X-Ray Evaluation Of Association Of Knee Arthritis With Foot Arches

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ABSTRACT

Background: *Knee arthritis is one of the most prevalent orthopedic conditions that affect people of all ages and genders. The changes in height of the medial longitudinal arch is one of the causes of knee arthritis. There is evidence that knee arthritis may be caused by flat feet. However, there isn't enough proof to support the link between knee OA and cavus foot.*

Objectives: *The major goal of this study is to explain the association between foot arch height and knee arthritis. The other objective is to find the incidence of pes planus and pes cavus in people who have knee arthritis.*

Methodology: *76 individuals of middle age who had knee arthritis were included, excluded people with any surgery or fracture of the lower extremity. Footprints were taken through inkpads for measurement of the medial longitudinal arch. The feet are classified into three types on the basis of the Staheli arch index. Data on knee and foot arthritis were collected through X-Ray, proforma, and footprints. Data were analyzed by SPSS. Descriptive Analysis Cross tabulation was used to assess the association between knee arthritis and foot arches.*

Results: *The findings of this study suggest an insignificant link between foot arch height and knee arthritis. Pes rectus was present in 56.6 percent of knee OA patients. Comparing pes planus and pes cavus, pes cavus was more common than pes planus among participants. Regardless of the height of the foot arch, the majority (57.9%) had Grade 3 knee arthritis.*

Conclusions: *It was concluded that arch height had little to no effect on age-related knee OA. Regardless of arch height, knee arthritis was quite common in females aged 41 to 50. The majority of patients had both knees affected by OA. Patients with knee arthritis were shown to have more pes cavus than pes planus in terms of foot type but that percentage was still less than normal foot type.*

Keywords: Pes planus, Pes cavus, Pes rectus, Knee arthritis, Staheli arch index, Footprints.

INTRODUCTION

Osteoarthritis, often referred to as wear-and-tear arthritis, degenerative disease, or age-related arthritis, is the most common cause of disability worldwide.[1] In the context of public health, the term "arthritis" is a catch-all phrase for more than 100 rheumatic illnesses and ailments that affect the joints, the tissues surrounding the joints, and other connective tissue.[2]

Around 250 million people across the globe are affected by this degenerative and progressive joint disease.[3] The prevalence of knee OA is associated with age-related changes and obesity plays a major role.[4] According to reliable epidemiological research, osteoarthritis affects 10% of men and 18% of women over the age of 60, with Knee OA making up the majority of cases.[5]

Foot arches provide elastic connections inside the foot that distribute stresses during weight bearing fairly before shifting them to the shin and thigh bones. Because of its potential impact on the mechanical alignment and dynamic function of the lower limb, foot posture has been linked to the emergence of lower-limb musculoskeletal problems. 6 Due to variations in the architecture of the arches, the knee experiences compressive and shear loads while walking or engaging in weight-bearing activities.

Massive changes in foot arch height can cause the lower extremities to wiggle, which further disrupts the mechanical load at the knee articulation. Even more immediately, the foot shapes the pattern of postural alignment and joint mobility at the knee and throughout the lower extremities by absorbing the mechanical stresses of ground contact. 7 . The medial, lateral, and transverse arches make up the foot. As the tallest of the three arches, the medial longitudinal arch is more crucial in identifying the kind of foot.8 Foot arches start to form when a kid starts to walk and continue to grow until they are between 7 to 9 years old.9 The three forms of the foot—pes planus, pes cavus, and pes rectus—are distinguished by the medial arch morphology.8 Foot arch has a crucial function in force transmission and shock absorption. Both pes planus and pes cavus can produce an imbalance in the strength of the muscles and joint misalignment, which can result in pronation and supination of the foot.10 In pes planus the mid-foot area pronates toward the ground, sometimes completely touching it, creating postural deformity characterized by a low medial longitudinal arch. A flatfoot is the most frequent reason for knee problems. When the foot arch flattens on the ground, the thigh and shin bones rotate inward, straining the knee. 11
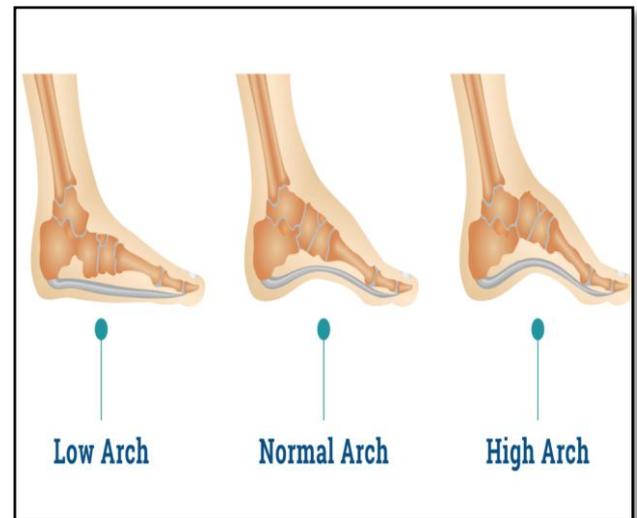

Figure 1: Different Arch Height of Human Foot

Pes planus, often known as flat foot, is one of the most common foot abnormalities. 29 percent of the trial subjects were found to have pes planus. Impaired Pes foot motions and more frequent pain and discomfort are linked to Pes planus deformity. In the past 20 years, pes planus prevalence and dispersion patterns have increased significantly (24 percent). [12] Pes cavus is the name for the prominent medial longitudinal arch of foot. When walking or standing, people with cavus feet place greater weight and strain on the ball and heel of their feet. Pes cavus can lead to excessive supination of the foot because of the foot's outward sliding.[1] Both toddlers and adults can develop pes cavus, an orthopedic ailment. The height of the foot's longitudinal arch, often known as a high arch, serves as its primary defining characteristic. The cavo-varus foot features a heel varus as a result of stiffness in the plantar facial region.[14] According to some statistics, its prevalence rises with age, from 2 percent at age three to as much as 7 percent at age sixteen. Although the prevalence in the adult population might be considerably higher, it ranges from 10.5 to 25% locked midfoot, a decreased flexible phase, and a diminished capacity to absorb stress during stride.[15]

The diagnosis of OA is still mostly based on plain radiography. Kellgren and Lawrence (KL) documented the first official attempts to create a radio-graphic categorization scheme for OA in 1957. Kellgren evaluated the inter and intraobserver reliability of radiographic alterations of rheumatism noticed in the hand. After investigating rheumatism in coal miners at the Bedford Colliery in North West England. KL attempted to develop a categorization system with an accompanying set of standard radiographs for OA of diarthrodial joints after establishing that there was significant disagreement among various observers.[16]

In epidemiological examinations of OA, the KL classification has been widely used as a study tool. Grade 1 shows probable osteophyte development and questionable restriction of the joint space. Grade 2 shows definite osteophyte development and potential joint space constriction. Grade 3 exhibits clear joint space constriction, considerable osteophyte production, some sclerosis, and potential joint deformity. Grade 4 shows the production of massive osteophytes, substantial joint space constriction with obvious sclerosis, and clear deformity of bone ends.[17] Since radiographs are costly, patient is exposed to radiations and podoscopy is conducted by a qualified podiatrist, footprint analysis is the quick, simple, and accurate method for measuring and diagnosing foot problems. Three indices are used in footprint analysis: the Clarke's angle, the Staheli arch index, and the Chippaux Smirak index.[18] Studies on knee arthritis typically focus only on the knee joint, paying little to no attention to other joints in the body. In order to establish a connection between the difference in foot arch height and knee pain, a cross-sectional research of middle-aged people with knee pain was conducted.

The therapeutic use of interventional techniques to improve the circumstances of the feet will benefit from the findings of this investigation. The findings of this study might be useful in identifying the various foot types in people with knee discomfort and in offering recommendations for foot orthotics

MATERIAL AND METHODOLOGY:

A cross sectional study was done using non-probability convenience sampling technique with a sample size of 76 individuals of middle age who had knee arthritis, excluded people with any surgery or fracture of the lower extremity. Footprints were taken through inkpads for measurement of the medial longitudinal arch. The feet are classified into three types on the basis of the Staheli arch index. Data on knee and foot arthritis were collected through X-Ray, proforma, and footprints. Data was analyzed by SPSS. Descriptive Analysis Cross tabulation was used to assess the association between knee arthritis and foot type.

An X-ray was taken while the knee is weight-bearing and in slight flexion for anteroposterior projection, the centering point was the center of the knee 1.5 cm distal to the apex of the patella, collimation was superior to include the distal femur inferior to include the proximal tibia/fibula lateral to include the skin margin medial to include the medial skin margin The footprints have been taken in a weight-bearing position individuals have been asked to area their foot on the ink pad in a standing role and then on a piece of paper to reap a footprint. The identical process was once repeated for the contrary foot.[19]

Calculation of Staheli Arch Index:

For the footprint analysis, SAI used to be used for the measurement of MLA. Two parallel strains were drawn with the help of scale. The first line 'F-E' was drawn at the widest section of the heel in centimeters. Second-line 'D-C' was drawn at the narrowest location of mid-foot. SAI measured by dividing the charge of line 'D-C' by line 'F-E'.[20]

$$SAI = \frac{narrowest\ region\ of\ midfoot}{widest\ region\ of\ the\ hindfoot}$$

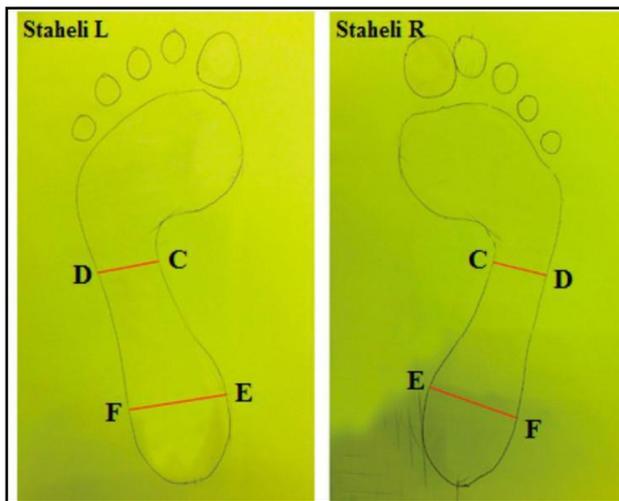$$SAI = \frac{segment\ D - C\ (cm)}{segment\ F - E\ (cm)}$$

Figure 2: Calculation of Staheli Arch Index

Classification of Foot Type.

The type of foot was classified on the basis of values of SAI. High values of SAI indicate a low arched flatfoot and low values of SAI indicate a high arched foot pes cavus (Table).[19]

Table 1: Classification of Foot Type.

SAI	Foot type
≥0.9	Pes Planus
0.44 to 0.89	Pes Rectus
≤0.43	Pes Cavus

Grading By Kellgren- Lawrence Classification.

K-L knee osteoarthritis classification was used to classify knee osteoarthritis in different grades. AP knee radiographs of patients were viewed and classified by K-L system. Each radiograph was assigned a grade from 0 to 4, which they correlated to increasing severity of OA, with Grade 0 signifying no presence of OA and Grade 4 signifying severe OA.[16]

Table 2: Kellgren-Lawrence Classification.

| Grade 0	None
Grade 1	Doubtful narrowing of the joint space with possible osteophyte formation
Grade 2	Possible narrowing of the joint space with definite osteophyte formation
Grade 3	Definite narrowing of joint space, moderate osteophyte formation, some sclerosis, and possible deformity of bony ends
Grade 4	large osteophyte formation, severe narrowing of the joint space with marked sclerosis, and definite deformity of bone ends
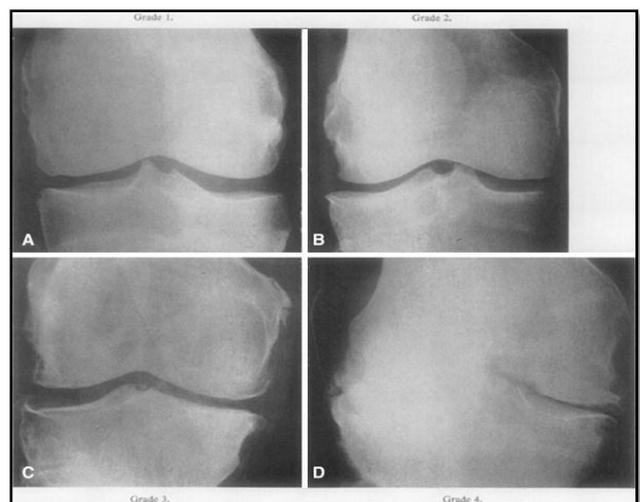
Figure 3: AP Knee X-Ray K-L Grades.

RESULTS:

This result was obtained from population of 76 patients of which 23.68% were male patients and 76.32% were female patients of age gr up 30-70 years with maximum patients in range of 41-50yrs old. The majority (44.74%) was of age group 41-50yrs,second most prevalent (43.42%) of age group 51-60yrs while 9.21% was of age group 61-70yrs and only 2.63% was of age group 30-40yrs. 66.79% had knee arthritis in both knees while 19.74% had knee arthritis in left knee and 14.47% had knee arthritis in right knee only. 57.9% had moderate grade 3 knee arthritis while 23.7% had severe knee arthritis and only 18.4% had minimal grade2 knee arthritis.

Majority of participants 56.6% had pes rectus while 27 patients had pes cavus foot type of which 15 (19.7%) had bilateral pes cavus and 12(15.8%) had unilateral pes cavus foot type. Pes planus was found to be least prevalent only 6 had pes planus of which 1 had bilateral pes planus foot and 5(6.6%) had unilateral pes planus. In total patients 14 with minimal knee arthritis (grade 2) 7 had pes rectus, 6 had bilateral pes cavus, 1 had unilateral pes cavus while none had bilateral or unilateral pes planus.

Total of 44 them had moderate knee arthritis (grade 3) in which 26 who had pes rectus, 7 had bilateral pes cavus, 7 with unilateral pes cavus, none had bilateral pes planus and only 4 were having unilateral pes planus. Total of 18 patients were falling in category of severe knee arthritis(grade 4) in which maximum 10 had pes rectus, 2 had bilateral pes cavus, 4 had unilateral pes cavus, 1 with unilateral pes planus and 1 with bilateral pes planus.
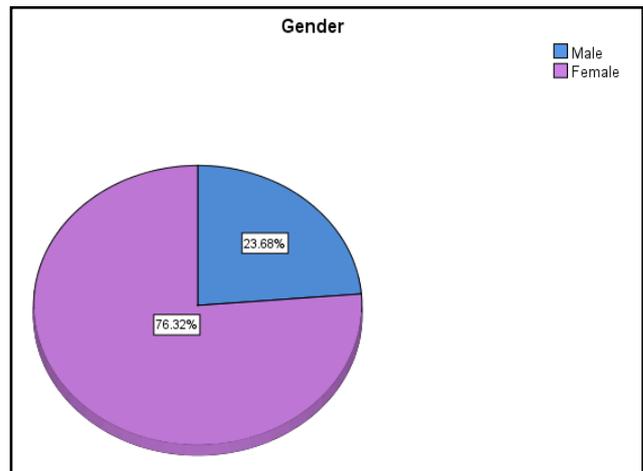

Graph 1: Pie Chart of Gender.

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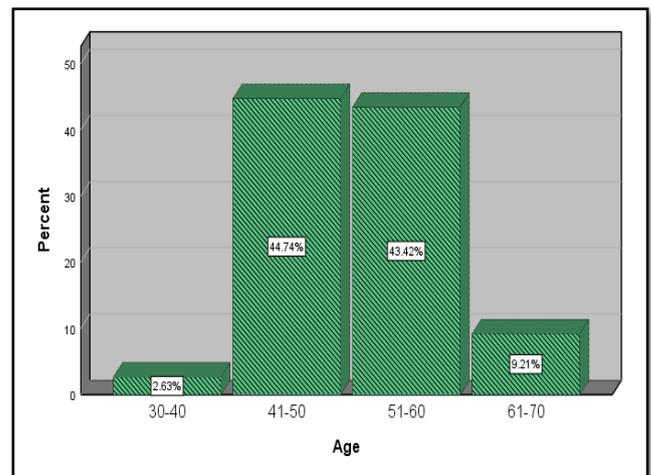
Graph 2: Bar chart of Patient`s Age.

Among 76 participants the majority (44.74%) was of age group 41-50yrs, second most prevalent (43.42%) of age group 51-60yrs while 9.21% was of age group 61-70yrs and only 2.63% was of age group 30-40yrs.
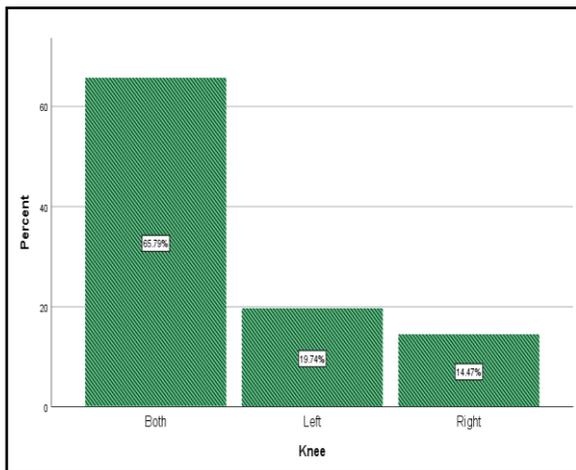
Graph 3: Bar Chart of Problematic Knee

In the population of 76 patients with knee arthritis, majority 66.79% had knee arthritis in both knees while 19.74% had knee arthritis in left knee and 14.47% had knee arthritis in right knee only.

Table 3: Kellgren-Lawrence Classification of Knee Arthritis.

Of all the 76 participants majority of them 57.9% had moderate grade 3 knee arthritis while 23.7% had severe knee arthritis and only 18.4% had minimal grade2 knee arthritis.

KL grade	Frequency	Percent
Minimal	14	18.4
Moderate	44	57.9
Severe	18	23.7
Total	76	100.0

Table 4: Foot Type:

Foot prints of 76 participant were measured by Staheli arch index, the results showed majority of participants 56.6% had pes rectus while 27 patients had pes cavus foot type of which 15 (19.7%) had bilateral pes cavus and

12(15.8%) had unilateral pes cavus. Pes planus was found to be least prevalent only 6 had pes planus of which 1 had bilateral pes planus and 5(6.6%) had unilateral pes planus.

Foot Type	Frequency	Percent
Pes rectus	43	56.6
Bilateral Pes cavus	15	19.7
Unilateral Pes cavus	12	15.8
Bilateral Pes planus	1	1.3
Unilateral Pes planus	5	6.6
Total	76	100.0

Table 5: Association of K-L Classification and Foot Type.

In total patients 14 with minimal knee arthritis (grade 2) 7 had pes rectus, 6 had bilateral pes cavus, 1 had unilateral pes cavus while none had bilateral or unilateral pes planus.

Total of 44 them had moderate knee arthritis (grade 3) in which 26 had pes rectus, 7 had bilateral pes cavus, 7 with unilateral pes cavus, none had bilateral pes planus and only 4 were having unilateral pes planus.

Total of 18 patients were falling in category of severe knee arthritis(grade 4) in which maximum 10 had pes rectus, 2 had bilateral pes cavus, 4 had unilateral pes cavus, 1 with unilateral pes planus and 1 with bilateral pes planus.

	Foot Type According To SAI					Total
	Pesrectus	Bilateral Pescavus	Unilateral Pescavus	Bilateral Pesplanus	Unilateral Pesplanus	
KL grade	**Minimal** 7	6	1	0	0	14
	Moderate 26	7	7	0	4	44
	Severe 10	2	4	1	1	18
Total	43	15	12	1	5	76

Table 6: **Chi Square Test**

The results show P value of the chi square test is 0.220 which is insignificant and shows a negative association between foot arch height and knee arthritis.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.685[a]	8	.220
Likelihood Ratio	10.534	8	.230
Linear-by-Linear Association	.766	1	.382
N of Valid Cases	76		
a. 10 cells (66.7%) have expected count less than 5. The minimum expected count is .18.			

DISCUSSION

A study done by lespasio MJ et al. concluded that knee arthritis was found to be more prevalent in women and especially in women in older age. Our study was consistent with this study as current study also had more females of older age with knee osteoarthritis than men.[2] According to J. Burns et al., persons with cavus foot frequently experience foot discomfort. Knee discomfort is exacerbated by the pes cavus. The individuals in our present study who complained of knee osteoarthritis also had cavus feet, however this ratio was lower than that of people with normal feet, supporting the theory.[21]

According to Buldt AK, there is no correlation between foot posture and knee and foot joint rotation motions in healthy normal persons .Despite current study included individuals with known knee arthritis, there was still weak link between foot arch height with knee arthritis.[22] Patients with and without knee arthritis had their foot posture compared by FE Abourazzak et al. they examined the foot posture of patients with clinically and radiographically confirmed medial compartment knee OA with asymptomatic healthy controls using the foot posture index (FPI), navicular height, and the medial arch. The findings indicated that pronated foot posture, pes cavus, and flat feet are associated

with medial compartment knee osteoarthritis .Our study supports was consistent with this regarding pes cavus foot while regarding pes planus we found least association with knee arthrtis.[23]

Among a single research, the prevalence of pes planus, pes cavus, and normal feet in knee arthritis patient was not well known in the literature previously. In particular participants with pes planus or pes cavus, previous research examined the mechanism of knee discomfort or lower extremity mechanics. However, in a recent research on foot arch height using a handy sample, people with knee arthritis who had normal arched feet were more common than those with high arches, while people with low arches were found least common.

CONCLUSION

According to the study knee arthritis was prevalent in the women in age group 41-50 years regardless of the arch height. There was weak a association between knee arthritis and foot arch height. Regarding pes cavus and pes planus this study shows a high prevalence of pes cavus than pes planus in patients with knee arthritis. . Regardless of the height of the foot arch, the majority (57.9%) had Grade 3 knee arthritis**.**

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