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# Radiological Assessment of Posterior Tibial Slope as A Risk Factor for Knee Osteoarthritis: A Hospital-Based Comparative Observational Study

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**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

## Abstract

**Background**: Knee osteoarthritis (OA) is a common cause of pain and functional limitation in adults. The geometry of the tibial plateau, including posterior tibial slope (PTS), contributes to knee biomechanics and may be associated with degenerative change. This study assessed radiographically measured PTS in individuals with early knee OA and in a comparison group without radiographic degeneration.

**Aim and objectives:** The aim was to evaluate PTS as a possible risk factor for knee OA. The primary objective was to estimate the mean PTS in osteoarthritic and normal knees; the secondary objective was to assess the relationship between radiologically assessed PTS and osteoarthritic degeneration.

**Methods**: This hospital-based comparative observational study was conducted in the Department of Orthopaedics, Assam Medical College and Hospital, Dibrugarh, from July 2023 to July 2024. Sixty individuals aged over 40 years were included: 30 with Kellgren–Lawrence (KL) grade 1 or 2 knee OA and 30 age- and sex-matched comparison participants without radiographic degenerative changes. Clinical assessment and standing anteroposterior and lateral radiographs were obtained. PTS was measured on the lateral radiograph using the proximal tibial anatomical axis. Data were analysed using Microsoft Excel 2010 and SPSS for Windows version 21; categorical comparisons used chi-square or Fisher's exact test, with $p<0.05$ considered statistically significant.

**Results**: The OA group comprised 21 women (70%) and 9 men (30%). The reported mean age was 53.13±22.35 years in the OA group and 45.60±6.04 years in the comparison group. The mean PTS was 13.05±1.62° among 39 osteoarthritic knees and 9.34±1.16° among 30 comparison knees. The distribution of PTS differed significantly between groups ($p<0.001$). The study - reported relative risk estimate for PTS >10° was 9.25. Sedentary physical activity was more frequent in the OA group (70% vs 40%; $p=0.012$).

**Conclusion**: In this sample, PTS was significantly steeper in knees with early OA than in comparison knees. The findings support an association between higher PTS and early knee OA, but the small, hospital-based sample and restriction to KL grades 1–2 limit causal interpretation. Larger studies are required.

**Keywords**: Knee osteoarthritis; posterior tibial slope; radiography; Kellgren–Lawrence grade; comparative observational study

## Introduction

Osteoarthritis is a major musculoskeletal condition associated with pain, stiffness, swelling, crepitus and progressive limitation of daily activities. Its prevalence rises with age, and women are frequently affected more than men. The burden of OA in India is substantial, with published epidemiological work documenting its distribution across states and population groups. Knee OA is particularly relevant because the joint bears body weight and is involved in walking, stair climbing, squatting and other common activities. [1,2,3]

The knee is a complex synovial joint formed by the femoral condyles, tibial plateau and patella. Its stability and function depend on the congruity of the articular surfaces, menisci, capsule, collateral and cruciate ligaments, and the surrounding musculature. The joint permits flexion and extension with a degree of rotation, while its geometry influences contact mechanics and movement. [4,5,6,7]

Posterior tibial slope is the posterior inclination of the tibial plateau relative to the longitudinal axis of the tibia, assessed in the sagittal plane. PTS is of clinical interest in knee biomechanics and in planning procedures such as knee arthroplasty. A steeper slope can influence anterior tibial translation and tibial shear forces, while differences in the method of measurement and in population anatomy can produce variation in reported values. [8,9,10,11,12]

Published investigations have reported differing relationships between PTS and OA. Some studies have described higher slope values in osteoarthritic knees, while others have described reduced slope with degenerative change or variation by population and measurement technique. Chiu and colleagues described a difference between normal and osteoarthritic tibial plateau slope in Chinese specimens; Thirunarayanan and colleagues reported higher PTS in arthritic than healthy knees in an Indian sample; and Muthuuri reported slope deterioration in an African population. [8,13,14] These contrasting findings indicate that PTS should be examined in defined populations using a consistent radiographic method.

This investigation was conducted at Assam Medical College and Hospital, Dibrugarh, to estimate PTS in individuals with early radiographic knee OA and in a comparison group without degenerative changes. The study also examined demographic and clinical characteristics of the groups and calculated a relative risk estimate based on a PTS threshold above 10 degrees.



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## Materials and Methods

### Study design, setting and duration

A hospital-based comparative observational study was conducted in the Department of Orthopaedics, Assam Medical College and Hospital, Dibrugarh, Assam, over one year, from July 2023 to July 2024. Institutional Ethics Committee (Human) clearance was obtained before the research commenced.

### Study population and sample size

A total of 60 individuals aged more than 40 years attending the Orthopaedics outpatient department. Thirty participants with knee OA constituted the disease group, and 30 participants without radiological degenerative changes constituted the comparison group. The sample size was calculated using standard deviations of PTS reported in prior work (2.38 in OA knees and 1.81 in normal knees), with 95% confidence and 90% power; the calculated size was 30 participants per group. [8]

### Eligibility criteria

For the OA group, inclusion criteria were age over 40 years, knee pain without another obvious pathology, difficulty with squatting and walking, and radiographic degenerative changes corresponding to KL grades 1 or 2. Exclusion criteria included age below 40 years, fractures around the knee, ligament injury around the knee, symptomatic knee associated with systemic pathology, knee infection, varus or valgus deformity, and KL grade 3 or 4 OA. [15,16]

The comparison group included individuals over 40 years of age without radiographic degenerative changes in the knee. Individuals with knee degeneration or knee infection were excluded. The study outcome was radiologically measured PTS.

### Clinical assessment

Participants underwent a general survey, including height and weight measurement and calculation of body mass index (BMI, kg/m²). A detailed clinical examination of the knee was performed. Examination included inspection in standing, sitting and supine positions; gait and attitude assessment; evaluation for swelling, effusion, muscle wasting, local temperature and tenderness; palpation of the joint line, patellar facets and popliteal fossa; assessment of patellar tap and patellar excursion; and examination of knee movements, including flexion, extension, abduction, adduction and rotation. The clinical proforma also recorded symptoms, symptom duration, laterality and visual analogue scale (VAS) pain score. [17,18]

### Radiographic assessment and PTS measurement

Radiographic assessment included standing anteroposterior (AP) and lateral views of the knee. OA severity was graded using the Kellgren–Lawrence classification. The AP radiographic protocol used standardized participant positioning and a caudal tube tilt as described in the study methodology. Image quality was assessed by the visualization and superimposition of tibial plateau borders and femoral condyles on the respective views. [19,20]

PTS was measured on a true lateral radiograph. The proximal tibial anatomical axis was defined using the midpoints of the outer cortical diameter at 5 cm and 15 cm distal to the knee joint; the slope was measured relative to the tibial plateau inclination. The same described radiographic approach was applied across groups. The study references prior methodological literature for this measurement. [8,10,12,21,22]



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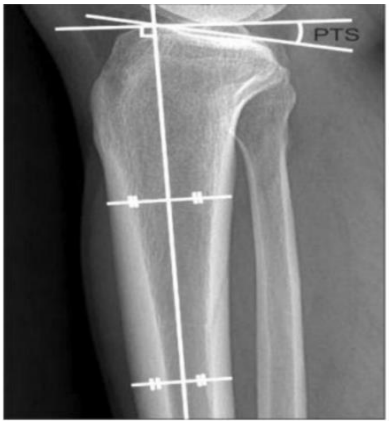



Figure 1: Radiographic illustration of posterior tibial slope measurement using the proximal tibial anatomical axis.

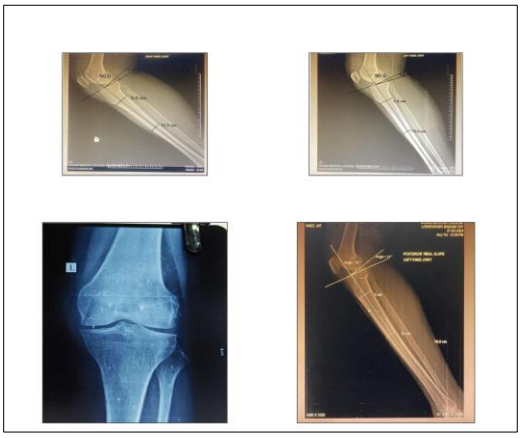


Figure 2: Representative knee radiographs from the thesis case discussion, including anteroposterior and lateral views with posterior tibial slope measurements.

**Participant characteristics**

Table 1: Age distribution of participants

| Age (years) | Comparison group n (%) | OA group n (%) |
|---|---|---|
| 41–50 | 24 (80.00) | 12 (40.00) |
| 51–60 | 5 (16.67) | 12 (40.00) |
| 61–70 | 1 (3.33) | 5 (16.67) |
| >70 | 0 (0.00) | 1 (3.33) |
| Total | 30 (100) | 30 (100) |
| Mean age ± SD (years) | 45.60 ± 6.04 | 53.13 ± 22.35 |
| Between-group p-value | — | 0.024 |

**Statistical analysis**

Data were analysed using Microsoft Excel 2010 and SPSS for Windows version 21. Continuous variables were documented as mean±standard deviation, and categorical variables as frequency and percentage. Chi-square and Fisher's exact tests were used for comparisons of categorical variables between the OA and comparison groups. Statistical significance was set at $p<0.05$. The study also calculated a relative risk estimate using PTS >10° as the exposed category and PTS <10° as the non-exposed category.

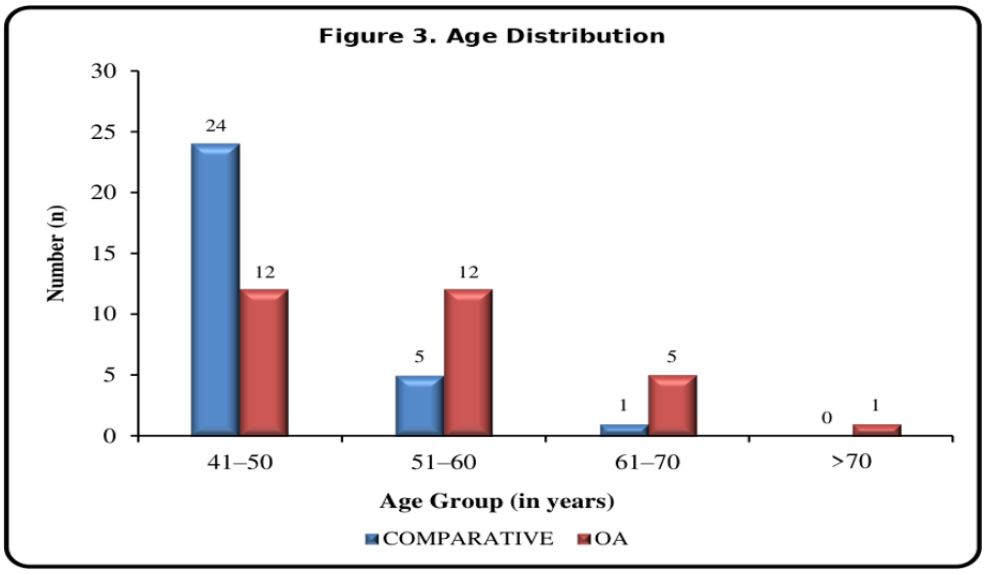
**Results**

A total of 60 participants were evaluated: 30 in the OA group and 30 in the comparison group. In the OA group, 39 knees were assessed because nine participants had bilateral OA; the comparison group contributed 30 knees. The results below distinguish participant-level and knee-level denominators where the study provides them.



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Figure 3:

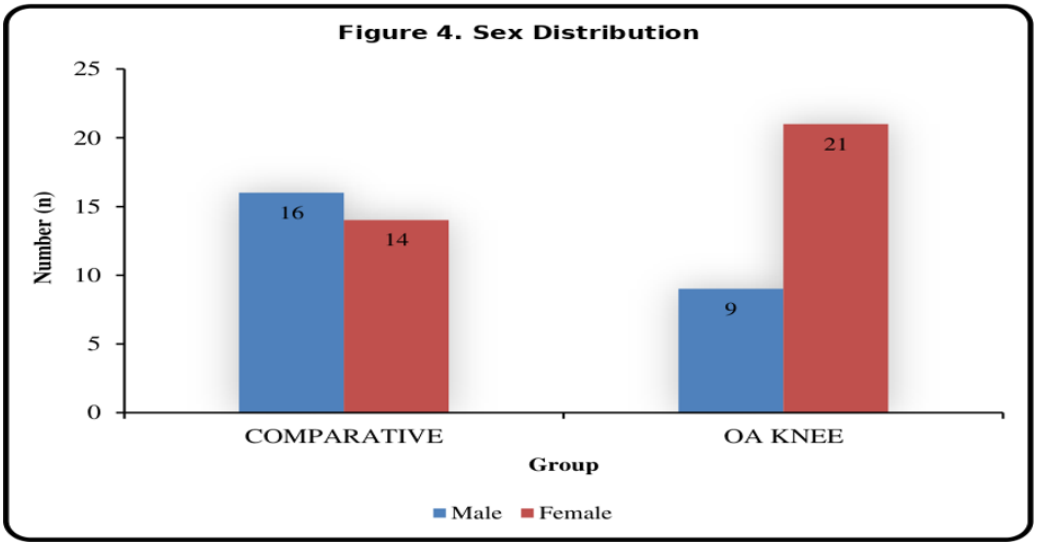



Participants in the OA group were distributed predominantly between 41 and 60 years (80%). The age distribution differed statistically between groups (Fisher's exact test, p=0.024).

Table 2: Sex distribution

| Sex | Comparison group n (%) | OA group n (%) |
|---|---|---|
| Male | 16 (53.33) | 9 (30.00) |
| Female | 14 (46.67) | 21 (70.00) |
| Total | 30 (100) | 30 (100) |
| Male: female ratio | 1:0.88 | 1:2.33 |
| p-value | — | 0.067 |

Figure 4:




Women accounted for 70% of the OA group, compared with 46.67% of the comparison group. The difference in sex distribution was not statistically significant (chi-square test, p=0.067).

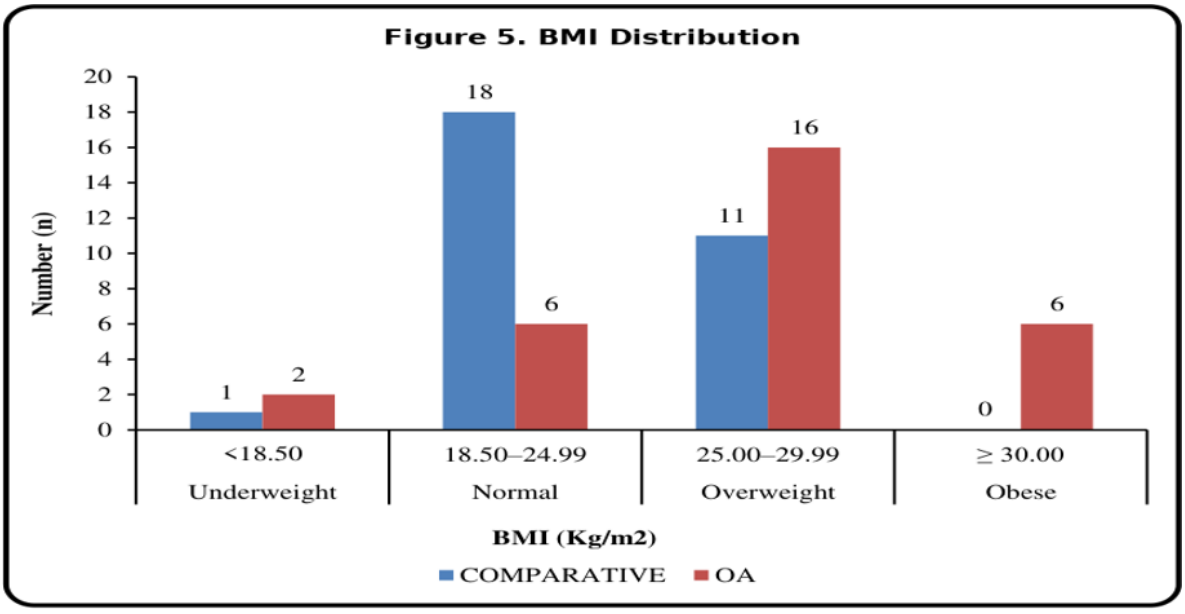


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Table 3: Selected demographic and lifestyle characteristics

| Variable | Comparison group n (%) | OA group n (%) | p-value |
|---|---|---|---|
| Religion: Hindu | 20 (66.67) | 26 (86.67) | 0.167 |
| Religion: Muslim | 6 (20.00) | 3 (10.00) | — |
| Religion: Christian | 4 (13.33) | 1 (3.33) | — |
| Ethnicity: tribal | 13 (43.33) | 11 (36.67) | 0.598 |
| Ethnicity: nontribal | 17 (56.67) | 19 (63.33) | — |
| BMI <18.50 kg/m² | 1 (3.33) | 2 (6.67) | 0.056 |
| BMI 18.50–24.99 kg/m² | 18 (60.00) | 6 (20.00) | — |
| BMI 25.00–29.99 kg/m² | 11 (36.67) | 16 (53.33) | — |
| BMI ≥30.00 kg/m² | 0 (0.00) | 6 (20.00) | — |
| Physical activity: sedentary | 12 (40.00) | 21 (70.00) | 0.012 |
| Physical activity: moderate | 2 (6.67) | 4 (13.33) | — |
| Physical activity: hard | 16 (53.33) | 5 (16.67) | — |

Figure 5:






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Figure 6:

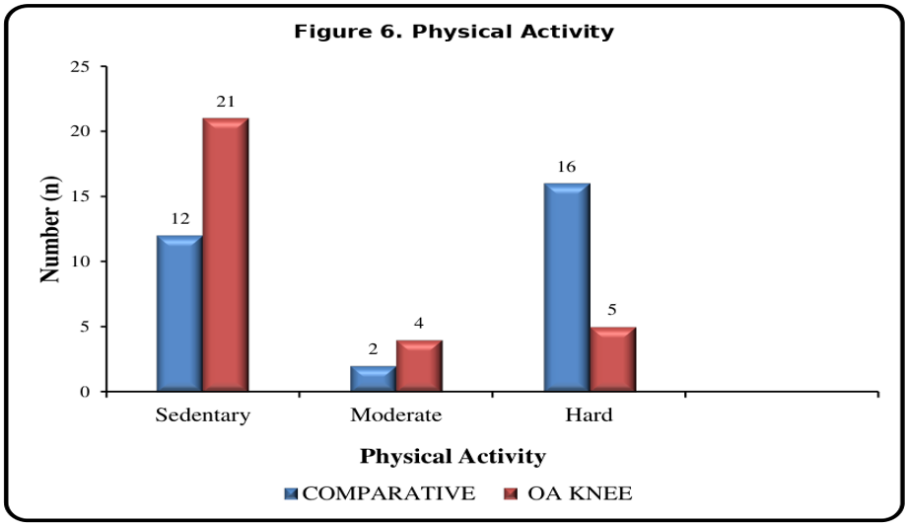
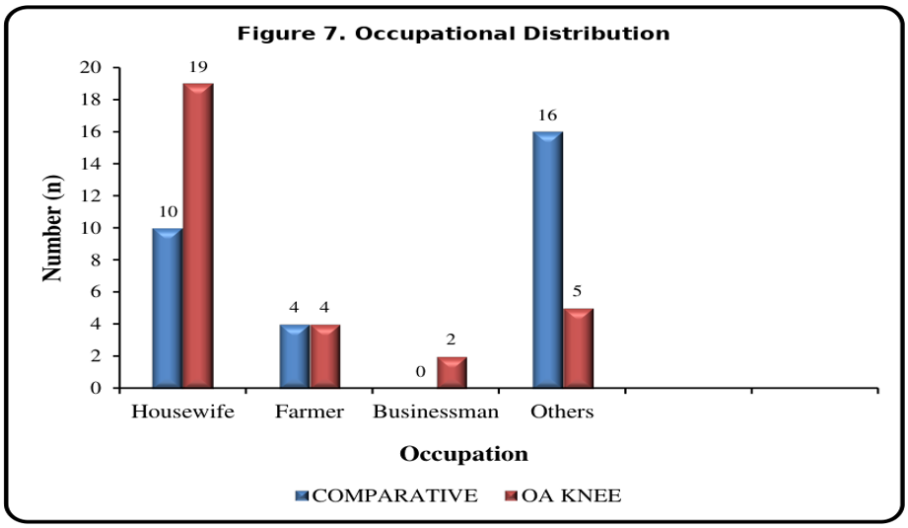



Figure 7:




The OA group included 19 housewives (63.33%), four farmers (13.33%), two businessmen (6.67%) and five participants in other occupational categories (16.67%). The study recorded a p-value of 0.050 for occupation. Religion and ethnicity comparisons were not statistically significant. BMI distribution approached but did not reach the prespecified threshold (p=0.056). Sedentary activity was more common in the OA group (70%) than in the comparison group (40%), with a significant group difference (p=0.012).

**Clinical characteristics of the OA group**

Table 4: Symptoms and clinical profile among participants with OA

| **Characteristic** | **n** | **%** |
|---|---|---|
| Knee pain and stiffness | 30 | 100.00 |
| Difficulty in walking | 15 | 50.00 |
| Difficulty in squatting | 20 | 66.67 |
| Other symptoms | 3 | 10.00 |



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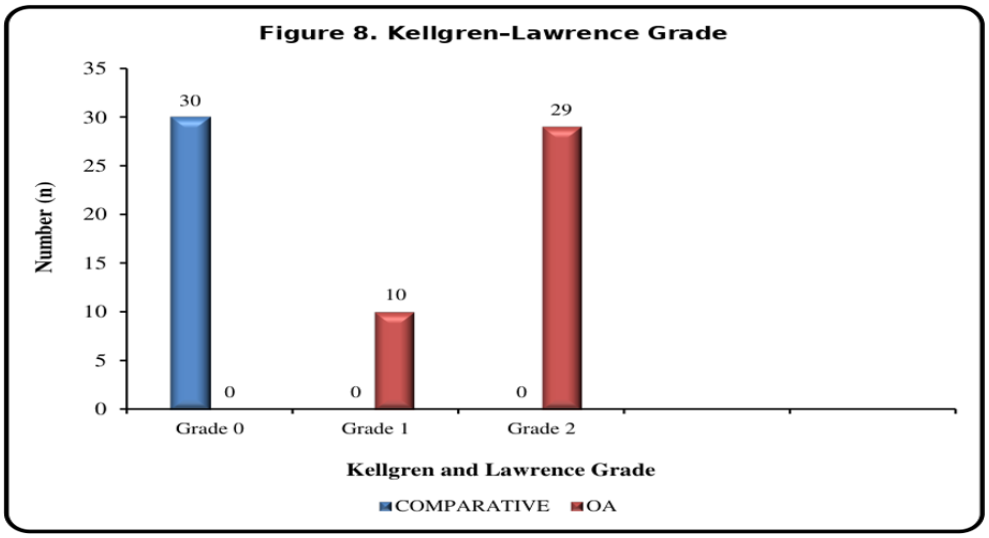
| | | |
|---|---|---|
| VAS 1–3 | 11 | 36.67 |
| VAS 4–6 | 19 | 63.33 |
| VAS >7 | 0 | 0.00 |
| Symptoms <3 months | 2 | 6.67 |
| Symptoms 3–6 months | 17 | 56.67 |
| Symptoms 7–9 months | 8 | 26.67 |
| Symptoms 10–12 months | 2 | 6.67 |
| Symptoms >12 months | 1 | 3.33 |
| Mean symptom duration ± SD (months) | 6.10 ± 3.66 | — |
| Unilateral OA | 21 | 70.00 |
| Bilateral OA | 9 | 30.00 |

All OA participants reported knee pain and stiffness. Difficulty in squatting was reported by 66.67% and difficulty in walking by 50%. Most participants (63.33%) had a VAS score of 4–6. Symptoms had lasted 3–6 months in 56.67% of participants. Nine participants had bilateral OA; among the 39 OA knees, 23 were left-sided and 16 were right-sided.

Table 5: Kellgren–Lawrence grade of knees assessed

| **KL grade** | **Comparison knees n (%)** | **OA knees n (%)** |
|---|---|---|
| Grade 0 | 30 (100.00) | 0 (0.00) |
| Grade 1 | 0 (0.00) | 10 (25.64) |
| Grade 2 | 0 (0.00) | 29 (74.36) |
| Total knees | 30 (100) | 39 (100) |
| p-value | — | <0.001 |

Figure 8:



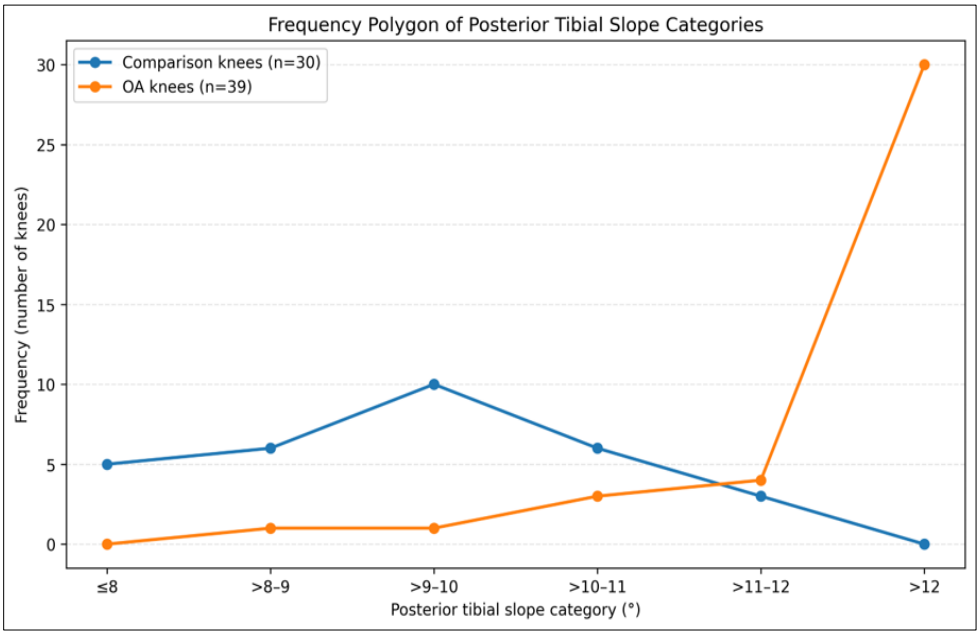

Among the 39 OA knees, 10 (25.64%) were classified as KL grade 1 and 29 (74.36%) as KL grade 2. The comparison knees were recorded as KL grade 0. Higher grades (KL 3 and 4) were excluded by the study criteria.

**Posterior tibial slope**

Table 6: Distribution of PTS by group

| PTS category (°) | Comparison knees n (%) | OA knees n (%) |
|---|---|---|
| ≤8 | 5 (16.67) | 0 (0.00) |
| >8–9 | 6 (20.00) | 1 (2.56) |
| >9–10 | 10 (33.33) | 1 (2.56) |
| >10–11 | 6 (20.00) | 3 (7.69) |
| >11–12 | 3 (10.00) | 4 (10.26) |
| >12 | 0 (0.00) | 30 (76.92) |
| Total | 30 (100) | 39 (100) |
| Mean PTS ± SD (°) | 9.34 ± 1.16 | 13.05 ± 1.62 |
| p-value | — | <0.001 |

Figure 9: Frequency polygon of posterior tibial slope categories in comparison and OA knees.

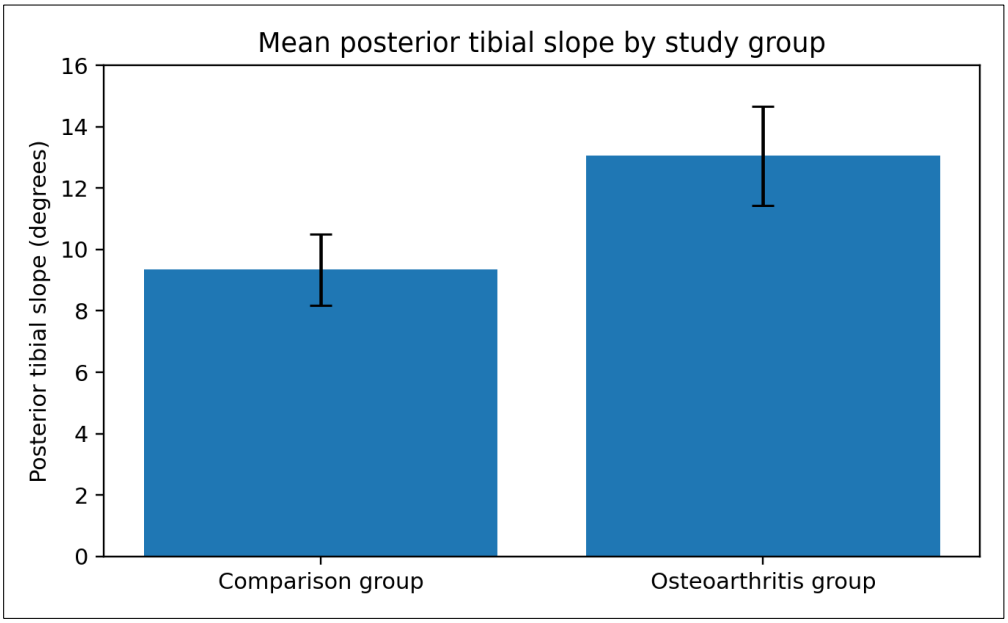



The distribution of PTS was markedly shifted toward higher values in the OA group. Thirty of 39 OA knees (76.92%) had a PTS above 12°, whereas no comparison knee was in this category. The mean PTS was 13.05±1.62° in the OA group and 9.34±1.16° in the comparison group. The difference in categorized PTS distribution was statistically significant (Fisher's exact test, $p<0.001$).



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Figure 10: Mean posterior tibial slope in comparison and osteoarthritis groups. Error bars represent the reported standard deviations.




**Relative risk estimate**

Table 7: Relative risk calculation using PTS >10°

| PTS category | OA knees | Comparison knees | Total |
|---|---|---|---|
| PTS >10° (exposed) | 37 | 9 | 46 |
| PTS <10° (non-exposed) | 2 | 21 | 23 |
| Total | 39 | 30 | 69 |

Based on the contingency table provided in the study, the relative risk was calculated as (37/46) divided by (2/23), yielding 9.25. This estimate indicates a higher proportion of OA among knees categorized as having PTS >10° in this sample. The source calculation used the labels PTS >10° and PTS <10°; knees exactly at 10° were not separately presented.

**Discussion**

The main finding of this hospital-based comparison was a higher mean posterior tibial slope among knees with early radiographic OA than among comparison knees without radiographic degeneration. The mean difference was 3.71 degrees (13.05° compared with 9.34°), and the reported group distribution difference was statistically significant ($p<0.001$). The study also reported a relative risk estimate of 9.25 for the PTS >10° category. Taken together, these findings suggest that a steeper PTS was associated with early knee OA in the studied population.

PTS is a relevant anatomical parameter because the inclination of the tibial plateau contributes to knee kinematics and load transmission. It is also considered in preoperative radiographic assessment for knee arthroplasty. The proximal tibial anatomical axis was selected in the present study to standardize the measurement, with reference points at 5 and 15 cm below the joint line. Measurement methodology matters:



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studies using different tibial axes, imaging modalities or plateau regions may report different values, making direct comparisons between studies difficult. [10,11,12,22]

These findings are consistent with investigations showing PTS was greater in OA knees than in normal knees. Chiu et al. described a posterior slope difference between normal and osteoarthritic knees in a Chinese sample. Dehghan and Bahmani found higher PTS values in OA patients than controls. Thirunarayanan et al. found mean PTS of 14.05° in arthritic knees and 9.69° in normal knees, a pattern comparable to the direction of difference in the present study. Saidapur et al. also reported higher PTS in patients with early OA than normal population values. [8,13,21,23]

Nevertheless, the literature does not uniformly show the same direction of association. Muthuuri's radiological study in an African population described a lower mean slope in the OA group and suggested that degenerative change could be associated with slope deterioration. Matsuda et al. examined normal and varus knees and reported differences by plateau side and alignment. Such heterogeneity may reflect population-specific anatomy, variation in OA stage, the distinction between medial and lateral plateau slope, sample selection, and the measurement axis. [9,14]

PTS values among healthy populations also differ. Didia and Jaja studied adult Nigerian subjects; Khattak et al. described lower-limb alignment and PTS in Pakistani individuals; Yoo et al. compared anatomical axes for PTS measurement; Yoga et al. examined Malaysian patients undergoing total knee replacement; and Medda et al. reported anatomical variation in an Eastern Indian population. Aljuhani et al. assessed medial and lateral PTS on MRI and considered the associations with sex, age and BMI. These studies underscore the importance of interpreting PTS in relation to ethnicity, measurement approach and clinical setting rather than treating a single threshold as universally applicable. [10,11,24,25,26,27]

In the present cohort, 70% of OA participants were women, and the male-to-female ratio was 1:2.33. The sex distribution difference between groups did not reach statistical significance (p=0.067). Female predominance has also been described in epidemiological and clinical studies of knee OA, including the work cited in the study . Although biological and social factors may contribute to sex differences in OA burden, the current study was not designed to establish mechanisms. [2,16,28,29]

Age distribution differed significantly between the study groups (p=0.024), with more OA participants in the 51–60 and 61–70 year categories than in the comparison group. Age is a recognized correlate of OA occurrence, but the comparison group's age profile was younger overall in the reported data. While the abstract describes the groups as age-matched, the frequency distribution demonstrates that they were not identical in age structure. This may introduce confounding into the PTS–OA association and should be considered when interpreting the result.

Lifestyle and anthropometric variables were also assessed. Sedentary physical activity was more frequent among OA participants than comparison participants, and the group difference was statistically significant (p=0.012). BMI category distribution was not statistically significant at the prespecified level (p=0.056), although overweight and obesity were more prevalent in the OA group in the tabulated data. The relationship between BMI and knee OA has been addressed in prior studies, including investigations of metabolic risk factors and systematic reviews of prospective cohorts. The present sample is too small to



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evaluate independent effects or adjust for confounding. [30,31,32]

The occupational profile of the OA group included a high proportion of housewives. Occupation was documented as significant at p=0.050 in the study analysis, but categories and group composition were varied, and no multivariable model was reported. Religion and ethnicity were not statistically significant in the group comparisons. These descriptive factors should not be interpreted as causal or population-level determinants based on this outpatient sample.

Most OA knees in the study were classified as KL grade 2 (74.36%), with the remaining 25.64% at grade 1. Patients with KL grades 3 and 4, particularly those with deformity, were excluded. Thus, the association observed is specific to early radiographic OA and does not establish how PTS behaves in advanced disease. The study summary states that PTS increases with progression of OA; however, because advanced grades were not included, a progression relationship could not be directly tested within this dataset.

The relative risk estimate of 9.25 is large and is based on the two-by-two table presented in the study: 37 OA knees and nine comparison knees in the PTS >10° category, versus two OA knees and 21 comparison knees in the PTS <10° category. The calculation is preserved from the source. Its interpretation should be cautious because the study is comparative and hospital-based rather than a prospective cohort with incident outcomes. Moreover, participants with bilateral OA contributed two knees, so the knee-level observations may not be independent. The study did not report a clustered analysis or confidence interval for the relative risk.

Clinical implications should therefore be framed as hypothesis-generating. PTS measurement on a standardized lateral radiograph may provide additional anatomical information during assessment of early knee OA. Nevertheless, it should not be regarded as a stand-alone screening test, prognostic marker or indication for intervention based on this study alone. Assessment of symptoms, clinical examination, alignment, radiographic grade and other established factors remains important.

**Strengths and limitations**

The investigation employed a comparative design, included a normal radiographic comparison group, applied explicit eligibility criteria, and measured PTS with a stated anatomical-axis method. It also recorded a range of demographic and clinical characteristics and reported categorical PTS distributions in addition to mean values.

Several limitations should be acknowledged. First, the sample size was small and the study was conducted at a single tertiary-care hospital, limiting generalizability. Second, only KL grades 1 and 2 were included; advanced OA was excluded. Third, the study was observational and cross-sectional in nature, so temporal sequence and causality cannot be established. Fourth, the groups differed in age distribution and were not identical in their demographic characteristics. Fifth, the OA group contributed 39 knees from 30 participants, but the analysis appears to treat knee-level counts without adjustment for within-person correlation. Sixth, the study did not report confidence intervals, a multivariable model, or inter-/intra-observer reliability for PTS measurement. Finally, some values differ across sections of the study; the tabulated results have been used as the primary source for this manuscript, and such discrepancies should be checked against the original dataset before journal submission.



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**Conclusion**

In this hospital-based comparative study of adults over 40 years, mean posterior tibial slope was significantly greater in knees with early radiographic osteoarthritis than in comparison knees without radiographic degeneration (13.05±1.62° vs 9.34±1.16°; $p<0.001$). The study -reported relative risk estimate for PTS >10° was 9.25. These findings indicate an association between steeper PTS and early knee OA in the study sample. Given the small sample, possible confounding, knee-level clustering and exclusion of advanced OA, larger prospective and methodologically robust studies are needed before PTS can be considered an established risk factor.

**References**


1. Singh A, Das S, Chopra A, Danda D, Paul BJ, March L, et al. Burden of osteoarthritis in India and its states, 1990–2019: findings from the Global Burden of Disease Study 2019. Osteoarthritis Cartilage. 2022;30(8):1070–1078.
2. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. Indian J Orthop. 2016;50(5):518–522.
3. Mastim MA, Borana C, Shah V, Dhadiwal R, Malhotra R, Kidiyoor B, et al. An open-labeled randomized prospective multi-center study to evaluate the efficacy and safety of intra-articular injection of OSSINEXT, an autologous growth factor concentrate, compared to hyaluronic acid in knee osteoarthritis. Cureus. 2022.
4. Chaurasia BD. Human Anatomy. 6th ed. Vol 2. CBS; p. 140–146.
5. Drake RL, Vogl AW. Gray's Anatomy for Students. 4th ed. Elsevier; 2019. p. 598–611.
6. Benninger B. Gray's Anatomy. 41st ed. p. 1383–1399.
7. Azar FM, Beaty JH. Campbell's Operative Orthopaedics. 14th ed. Vol 3. Elsevier; p. 2198–2373.
8. Thirunarayanan V, Ramprasath DR, Amarnath R, Arun V. An observation of posterior tibial slope and metaphysio-diaphyseal angle in Indian population. J Orthop Joint Surg. 2021;2(2):52–56.
9. Matsuda S, Miura H, Nagamine R, Urabe K, Ikenoue T, Okazaki K, et al. Posterior tibial slope in the normal and varus knee. Am J Knee Surg. 1999;12(3):165–168.
10. Yoo JH, Chang CB, Shin KS, Seong SC, Kim TK. Anatomical references to assess the posterior tibial slope in total knee arthroplasty: a comparison of 5 anatomical axes. J Arthroplasty. 2008;23(4):586–592.
11. Aljuhani WS, Qasim SS, Alrasheed A, Altwalah J, Alsalman MJ. The effect of gender, age, and body mass index on the medial and lateral posterior tibial slopes: an MRI study. Knee Surg Relat Res. 2021;33(1):12.
12. Kavak S, Kaya S. Evaluation of the relationship of posterior tibial slope with gender and age in Turkish population with 3 different methods. BMC Musculoskelet Disord. 2024;25:102.
13. Chiu KY, Zhang SD, Zhang GH. Posterior slope of tibial plateau in Chinese. J Arthroplasty. 2000;15(2):224–227.
14. Muthuuri JM. Determination of posterior tibia slope and slope deterioration with osteoarthritis: a radiological study in an African population. East Afr Orthop J. 2014;8(1):16–20.




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15. Kohn MD, Sassoon AA, Fernando ND. Classifications in brief: Kellgren–Lawrence classification of osteoarthritis. Clin Orthop Relat Res. 2016;474(8):1886–1893.
16. Akinpelu AO, Alonge TO, Adekanla BA, Odole AC. Prevalence and pattern of symptomatic knee osteoarthritis in Nigeria: a community-based study. Internet J Allied Health Sci Pract. 2009;7(3):10.
17. Park K. Park's Textbook of Preventive and Social Medicine. 25th ed. Bhanot; 2019. p. 426–430.
18. Das S. A Manual on Clinical Surgery. 13th ed. 2018. p. 248–253.
19. Felson D. Knee and Full Limb Radiography Operation Manual. Version 1.0. Boston University MOST Radiography Center; 2013. p. 3–42.
20. Kellgren JH, Lawrence JS. Radiological assessment of osteo-arthrosis. Ann Rheum Dis. 1957;16(4):494–502.
21. Saidapur DSK, Srinivas DPS, Shete DS, Hundekar DA, Jatti DRS. Radiological assessment of the posterior tibial slope as a risk factor for osteoarthritis of the knee in Indian population. 2023:397–402.
22. Bisicchia S, Scordo GM, Prins J, Tudisco C. Do ethnicity and gender influence posterior tibial slope? J Orthop Traumatol. 2017;18(4):319–324.
23. Dehghan M, Bahmani MT. Anatomical parameters associated with osteoarthritis of the knee joint. Armaghane Danesh. 2014;19(5):462–469.
24. Didia BC, Jaja BNR. Posterior slope of tibial plateau in adult Nigerian subjects. Int J Morphol. 2009;27(1).
25. Khattak MJ, Umer M, Davis ET, Habib M, Ahmed M. Lower-limb alignment and posterior tibial slope in Pakistanis: a radiographic study. J Orthop Surg (Hong Kong). 2010;18(1):22–25.
26. Yoga R, Sivapathasundaram N, Suresh C. Posterior slope of the tibia plateau in Malaysian patients undergoing total knee replacement. MOJ. 2009;3(1):78–80.
27. Medda S, Kundu R, Sengupta S, Pal AK. Anatomical variation of posterior slope of tibial plateau in adult Eastern Indian population. Indian J Orthop. 2017;51(1):69–74.
28. Iqbal MN, Haidri FR, Motiani B, Mannan A. Frequency of factors associated with knee osteoarthritis. J Pak Med Assoc. 2011;61(8):786–789.
29. Kaur R, Sharma VL. Prevalence of knee osteoarthritis and its correlation in women of rural and urban parts of Hoshiarpur (Punjab). J Postgrad Med Educ Res. 2015;49(1):32–36.
30. Yoshimura N, Muraki S, Oka H, Kawaguchi H, Nakamura K, Akune T. Association of knee osteoarthritis with the accumulation of metabolic risk factors such as overweight, hypertension, dyslipidemia, and impaired glucose tolerance in Japanese men and women: the ROAD Study. J Rheumatol. 2011;38(5):921–930.
31. Xie D, Wei J, Zeng C, Yang T, Li H, Wang Y, et al. Association between metabolic syndrome and knee osteoarthritis: a cross-sectional study. BMC Musculoskelet Disord. 2017;18:533.
32. Zheng H, Chen C. Body mass index and risk of knee osteoarthritis: systematic review and meta-analysis of prospective studies. BMJ Open. 2015;5 (12):e007568.



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