

ORIGINAL ARTICLE

Normal Knee Joint Spaces in Healthy Young Adults; Radiographic Measurement

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ABSTRACT

Background: The weight bearing hinge joint which comprises of two condylar joint is named as knee joint.

Objective: The study was carried out to find the radiographic measurements in case of normal knee joints of adults.

Study design: It is a prospective study conducted at Orthopedic Department, Mardan Medical Complex and Radiology Department, Institute of Kidney Disease (IKD) Peshawar for the duration of six months from October 2021 to March 2022.

Material and Methods: The study was conducted on 170 patients (patients/subjects) who visited the radiology (radiology and orthopedic) department of the hospital. The computerized data was plotted from standard radiographs and the monitoring was carried out to see the progression of degenerative conditions of knee. Statistical analysis was done by using SPSS tool and other software like Microsoft excel were also used for this purpose. The data was shown as mean and standard deviations in case of all variables. The ethical and review board committee of the hospital approved the study.

Results: The data was taken from 170 patients. Patients were aware of the study and signed the consent willingly. Among these 170 patients, there were 94 females and 76 males. The average age of the patients participating in this study was 48 ± 13 (38 ± 13) years. In case of women the average right medial space was 0.25 ± 0.07 (it is mm or cm??) right lateral space was 0.45 ± 0.06 , left medial was 0.19 ± 0.08 and left lateral space was 0.44 ± 0.0 . In case of male patients, the values of right lateral space, right medial space, left lateral space and left medial space were 0.47 ± 0.07 , 0.26 ± 0.05 , and 0.47 ± 0.06 , 0.23 ± 0.01 respectively. (in other studies normal space is 4.44 medial and 5.62 mm lateral and it is 0.45 and 0.25 mm in our study, I think it should be comparable)

Conclusion: The study was carried out to find the radiographic measurements of normal spaces of normal knee joint in adults. The AP view was used to observe the bilateral knee joints both medial and lateral sides. The knee joint space width was variable. However, width of left and right side joint space compartments have no difference. There was no statistical variation found between both genders as well.

Keywords: Bilateral knee joints, radiographic measurements, joint space compartments, condyles and articular surfaces.

INTRODUCTION

One of the weight bearing hinge joint which comprises of two condylar joint is named as knee joint. The knee joint is characterized by the space present between tibial and femoral condyle. It is the one of the largest joint of the human body. The femur, tibia, and patella are joined at the knee via a synovial joint. The articular cartilages separate the tibiofemoral articulations¹⁻². The flexion and extension of the knee in the sagittal plane are primarily possible along one axis since the knee joint is hinged. Additionally, it permits a little medial rotation during knee flexion and the final stage of knee extension as well as a little lateral rotation when "unlocking" the knee. The space joint is characterized by the distance present between the proximal tibia and distal femur. The knee joint space narrowing is highly observed in the congenital disease known as osteoarthritis. It is a degenerative disease. The effects of physical exercise on the articular structures of weight-bearing joints are still uncertain. OA is normally observed in older people³⁻⁴. This types of osteoarthritis is idiopathic osteoarthritis. Because of the multifactorial nature of the OA it is challenging for the orthopedics to study the genetic epidemiology of the disorder.

An indirect method of determining cartilage thickness is to measure joint space width (JSW). This has emerged as the accepted and reproducible instrument for assessing knee cartilage degenerative diseases⁵⁻⁶. These appear as a radiolucent region on a frontal radiograph and it range in size from 3 to 8 mm. Males have wider JSW and the females has less wider more often. The osteoarthritis (OA) causes the knee joint constriction. It is the most prevalent joint disorder and added to the significant financial, social, and mental expenses. The radiographic evidence of OA are observed in the developing countries. Osteoarthritis can develop spontaneously or develop later as a result of earlier injury or trauma. The joint's medial compartments narrowing may be one of the initial symptoms of OA. The cystic alterations of the articular

surfaces and subchondral sclerosis are the other symptoms reported⁷⁻⁸. The marked reduction in JSW are observed with ageing. Anteroposterior (AP) radiographs show the joint space width (JSW) as a radiolucent region. It was observed that the OA patients normally have joint space width shortening at a rate of 0.1 to 0.2mm each year. OA is the main factor contributing to the narrowing of the knee joint space. For evaluation of the knee cartilage this radiographic technique is proved to be highly useful not only for the evaluation of the knee cartilage but also for the evaluation of the early knee cartilage degeneration abnormalities⁹⁻¹⁰.

MATERIAL AND METHODS

It is a prospective study conducted at Orthopedic Department, Mardan Medical Complex and Radiology Department, Institute of Kidney Disease (IKD) Peshawar for the duration of six months from October 2021 to March 2022. The study was conducted on 170 patients visited the (orthopedic deptt of MMC and radiology deptt of IKD) radiology department of the hospital. The data was taken. Patients (subject word better than patient) were aware of the study and signed the consent willingly. The ethical and review board committee of the hospital approved the study. Among these 170 patients, there were 94 females and 76 males. The average age of the patients participating in this study was 48 ± 13 years.

Exclusion criteria: All the patients who were diagnosed with the following disorders were excluded from the study;

- degenerative arthritis
- chronic joint disorders
- chronic bone injury
- prior surgery of knee
- congenital deformities of limbs

The computerized data was plotted from standard radiographs and the monitoring was carried out to see the

progression of degenerative conditions of knee. Statistical analysis was done by using SPSS tool and other software like Microsoft excel were also used for this purpose. The data was shown as mean and standard deviations in case of all variables.

RESULTS

The data was taken from 170 patients. Patients were aware of the study and patients willingly signed the consent. Among these 170 patients, there were 94 females and 76 males. The average age of the patients participating in this study was 48 ± 13 years. In case of women the average right medial space was 0.25±0.07 right lateral space was 0.45±0.06, left medial was 0.19±0.08 and left lateral space was 0.44±0.0. In case of male patients, the values of right lateral space, right medial space, left lateral space and left medial space were 0.47±0.07, 0.26±0.05, and 0.47±0.06, 0.23±0.01 respectively. (Table no.1.)

Table 3 shows the evaluation of the various joint spaces on the basis of gender. The range from maximum to minimum is shown in the data. Mean and standard deviation is shown in case of male and female participants.

Table 1: On the basis of age group in female patients, measurements of joint space

Age groups of patients	Right medial space (RMS)	Right lateral space (RLS)	Left medial space (LMS)	Left lateral space (LLS)
21-30	0.21±0.04	0.43±0.03	0.23±0.05	0.50±0.06
031-40	0.29±0.01	0.48±0.05	0.19±0.05	0.48±0.09
41-50	0.25±0.02	0.45±0.05	0.19±0.08	0.44±0.07
51-60	0.29±0.05	0.49±0.02	0.24±0.02	0.50±0.02
61-70	0.28±0.03	0.54±0.04	0.22±0.09	0.49±0.14
Age above 70	0.26±0.08	0.46±0.02	0.28±0.05	0.50±0.16

(space should decrease with increasing age)
(Unit like cm or mm not mentioned)

There RMS and LMS have strong association, both values were statistically significant with a p value less than 0.05. There was a strong correlation found between LLS and RLS as well as values were statistically significant. (table no.2).

Table.2: On the basis of age group in male patients, measurements of joint space

Age groups of patients	Right medial space (RMS)	Right lateral space (RLS)	Left medial space (LMS)	Left lateral space (LLS)
21-30	0.21±0.04	0.43±0.04	0.23±0.05	0.49±0.07
031-40	0.20±0.01	0.46±0.01	0.18±0.05	0.43±0.03
41-50	0.26±0.05	0.47±0.07	0.23±0.01	0.47±0.06
51-60	0.26±0.07	0.47±0.09	0.51±0.03	0.51±0.01
61-70	0.29±0.01	0.51±0.14	0.29±0.01	0.48±0.12
Age above 70	0.27±0.06	0.42±0.01	0.24±0.06	0.51±0.17

(space should decrease with increasing age)
(Unit like cm or mm not mentioned)

The standard radiographs were used to plot computerized data. Statistical analysis was done by using SPSS. The data was shown as mean and standard deviations in case of all variables.

Table 3: The analysis of various joint spaces on the bases of gender

Female	Range from max to min	Average (SD)	Male	Range from max to min	Average (SD)
Right (MS)	0.48-0.13	0.23±0.07	0.51-0.02	0.22±0.08	
Left (MS)	0.43-0.11	0.22±0.08	0.45-0.11	0.11±0.08	
Right (LS)	0.77-0.18	0.48±0.11	0.71-0.14	0.17±0.07	
Left (LS)	0.73-0.28	0.50±0.30	0.66-0.18	0.16±0.06	

(Unit like cm or mm not mentioned)

DISCUSSION

This study was carried out to find the radiographic measurements in case of normal knee joints of adults. Patients were fully aware of the study and were willing to participate. Both genders were included in the study and female were found to be present in

majority. Knee forms a hinge joint in between leg and thigh. Likewise, tibial articular surfaces present on tibial plateau are also present in the articular surface¹¹⁻¹². The anatomy of normal radiography of the knee revealed that there were present well corticated adductor tubercle and two condyles. The measurements of the knee joint space were carried out for both medial and lateral on the bilateral AP form of radiographs in case of healthy adults. Measurement was carried out and it was found that the width both medial and lateral, was showing variations on both sides. In this study the values for RMS, LMS, RLS and LLS were 0.25±0.07, 0.45±0.06, 0.19±0.08 and 0.44±0.07 in case of females and in case of male the values came out to be 0.26±0.05, 0.47±0.07, 0.23±0.01 and 0.47±0.06 for each group¹³⁻¹⁴. There existed a statistically significant link between right and left medial space. Another strong correlation that was statistically significant was found between RLS and LLS. There was no significant result obtained for left and right joint space data. Another finding showed that there was no significant difference found between knee joint spaces of both genders. Previous data supported our findings¹⁵⁻¹⁶.

This study involved taking measurements of bilateral knees in erect form on the AP view projector. The indirect way to measure cartilage is to measure distance between proximal tibia and the distal femur. That distance is known as joint space width. It has become the common way to measure the knee cartilage degenerative states. As per study carried out to find measurements of knee joint space, it was found that the average lateral joint space and right medial joint space was 4.7±0.8 and 5.64±0.88 (unit ??) respectively¹⁷⁻¹⁸. And the data of left medial and left lateral knee joint space showed that the space came out as 4.76 ± 0.77 and 5.43±0.88 and there was no statistical significance associated with the result. According to latest studies it was found that there was no major statistical link between the width of left and right knee joint space. The study was carried out and the mean medial and lateral measurements were carried out. The data of left medial and lateral joint came out to be 567±1.22 (very much high value)and 5.6±1.07. The data for the right side came out to be 5.21±1.11 and 5.77±1.2 respectively. These findings suggest that there was no major variation between right and left JSW. And these results were quite consistent with our findings as well¹⁹⁻²¹.

Another study revealed that the results of knee radiographs carried out on women and in all participants the JSW lowered with the increasing age. The features like osteophytes, sclerosis and joint space narrowing was measured. The patients had no previous radiographic abnormality related to osteoarthritis. Longitudinal analysis was carried out and it was found that there was a significant reduction over the course of four years of the medial compartment²²⁻²³. As per studies the minimum joint space width was measured and healthy individuals were included in the study to measure their tibial cartilage morphology. The females were 60% out of all patients that participated in their study. The average age was 37 years. The minimum joint space width was calculated for each patient and it was found that with the increase in age of the patient the joint space width was not increasing. This data was further analyzed and it was revealed that the medial JSW data also does not decrease with the decrease in age and it remained constant throughout the years. Same trend was observed in case of cartilage as well²⁴.

According to the studies it was found that the procedures that were used to quantitatively assess knee joint spaces by making use of digital form of radiographs had a bad score for inter-observer coefficient of variation and these digital observers are far better than the rulers and dividers used previously. The computerized data can help see the progress of knee degenerative state and then the need for a therapy can be decided easily²⁵.

CONCLUSION

The study was carried out to find the measurements of normal spaces of normal knee joint radiographically in case of adults. The AP view was used to observe the bilateral knee joints both M and L sides. The knee joint space width was variable. However, width of

left and right side joint space compartments have no difference. There was no statistical variation found between both genders as well.

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