

The Reproducibility of Radiographic Measurement of Lateral Meniscus Horn Position

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Purpose: The objective of our investigation was to evaluate whether it is possible to locate and reproduce the tibial insertion areas of the anterior and posterior horns of the lateral meniscus on preoperative radiographs. **Methods:** In 20 tibia heads, we prepared anterior and posterior horn insertions and marked their circumference with radiopaque steel balls of 1.6 mm in diameter. Standardized anteroposterior and lateral radiographs were made. On these radiographs, different landmarks were defined, their distances measured (tibial width and depth, distance from lateral tibia border to meniscus insertion midpoint, distance from anterior tibia border to meniscus insertion midpoint, distance from anterior and lateral tibia border to lateral intercondylar spine), and ratios determined. **Results:** The anterior horn midpoint is located at $45.1\% \pm 1.3\%$ of tibial width and $41.9\% \pm 3.2\%$ of tibial depth, and the posterior horn midpoint is located at $49.8\% \pm 1.9\%$ of tibial width and $72.1\% \pm 2.3\%$ of tibial depth. The statistical analysis of these measures showed a precise and constant positioning of the lateral meniscus insertions on the tibia plateau. We also found constant topographic relations to the lateral intercondylar spine. **Conclusions:** Anterior and posterior lateral meniscus horn insertions can be determined on radiographs with a high precision and reproducibility. **Clinical Relevance:** We have developed a technique for precise radiographic tibial horn determination in lateral meniscus transplantation. **Key Words:** Lateral meniscus—Meniscus transplantation—Meniscus insertion anatomy—Bony landmarks.

The developments in joint surgery have been such that most meniscal injuries can currently be treated with repair or partial resection. However, in some cases total meniscectomy still has to be performed. Numerous clinical and experimental studies show that meniscectomy leads to progressive degenerative osteoarthritis.^{1,2} It has been shown that the loss of the lateral meniscus resulted in a 50% decrease in total contact area and a 200% to 300% increase in

peak local contact pressure.³ Meniscus transplantation has been considered as a possible treatment by which to slow this process of joint degeneration.⁴⁻⁶

Anatomically correct graft placement is crucial in restoring normal knee biomechanics and is essential for the long-term survival of the graft.⁷ An animal model showed that a minimal misplacement of the graft of only a few millimeters led to failure of the procedure.⁸ Correct placement of the graft is difficult with the use of the currently available techniques, with either open or arthroscopically assisted procedures.^{9,10}

Meniscal insertion anatomy and radiographic positions of meniscus horns have been described in previous studies.¹¹⁻¹³ However, the reproducibility of these radiographic descriptions has not been analyzed.

The purpose of this study was to determine the exact insertion areas of the anterior and posterior lateral meniscus horns on preoperative radiographs, to reproduce these locations, and to describe constant bony landmarks. Our hypothesis was that these locations would be highly precise with a low variability. Their determination on radiographs should be highly reproducible.

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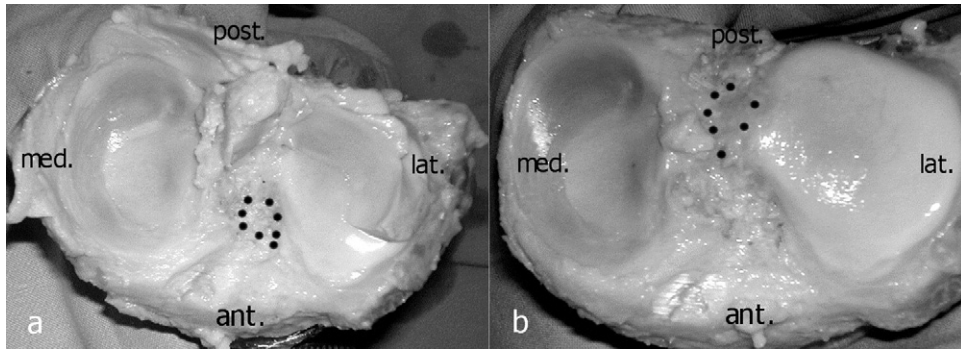


FIGURE 1. (a) Anterior and (b) posterior horn preparation; black marks indicate radiopaque steel balls outlining insertion circumference. (post, posterior; med, medial; lat, lateral; ant, anterior.)

METHODS

In this study 20 formaldehyde-fixed human cadaveric knees (10 pairs) with a mean age of 71 years (range, 50 to 91 years) were dissected and all soft tissues removed. Of the knees, 8 showed no macroscopic signs of degenerative articular cartilage changes (according to Jackson et al.¹⁴), 9 had grade I changes, and 3 had grade II changes. Tibial insertions of the cruciate ligaments

were removed and meniscus horns exposed. The lateral meniscus horns were sectioned from the tibia, their insertions marked, and their circumference outlined with radiopaque steel balls of 1.6 mm in diameter (Fig 1).

For standardization of the radiographs, the tibia heads were fixed in a custom-designed L-shaped box allowing the fixation of the specimen with the 2 pos-

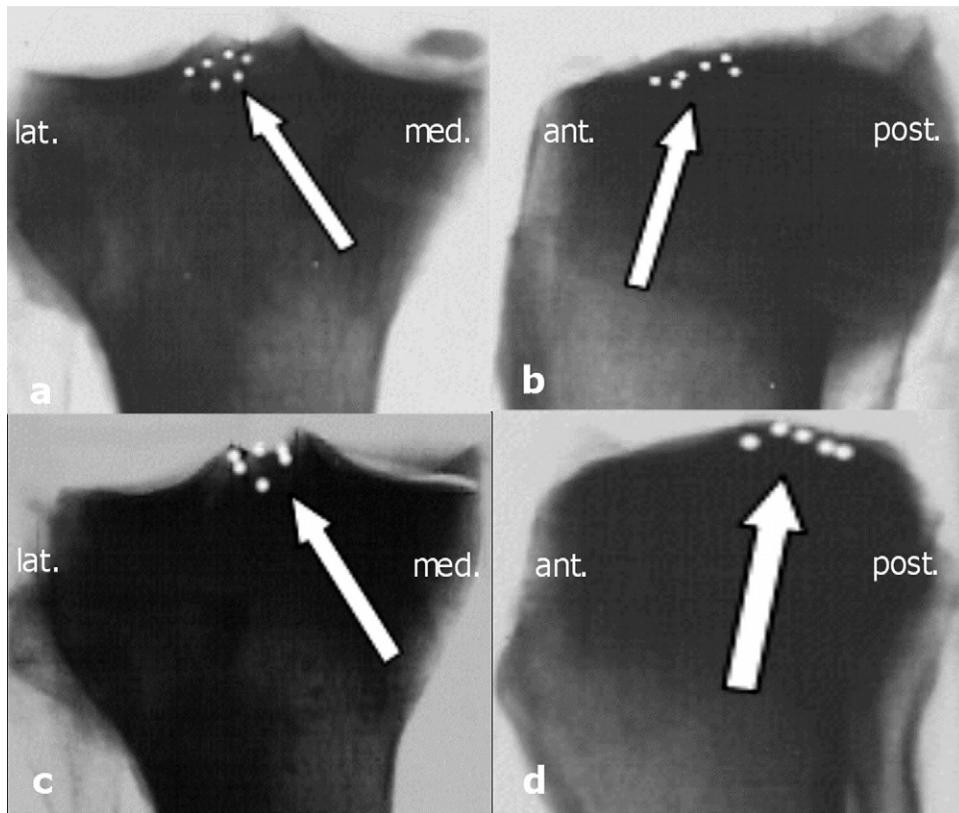


FIGURE 2. Standardized AP and lateral radiographs of tibia heads with prepared (a, b) anterior and (c, d) posterior horn sites; white marks indicate radiopaque steel balls (arrows). (post, posterior; med, medial; lat, lateral; ant, anterior.)

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