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Evidence-based practice in the utilization of knee radiographs— A survey of all members of the British Orthopaedic Association

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Abstract There has been a debate amongst orthopaedic surgeons about which plain radiographs are required in common knee conditions and this is a 5-year review assessing the influence of recent publications on the use of radiographs. A postal survey of all members of the British Orthopaedic Association was performed. The response rate was 60% (990/1,650). There was a broad agreement on the use of anteroposterior and lateral radiographs. The use of the posteroanterior (PA) weight-bearing radiograph has increased from 82 to 86%. The use of skyline view for suspected arthritis and after knee replacement has increased from 23 to 41%. There is still disparity amongst orthopaedic surgeons regarding the knee flexion angle for skyline and weight-bearing views. After review of the literature we recommend that a single skyline view in 30° flexion is adequate and should be a standard investigation in knee disorders. We also stress the importance of weight-bearing PA radiograph in 30° knee flexion for adequate assessment in all patients with suspected arthritis.

Résumé *But:* Il y a un débat parmi les orthopédistes au sujet des radiographies nécessaires pour un bilan de genou. Ce travail est une revue sur 5 ans étudiant l'influence des publications récentes sur ce problème. *Méthode:* envoi d'un questionnaire par voie postale à tous les membres de la British Orthopaedic Association. *Résultats:* Taux de réponse de 60%. Il y a un large agrément pour l'utilisation des radiographies antéro-postérieures et latérales. L'utilisation des radiographies postéro-antérieures en charge s'est accru de 82 à 86%. L'utilisation des incidences tangentielles pour la suspicion d'arthrose ou après remplacement prothétique a augmenté de 23 à 41%. Il persiste des

disparités entre les orthopédistes pour l'angle de flexion des incidences tangentielles et dans les clichés en charge. *Discussion:* après une revue de la littérature nous pensons que le cliché tangentiel à 30° de flexion doit être une incidence standard et nous insistons sur l'importance des clichés postéro-antérieurs en charge à 30° de flexion dans les suspicions d'arthrose.

Introduction

Plain radiographs have been used routinely in the investigation of various knee conditions [1]. There is often debate amongst orthopaedic surgeons about the X-rays required for knee conditions. As a standard anteroposterior (AP) and lateral radiograph may not be sufficient to show the true extent of the pathology different views have been described like skyline, weight-bearing and tunnel views. In addition, different methods are described for obtaining individual views, which might result in possibly significant variations in what is seen.

In July 1999 we carried out a study of the members of the British Orthopaedic Association to identify which plain radiograph views were requested in the assessment of a variety of knee complaints. Some very useful data were collected from the survey and the results were later published in *The Knee* [15]. This study is a follow-up exercise 5 years after the original survey to investigate the influence of recent publications on the pattern of X-ray requesting.

Materials and methods

The original questionnaire used in the last study was improvised to discover which X-ray views are organised routinely in the following knee conditions:

1. Osteoarthritis (OA) and rheumatoid arthritis (RA)
2. Total knee replacement (TKR)
3. Patella instability
4. Anterior knee pain

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Table 1 Number of surgeons routinely requesting specified X-ray views

(n=840)	AP	Lateral	Skyline	Tunnel
OA & RA	840 (100%)	840 (100%)	347 (41.3%)	51 (6%)
Post TKR	840 (100%)	840 (100%)	217 (25.8%)	04 (0.5%)
Patella instability	784 (93.3%)	789 (94%)	815 (97.1%)	49 (5.8%)
Anterior knee pain	765 (91.1%)	768 (91.4%)	727 (86.5%)	109 (13%)

Table 2 Weight-bearing posteroanterior (PA) knee X-ray requests (n=840)

Do not request	In extension	In 30° flexion	In 45° flexion	Extension + 30°	Extension + 45°	Did not specify
119 (14.1%)	538 (64.1%)	102 (12.1%)	12 (1.4%)	50 (6.0%)	10 (1.2%)	09 (1.1%)

These were chosen as they are common, and X-rays generally play a part in their management. Specific questions were also asked as to whether weight-bearing posteroanterior (PA) X-rays are requested in older patients, and if so, at what degree of knee flexion. Similarly detail was sought as to which knee flexion angle was used to obtain skyline views.

A mailing list was provided by the British Orthopaedic Association, and the questionnaire then sent to all 1,650 members in December 2004.

Results

Of the 1,650 questionnaires, 990 (60%) were returned. Of these, 150 were excluded as the respondents were either not engaged in clinical practice or regularly involved in knee surgery. The results from the remaining 840 responses are shown in Tables 1, 2 and 3 and Fig. 1.

Discussion

We compared the results of this survey with the results of our previous study in 2000. Except for a few improvements, there is still disparity among surgeons regarding which views should be requested and what are the best techniques to achieve them.

All surgeons use AP and lateral X-rays in arthritis and after total knee replacement but there is difference of opinion regarding other views.

In the last survey 18% of surgeons were not using weight-bearing PA films in patients with arthritis. Despite evidence in the literature [2, 4], 14% of respondents still do not use it.

At the time of our last study 6 years ago, the 'standard' position for taking a weight-bearing X-ray (followed by 56.5% in last study) was to have the knee in maximum

extension. Although 64% of surgeons in our survey follow this, several studies in the literature favour different degrees of flexion for optimum detection of tibiofemoral arthritis.

Davies et al. concluded that a standing PA X-ray with the knee flexed to 30° is satisfactory, and importantly, is easy to obtain and well tolerated by patients [3]. Vignon et al. concluded that PA imaging of the knee in the schuss position (20–30° flexion) increases the reproducibility of radiographic joint space width measurements in arthritic knees [12]. Deep et al. evaluated the joint space height in non-osteoarthritic tibiofemoral joints in semi-flexion and full extension. They showed that there may be a difference of up to 2 mm in the two views. This could be attributed to inherent differential thickness of articular cartilage and change in areas of contact between femoral and tibial condyles [16].

In our study only 12% of respondents requested the weight-bearing X-ray in 30° flexion.

The importance of skyline views in the assessment of patella instability is clearly documented [7–9], and our findings confirm that the vast majority of surgeons (97.1%) request them. The value of a skyline view in other anterior knee pathology is less clear cut, but this survey indicates that 86.5% of orthopaedic surgeons require it when investigating anterior knee pain.

Evidence in the literature demonstrates the importance of skyline view in patellofemoral arthritis [5, 6, 13, 14].

Various methods for taking skyline X-rays have been described, both with regard to patient position and knee flexion. Merchant et al. advised that the knee should be flexed to 45° [7], though Laurin et al. stated that if the knee is at an angle of more than 20°, patellofemoral pathology might be missed due to quadriceps contraction [8]. Whilst these and other studies have suggested a single angle, Ficat et al. advocated a series of skyline X-rays, at 30°, 60° and 90° of knee flexion to cover all possibilities [9]. Our findings reflect this difference of opinion (Table 3), and when one position is used, various flexion angles are suggested.

Davies et al. showed that one radiograph ideally taken at 30° flexion offers the best means of assessing the patellofemoral joint. They suggested that there is no advantage in requesting multiple images at different angles

Table 3 Patella skyline X-ray requests (n=800)

No mention	1 view	2 views	3 views
60 (7.2%)	537 (63.9%)	140 (16.6%)	103 (12.3%)

Fig. 1 Angle of knee flexion used by surgeons requesting skyline X-ray at one angle of flexion ($n=538$)

of knee flexion [11]. Our findings show that amongst surgeons using one skyline view 70% use 30° of knee flexion.

More surgeons are now using skyline views to assess patellofemoral joint arthritis than before: 41.3% respondents used it in this survey as compared to only 23.1% in the last, and 25.8% of surgeons use it to assess the position of the patella relative to the femoral component as compared to 18.4% in the previous study.

The number of surgeons using tunnel view has decreased as compared to the last study. It is mostly used by surgeons (13%) in investigation of anterior knee pain. A small minority of surgeons (6%) still request it in the investigation of arthritis and patella instability [10]. There is no convincing evidence to show any value of tunnel view.

Conclusion

Surgeons request X-rays with a view that it will provide maximum information and therefore have the most bearing on treatment. Despite this evidence there is no uniformity in the pattern of X-ray requests for common knee conditions.

Our results suggest that more surgeons have now started appreciating the value of skyline and flexed PA weight-bearing views.

We would recommend that PA, lateral and skyline views be routinely requested in the four common knee conditions considered here. We feel that there is no need for multiple skyline views and a single X-ray in 30° flexion should be standard practice for diagnosing patellofemoral arthritis. Evidence shows that the PA radiograph should be weight bearing taken in about 30° of flexion. Although 86% of

surgeons request weight-bearing views, only 12% request it in 30° flexion. We recommend all surgeons to follow this pattern for the weight-bearing PA radiograph.

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