 | 4.9± 0.3 | 4.3 ± 0.6 | 4.4± 0.5 |
| **41-50 Age** | 4.6 ± 0.3 | 4.7 ±0.4 | 4.1 ± 0.9 | 4.2± 0.7 |

**RMS-Right medial joint space, RLS- Right lateral joint space, LMS- Left medial joint space, LLS-Left lateral joint space.**

The above table shows that the mean RMS and RLS in males in the age group of 21-30 years was 4.4 ± 0.3mm and 4.6 ± 0.3 respectively and in the same age group the LMS and LLS were found to be 4.2 ± 0.3 mm and 4.3± 0.7 respectively. Similarly, the mean RMS and RLS in males in the age group of 31-40 years was 4.7± 0.5 mm and 4.9± 0.3 mm respectively and in the same age group the LMS and LLS were found to be 4.3 ± 0.6 mm and 4.4± 0.5 respectively. Likewise, the mean RMS and RLS in females in the age group of 41-50 years was 4.6 ± 0.3 mm and 4.7 ± 0.4 respectively and in the same age group the LMS and LLS were found to be 4.1 ± 0.9 mm and 4.2± 0.7mm respectively.

**Discussion**

Osteoarthritis a degenerative condition most common in knee joints is a painful and disabling disease, which can cause time loss in terms of working hours and during its treatment along with medical treatment, sometimes it may need surgical procedures as well.[17,18] Thereby necessitating to carry out studies as the joints. From the results of the current study, it is conferred that the mean knee joint space width on the right side is more than that of the left side. Further when comparing two compartments of one knee it was found that the lateral knee joint space width is more as compared to that of medial joint space width. There was no statical significant difference in the knee joint space width between the two genders. While comparing lateral and medial JSW the values of present study were consistent with the studies conducted by Ismail Anas et al[7] in Nigerian population and Sargon et al [19] They found mean lateral JSW is greater than that of medial JSW. The JSW in our study is greater than that of medial JSW. The JSW in our study is lower than those measured by Lanyan et al [20] in normal knees.

The study conducted by Beattie et al[21] found JSW in males more than that of JSW in females significantly which is inconsistent with our study. In our study it was found that there is the mean values of knee joint space width on right side was greater than that of left side which is inconsistent with the study conducted by Zamin Y et al.[22]

**Conclusion:** The study of medial and lateral joint spaces of both knee joints were measured in the x-rays of erect knee Antero Posterior View. Variations were found on the medial and lateral joint space widths and side variations were also observed. There was statistically no significant difference in the joint space width in Males and Females. The results calculated provides important information regarding gender and side variations of knee joint space width for orthopaedicians and radiologists. It will help Orthopaedicians in diagnosing and treating various clinical conditions like Osteoarthritis, which is commonest in knee joints.

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