

ORIGINAL PAPERS

Reproducibility of measurements of axial patellar views at 30°

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Abstract

Introduction: Different types of studies and radiographic parameters have been established to diagnose potential patellofemoral alterations; one of the most commonly used of these is the axial patellar view at 30°.

Purpose: To assess the reproducibility of patellar measurements on axial patella X-rays at 30°.

Materials and methods: In 23 patients we performed 2 axial X-rays of the same patella, at a fixed 30° angle; both films were obtained with the same technique, at an interval of 5min between them. The 3 most frequently used parameters were used to measure alterations in patellofemoral alignment: Laurin's lateral patellofemoral angle, Sasaki and Yagi's lateral deviation and Merchant's congruence angle. These measurements were taken by one same observer in all radiographs. A statistical analysis was made of the results, comparing each measurement on the 2 radiographs and analyzing the intraclass correlation coefficient.

Results: We found very good concordance levels with an intraclass correlation coefficient for the three angles studied greater than 0.90.

Conclusions: The technique described boasts a high degree of reproducibility.

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PALABRAS CLAVE

Rodilla;
Rótula;
Dolor femoropatelar;
Radiografía axial;
Reproducibilidad

Reproducibilidad de las mediciones de radiografías axiales de rótula a 30°**Resumen**

Introducción: para conseguir un diagnóstico de las posibles alteraciones femoropatelares se han definido distintos tipos de exploraciones complementarias y gran cantidad de parámetros radiográficos; uno de los más utilizados es la proyección radiográfica axial de rótula a 30°.

Objetivo: valorar la reproducibilidad de las mediciones patelares en la radiografía axial de rótula a 30°.

Material y método: en 23 pacientes se realizaron 2 radiografías axiales de la misma rótula, en ángulo fijo de 30° y con la misma técnica, con un intervalo entre ambas de 5min. Se utilizaron como mediciones radiográficas los 3 parámetros más usados para medir las alteraciones en la alineación patelofemoral: ángulo patelofemoral lateral de Laurin, desviador lateral de Sasaki y Yagi y el ángulo de congruencia de Merchant. Un mismo observador realizó estas mediciones en todas las radiografías. Se realizó un análisis estadístico de los resultados comparando cada medición en las 2 radiografías y se analizó el coeficiente de correlación intraclase.

Resultados: encontramos una concordancia muy buena con un coeficiente de correlación intraclase para los tres ángulos analizados >0,90.

Conclusiones: la técnica usada tiene un alto grado de reproducibilidad.

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Introduction

The so-called patellofemoral pain or anterior knee pain syndrome is probably one of the most frequent clinical presentations in any orthopedic and trauma surgery department¹. Its incidence is higher in females and it first manifests itself during adolescence, but its unspecificity makes diagnosis difficult, to the extent that diagnosis is sometimes based on clinical symptoms only. Having said this, it must be said that some reliable complementary tests could be of great use.

The causes of anterior knee pain are numerous and many of them remain unknown even today². Attempts have been made to relate this kind of pain with alterations in articular cartilage, but the current trend is to relate it with the mechanical alterations brought about by compressive and shear forces acting on the knee joint³.

The most characteristic symptom of patients affected with this disease is usually diffuse, dull pain that the patient tends to identify by placing his hand on the patella. Pain tends to be aggravated with knee flexion, squatting and stair descent.

For an accurate diagnosis, it is essential to carry out a clinical examination supported by certain supplementary tests such as anteroposterior, lateral and axial x-rays of the patella at different angles, computerized tomography (CAT) scans, and magnetic resonance (MRI). Of all these tests, axial radiographs at 30 degrees, known as Ficat views, are usually economical, extremely useful and easy to perform. The purpose of this study was to assess the degree of reproducibility of these axial patellar views at 30 degrees.

Materials and methods

For the present study, we selected 26 of the patients that had presented at our service between January and June 2006 with patellofemoral pain arising from mechanical factors. According to our inclusion criteria, patients had to be of age, suffer from patellofemoral pain and agree to be subjected to 2 radiographs. Patients with inflammatory or post-traumatic pain were excluded from the study. The sample was taken following a sample-sized table. Patients were required to give their informed consent prior to the performance of the radiographs.

Two x-rays were taken of the same knee in each patient, with an interval of 5 min. In both shots the patients was placed in identical positions and in the same x-ray device. The radiographs were taken following the same technique, using a wedge that kept the knee flexed at 30 degrees. Before taking the x-rays, the angulation of the knee was checked with a goniometer. The beam was oriented caudo-cranially and was parallel to the plane of the table and perpendicular to the radiography plate, which the patients themselves kept in the right position (fig. 1).

On each of the films obtained, the following measurements were made: Laurin's lateral patellofemoral angle¹ (fig. 2A), Sasaki and Yagi's lateral deviation⁴ (fig. 2B) and Merchant's congruence angle⁵ (fig. 2C). All measurements were made by the same observer. Three patients were excluded from the study because the quality of the x-rays was too poor to measure the above mentioned angles.

The statistical calculations were made with the SPSS statistical analysis software. We used Student's paired samples "t" test to verify whether there were significant

differences between the first and the second measurement of Laurin's lateral patellofemoral angle and Merchant's congruence angle. For Sasaki and Yagi's lateral deviation we used Wilcoxon's signed-rank test. We also analyzed the intraclass correlation coefficient, which quantifies the concordance between different measurements of a numerical variable, in which the maximum concordance corresponds to 1 (0 indicates null concordance). In all cases we hypothesized a confidence level of $p < 0.05$.

Results

The total number of patients in our study sample was 23 (3 were excluded due to the poor quality of the x-rays). Of these, 73.9% were female and 26.1% male. 21.7% of patients had sustained a prior dislocation. In 69.6% of cases the right knee was analyzed.

The results of the two measurements made of the different angles are shown in table 1. It can be seen that there were no statistically significant differences between the related measurements. The intraclass correlation coefficient (ICC) was calculated, with a 95% confidence interval, between the two sets of measurements of the 3 angles studied. For all 3 angle types we obtained a very high

Table 1 Comparison of the 2 measurements of the different angle types

Angle type	Measurement 1	Measurement 2	p
Laurin	29.35±15.06	28.09±15.31	0.244
Merchant	4.61±18.32	5.04±18.41	0.797
Sasaki	9.56±6.74	8.34±5.14	0.147

Values expressed are mean values ± standard deviation.

ICC value. For Laurin's lateral patellofemoral angle we obtained 0.97 (95% CI, range: 0.93–0.98); the value for Sasaki and Yagi's lateral deviation angle was 0.90 (CI 95% range: 0.77–0.96); and Merchant's congruence angle was 0.95 (CI 95% range: 0.88–0.97), which indicates that for all of them the concordance ratio was very good.

Discussion

Axial patellar radiographs seem to be useful in the assessment of potential patellofemoral conditions and in the planning of treatment², although the reproducibility of the measurements made on such views remains unknown.

On the basis of the data obtained, our study indicates that making axial x-rays at 30 degrees is a reproducible technique. Nonetheless, our study has certain limitations such as the size of our sample (23 patients) and the fact that it was conducted on patients who presented in the emergency ward with a specific complaint (patellofemoral pain). Our purpose was not to determine whether the proposed x-ray measurements were the most appropriate for diagnosing this disease, but rather to determine the reproducibility of the radiographic method.

Even if we have found no papers in the literature that look into the reproducibility of the technique of making axial patella radiographs, we did find a CAT study of the patella, which analyzed inter-observer variability when using this method⁶, as well as several studies on measurements on lateral knee radiographs that analyzed inter-observer variability with the technique, but which did not include axial patellofemoral films^{7,8}. Other studies have focused on alterations in patellofemoral alignment and on

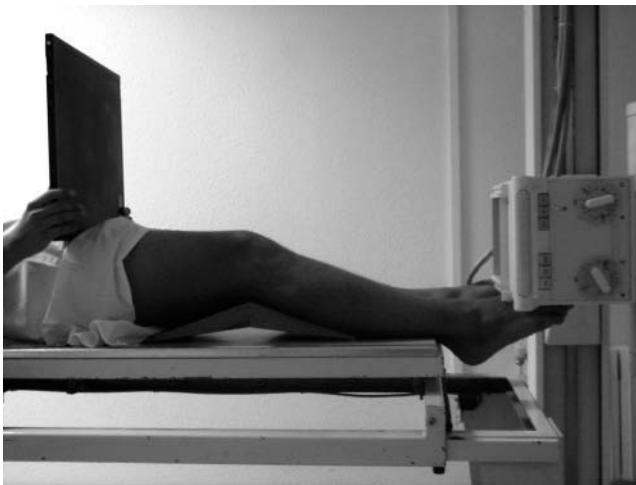


Figure 1 Axial patellar radiograph with a 30 degree wedge.

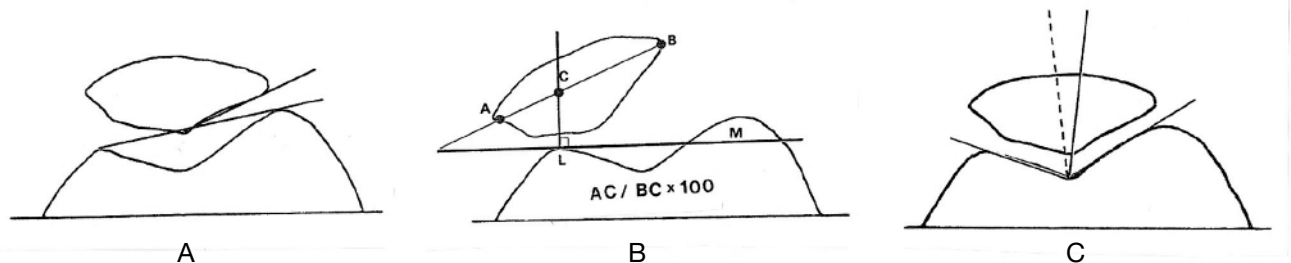


Figure 2 Measurements taken. A: Laurin's lateral patellofemoral angle. B: Sasaki and Yagi's lateral deviation angle. C: Merchant's congruence angle.

conditions arising from these alterations, but do not analyze the reproducibility of the radiographic technique^{2,3,9,10}.

The technique used for the performance of the x-rays has the advantage of being economical and makes it possible to carry out the radiographs reproducibly in any kind of setting.

In the present study, with our patient sample and following the protocol described above, we have identified very good concordance between both measurements of ICC, in Laurin's lateral patellofemoral angle Sasaki and Yagi's lateral deviation angle and Merchant's congruence angle, which indicates that these measurements were characterized by a high degree of reliability.

To conclude, reproducibility of imaging tests in patellofemoral pain is essential for appropriate diagnosis and treatment of this condition. The present study shows that the technique used for the performance of axial patellar radiographs is reproducible.

Conflict of interests

The authors have not received any financial support in the preparation of this article. Nor have they signed any agreement entitling them to receive benefits or fees from any commercial entity. Furthermore, no commercial entity has paid or will pay any sum to any foundation, educational institution or other non-profit-making organization to which they may be affiliated.

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