Original Research Article

CHARACTERIZATION OF KNEE JOINT CHANGES IN SUDANESE USING PLAIN X-RAY

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Abstract:
The aim of this study was to characterize knee joints changes in Sudanese population using plain x-ray, in order to comprehend the potential pathological changes that might appears in the plain x-ray film also to calculate bone size for artificial knee joint before surgery. A total of 257 symptomatic knee joints were enrolled in this study,106 showed no change in the x-ray film 'normal', (56 male and 50 female), 151 showed change of knee joint in the plain x-ray (55 males and 96 females).Their age range from18 to 78 years. In this study also study found that the mediolateral femur measurements for male is equal to 6.4 ±1.03 and 5.9± 0.7 for female and the mediolateral tibia measurements is equal to 6.8 ± 0.9 for male and 6.3 ± 0.6 for female. These differences were significant at p=0.05 using the t-test with t=2.62 for male and t=3.07 for female and p=0.04 and 0.02 respectively. The mediolateral femur and tibia measurement were significantly correlated with the height and circumference of the knee, as well these measurements were correlated significantly with the artificial femur and tibia size. Also this study found that the diagnosis = [(TL2X×0.86) + (FL1X×-0.29) + (TW3X×0.63) + (TL1X×0.38)] – 5.85. To identifies the normal for symptomatic cases where the result =1, the patient were normal otherwise patient were affected.

Key words: Characterization of knee joint, Circumference of knee joint and BMI.

Introduction

Annually there were over 500,000 total knee replacement procedures performed in the US. It is projected that by 2030, the volume of this procedure will increase to over 3.48 million per year due to the aging baby-boomers, increased obesity and indications for total knee replacement that extend to both younger as well as older patients.1 From 2000 to 2006, the Medicare total knee replacement rate overall in the United States increased by 58%, from 5.5 to 8.7 per 1,000.2 [1]. The circumference of the knees and thighs at three locations was measured

in 10 patients on two consecutive occasions by three observers. Analysis of the results for interobserver, intraobserver and among-patient variation established that a change in circumference noted by different observers on two different days is significant if it exceeds 1-5 cm at the midpatella, 2-7 cm at 7 cm above, and 3-5 cm at 15 cm above the patella. If a single observer performs both measurements, the change need exceed only 1-0, 2-0, and 2-7 cm, respectively, to be significant [2].

Also in Sudan there were not enough data published locally or internationally regarding the knee joint measurement or knee correlated with gender or even occupation.

The main objective of the current study was 1- To predict the bone measurement using the height and circumference of the knee joint. 2- To find the significant difference between male and female. 3- And to diagnose patient as normal or abnormal. 4- To choose the knee size before the surgeries.

Materials and methods

A total number of 257 patients, 111 (43.19 %) were male and 146 (56.81%) were female; their knee joints X-ray were measured. A bout 106 normal patients (56 male and 50 female) with age ranged between (18-65) years. Bio-data such as height, weight, body mass index and different heights and circumferences of knees were recorded. Also 151 diseased patients with age range between (20-78) years. (55) Were males with percentage (36.42 %) and (96) were females with percentage (63.58 %), were examined using plain x-ray of knee joints as standard group of the same age group.

The data will be presented by using frequency distribution tables which showed the variables then analysis of them by Microsoft EXCEL and statistical package for social science SPSS version 16 under windows. The study was carried in Khartoum state –Sudan in the period from June/2012 to September/2014 in the Modern Medical Centre and Antalya Medical Centre. Also all measurements and imaging performance were carried by the same staff and researchers to prevent enter-expert factor affecting results.

To predict the artificial knee size before surgery researchers were collected all patients that have an artificial knee joint in Sharg Elneel Hospital, Khartoum, Sudan, that was done**,** in the period from August/2014 to October/2014, three months. The artificial knee joint were made of Co Cr Mo alloy for the femur and tibia material and UHMWPE as an insert material. Both female and male patients were (63), **24** male, (15 Rt. Knee and 9 Lt. Knee), and **39** female, (20 Rt. Knee and 19 Lt. Knee) with different ages.

Results and discussion

The results of this study revealed that; there is a difference between male and female body mass index (BMI) although their weight show minor variation Table 1. Also in respect to height and circumference of knee there were no remarkable differences between Rt. and Lt. Knee for normal patient. These results match the result of Badria et al (8).

Table (1) the mean ± standard deviation of patient age, weight, height, body mass index and knee joint dimension (Rt. & Lt.) for male and female)

Variables	Male Mean ± SD	Female Mean ± SD
Age	39.2 ± 12.3	42.5 ± 10.1
Height of the Patient	175.6 ± 6.8	166.0 ± 8.0
Weight of the Patient	76.8 ± 12.3	78.1 ± 15.4
BMI	24.9 ± 3.7	28.3 ± 5.1
Height of the Rt. Knee	57.5 ± 3.6	54.2 ± 3.9

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Height of the Lt. Knee	57.5 ± 3.6	54.1 ± 3.9
Circumference of the Rt. Knee	36.9 ± 3.0	39.5 ± 5.3
Circumference of the Rt. Knee	36.8 ± 3.1	39.3 ± 5.3

The artificial femur size (AFS) for male increases by 0.73 unit/1 mm of mediolateral femur size MLFS), where the artificial size can be predicted using the following equation:

AFS= (0.7273xMLFS) - 42.515as seen in the figure 1, (A).
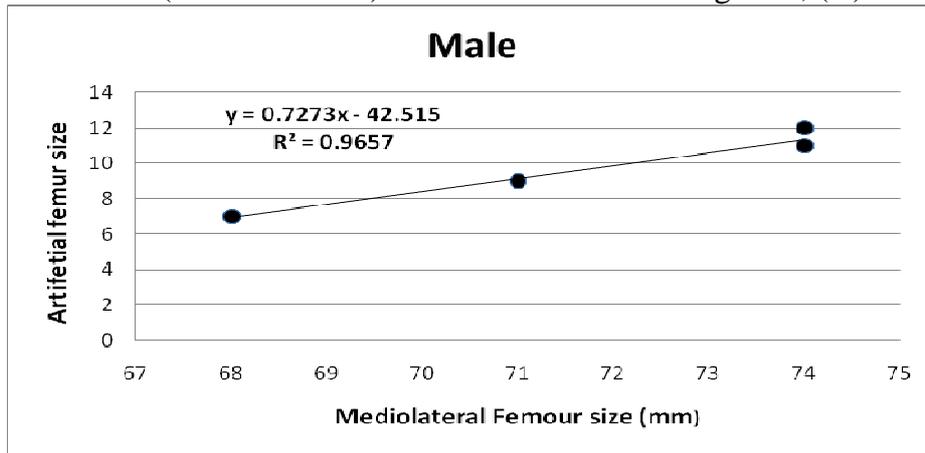
(A)

The artificial tibia size (ATS) for male increase by 0.58unit/1 mm of mediolateral tibia size (MLTS), where the artificial size can be predicted using the following equation:

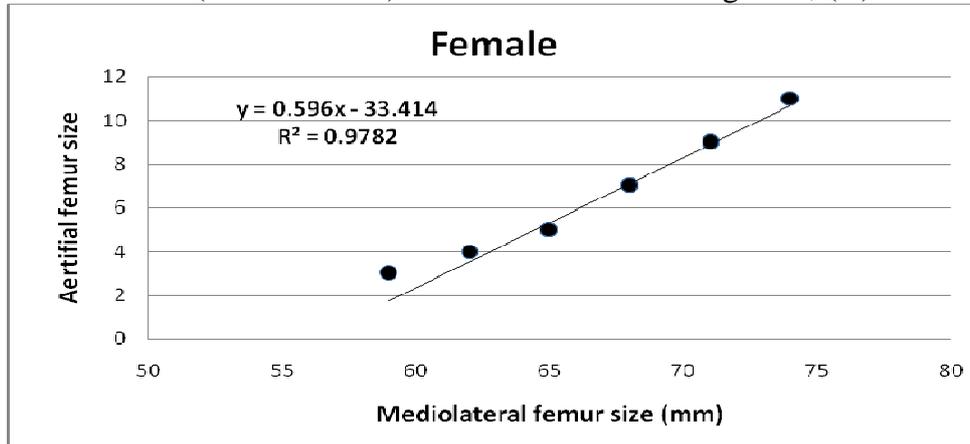ATS= (0.577xMLTS) - 33.829   as seen in the figure 1, (B)
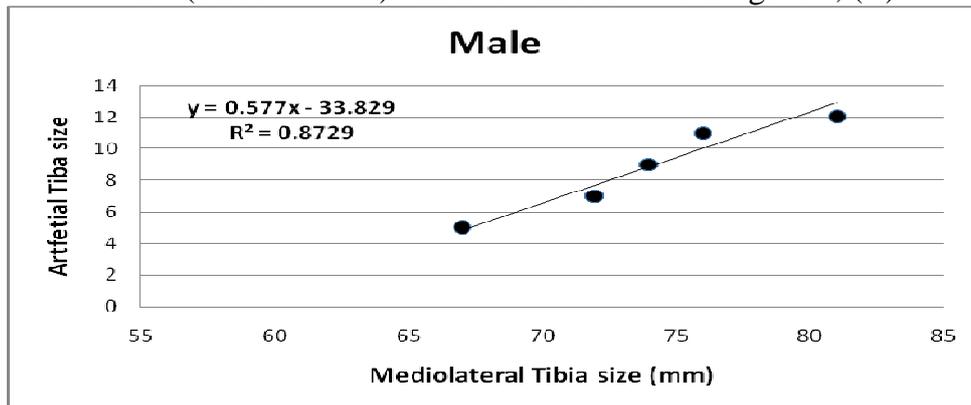
(B)

Figure 1: scatter plot show a direct linear relationship of the mediolateral femur and tibia size with the artificial knee for male.

The artificial femur size (AFS) for male increases by 0.60 unit/1 mm of mediolateral femur size MLFS), where the artificial size can be predicted using the following equation:
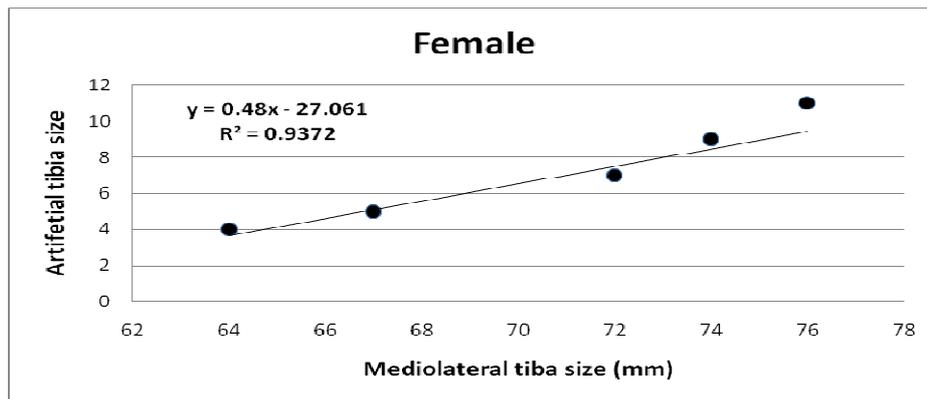
AFS= (0.596xMLFS) -33.414as seen in the figure 2, (A).

(A)

The artificial tibia size (ATS) for male increase by 0.48unit/1 mm of mediolateral tibia size (MLTS), where the artificial size can be predicted using the following equation:

ATS= (0.48xMLTS)-27.061   as seen in the figure 2, (B)

(B)

Figure 2: scatter plot show a direct linear relationship of the mediolateral femur and tibia size with the artificial knee for female.

Conclusion

This study found that **the diagnosis** = (TL2X×0.86) + (FL1X×-0.294) + (TW3X×0.625) + (TL1X×0.383) – 5. 846. Diagnosis= 1 normal knee, 2 abnormal knees.

In this study also study found that the mediolateral femur measurements for male is equal to 6.4 ±1.03 and 5.9± 0.7 for female and the mediolateral tibia measurements is equal to 6.8 ± 0.9 for male and 6.3 ± 0.6 for female. These differences were significant at p=0.05 using the t-test with t=2.62 for male and t=3.07 for female and p=0.04 and 0.02 respectively. The mediolateral femur and tibia measurement were significantly correlated with the height and circumference of the knee, as well these measurements were correlated significantly with the artificial femur and tibia size.

T=Tibia, F=Femur, L=Length, W=Weight and X=X-Rays image.

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