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Original Article

Comparative radiographic analysis on the anatomical axis in knee osteoarthritis cases: inter and intraobserver evaluation☆

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ABSTRACT

Objective: To make a comparative inter and intraobserver analysis on measurements of the anatomical axis between panoramic radiographs of the lower limbs in anteroposterior (AP) view with bipedal weight-bearing, on short film.

Methods: An accuracy study comparing radiographic measurements on 47 knees of patients attending the knee surgery outpatient clinic due to osteoarthritis. The radiographic evaluation used was as standardized for the total knee arthroplasty program, including panoramic AP views of the lower limbs and short radiographs of the knees in AP and lateral views, all with bipedal weight-bearing. Following this, the anatomical axis of the lower limbs or the femorotibial angle was measured by five independent examiners on the panoramic and short AP radiographs; three of the examiners were considered to be more experienced and two, less experienced. All the measurements were made again by the same examiners after an interval of not less than 15 days. The statistical analysis was performed using the intraclass correlation coefficient, in order to evaluate the inter and intraobserver concordance of the anatomical axis measurements.

Results: From the statistical analysis, it was observed that there was strongly significant concordance between the anatomical axis measurements on the panoramic and short radiographs, for all the five examiners and for both measurements.

Conclusions: Under the conditions studied, short radiographs were equivalent to panoramic radiographs for evaluating the anatomical axis of the lower limbs in patients with advanced osteoarthritis. The measurements used also showed high rates of inter and intraobserver concordance and reproducibility.

☆ Work developed in the Department of Orthopedics and Traumatology and the Department of Radiology of the Hospital da Força Aérea do Galeão, Rio de Janeiro, RJ, Brazil.

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Análise radiográfica comparativa do eixo anatômico na osteoartrite do joelho. Avaliação inter e intraobservadores

Palavras-chave:
Osteoartrite/radiografia
Joelho
Extremidade inferior

RESUMO

Objetivo: Fazer a análise comparativa inter e intraobservador da medida do eixo anatômico entre as radiografias panorâmica, dos membros inferiores (MMII) com raio anteroposterior (AP) e apoio bipodálico e AP com carga bipodal em filme curto.
Métodos: Foi feito estudo de acurácia que comparou medidas radiográficas em 47 joelhos de pacientes do ambulatório de cirurgia do joelho, por osteoartrite (OA). A avaliação radiográfica usada foi a padronizada para a programação de ATJ, incluindo as incidências panorâmica dos MMII em AP e as radiografias curtas dos joelhos em AP e perfil, todas com apoio bipodálico. Em seguida, as radiografias panorâmicas e curtas em AP tiveram os eixos anatômicos dos MMII ou ângulo femorotibial (AFT) medidos por cinco examinadores independentes, dos quais três eram considerados mais experientes e dois menos experientes. Todas as medidas foram refeitas pelos mesmos examinadores em um intervalo não menor do que 15 dias. A análise estatística foi feita com o uso do coeficiente de correlação intraclasses (ICC) para avaliar a concordância na medida do eixo anatômico inter e intraobservadores.
Resultados: Após análise estatística observou-se forte concordância significativa entre o eixo anatômico medido nas radiografias panorâmica e curta para todos os cinco examinadores e para ambas as medidas.
Conclusões: Nas condições estudadas a radiografia curta equipara-se à panorâmica na avaliação do eixo anatômico dos MMII em pacientes com OA avançada. A mensuração usada também mostra alta taxa de concordância e reprodutibilidade inter e intraobsevadores.

Introduction

The alignment of the lower limbs, evaluated according to their anatomical and mechanical axes, is considered to be a fundamental element in the genesis and progression of degenerative joint disease or osteoarthritis (OA) of the knee.[1–6] Valgus or varus deformities of the knee are related to the risk that the lateral and medial compartments, respectively, may be affected.[2,3,5,6] Knowledge of this alignment also becomes essential for adequate therapeutic planning for patients with knee OA, especially for those who are awaiting osteotomy or arthroplasty, as well as for their postoperative follow-up.[3,7–10]

Although clinical assessment is correct and necessary, radiographic examination is a fundamental tool for preoperative planning.[3,7–10] Panoramic radiography of the lower limbs in AP view with weight borne either on one foot or on two feet is considered to be the gold standard and is widely recommended in these situations.[1–4,7–13] However, short radiographs of the knees remain essential for better understanding, staging and classification of degenerative disease, in AP and lateral views, also with weight-bearing.[2,5,6,14–18] There are logistic difficulties in producing panoramic radiographs, which may be of dubious quality when performed. The hips or ankles are often omitted, which may be because of poor positioning between the apparatus and the patient, inadequate penetration of one of the extremities or incompatibility between the sizes of the film and patient. Moreover, panoramic radiography exposes patients to greater quantities of ionizing radiation and leads to additional costs.[5,6,15] In this light, we conceptualized a study with the following objectives: to evaluate the reliability of measurements of the femorotibial angle (FTA) on short radiographs in comparison with the values found on panoramic radiographs of the lower limbs; and to evaluate the reproducibility of interobserver and intraobserver measurements.

Materials and methods

An accuracy study was conducted to compare radiographic measurements on 50 knees, from the first patients who presented at the knee surgery outpatient clinic of our institution with an indication for total knee arthroplasty (TKA) because of OA: Kellgren and Lawrence[19] 3 or 4 and Ahlbäck[20] 3–5, as assessed by the senior researcher (MNG). The only exclusion criterion was a radiographic examination of inadequate quality, and three knees were thus eliminated from this study. The radiographic evaluation used was the one standardized for scheduling TKA, including panoramic radiographs of the lower limbs in AP view (long radiographs) and short radiographs of the knees in AP in lateral views, all with weight borne on two feet.

The radiographic examinations were performed in the radiology sector of our service using the Prestige SI apparatus. The equipment was operated by a single radiology technician, without the aid of radioscopy. Care was taken to ensure that the knees were extended to their maximum and that the patients' patellae were facing forwards. The films for the panoramic radiographs all measured 130 cm × 35 cm (Kodak®) and the films for the short radiographs, 24 cm × 30 cm (Kodak®). Following this, the anatomical axes of the lower limbs (or FTA) were measured on all the AP radiographs by