

# Quality assessment of early versus late post-operative radiographs in joint replacement surgery

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## Abstract

The aim of this study was to evaluate the quality of early postoperative radiographs in comparison to the late ones following total hip and knee replacement surgery. We assessed the post-operative radiographs of 87 patients who had total hip (46 patients) or total knee arthroplasty (41 patients). The antero-posterior and the lateral views in both the early and late post-operative films were evaluated using pre-defined criteria. A total score (out of 8) was given to each set of post-operative radiographs. The mean early and late post-operative X-ray scores for the hip radiographs were 4.54 and 6.87 respectively, while those for the knee radiographs were 5.84 and 6.83. The differences in the early and late post-operative X-ray scores were statistically highly significant ( $p < 0.001$ ). We question the value and necessity of early post-operative X-rays particularly in total knee arthroplasty and recommend obtaining them in the first follow-up visit.

## INSTITUTION

Work was carried out in the department of trauma and orthopaedics at the Norfolk and Norwich University Hospital, Norwich, NR4 7UY, United Kingdom

## INTRODUCTION

It is a routine practice in most orthopaedic units to obtain post-operative radiographs following primary total hip replacement (THR) and total knee replacement (TKR) operations. These radiographs are usually requested in the early postoperative period before the patient is discharged from hospital. The postoperative X-ray is used as a base line for subsequent imaging comparison and to identify post-operative complications. In order for these radiographs to serve as a useful comparison tool, reproducible high quality films are needed. It was demonstrated that only 36 % of knee replacement radiographs are of a sufficient quality to provide an accurate baseline for future studies (2). In the early postoperative period, there are various factors that can influence the quality of the X-ray film such as postoperative pain, restricted range of movement over the prosthetic joint and subsequently difficulties in patient positioning by the radiographer with the potential for repeating the X-ray films. In this study we evaluate the quality of the early postoperative radiographs (obtained before discharge) in comparison to that of the late films requested in the post-operative follow up visit.

## PATIENTS AND METHODS

We identified 197 patients following primary total knee and total hip replacements for osteoarthritis in our institute over a 3 months period (3rd January 2006 to 9th March 2006). Of whom, 87 had both early and late radiographs available (46 THR and 41 TKR). The early radiographs were taken before the patient was discharged from hospital and the late films were obtained in the out-patient follow-up clinic. Our aim was to assess and compare the quality of the early postoperative radiographs with that of the later films.

A scoring system was established to assess the quality of each radiograph (including the antero-posterior and the lateral views). On looking at each radiological image we used four parameters. These parameters were:

- Adequacy
- Exposure
- Position
- Rotation

We defined adequacy as the ability to view the whole prosthesis including the cement restrictor in cases of THR (1 point was given for adequate and 0 for inadequate). Exposure is defined as the ability to assess the interfaces between the different tissues and the cement mantle (1 point

was given for adequately exposed and 0 for over-penetrated or under-penetrated images). Position, indicates whether the prosthetic joint space is at the centre of the X-ray beam in case of TKR. With regard to THR adequate position depends on whether the AP view showing both hips or the lateral view of the prosthetic hip joint were at the centre of the X-ray beam (1 point for centred and 0 for non-centred images). Rotation indicates whether the standard X-ray views were taken with the limb correctly positioned (1 point for non-rotated and 0 for rotated views). For each radiograph, these parameters were evaluated by 2 observers.

A score (out of 4) was given for each radiographic view using the above parameters, and a total score (out of 8) was given to each set of AP and lateral X-rays.

**RESULTS**

All patients who had both early (pre-discharge) and late radiographs following primary TKR and THR were included in the study. The total number of patients was 87. The early postoperative X-rays were taken in an average of 1.5 days after surgery in the 46 THR patients, and an average of 2.2 days post surgery in the 41 TKR patients. The late films were taken in an average of 15 and 17 weeks postoperatively following THR and TKR respectively.

Each of the 87 prosthetic joint had two radiographic scores, one for the early postoperative X-ray and another one for the late radiograph. For hip replacement surgery, the mean score for the early postoperative radiographs was 4.54/8 and that for the late films was 6.87/8. The mean score for the early postoperative X-ray following TKR was 5.84/8 and that for the late postoperative films was 6.83/8. The differences in the early and late post-operative X-ray scores following both THR and TKR were highly significant (p<0.001, Wilcoxon-Rank test). Table ? illustrates a summary of the results.

**Figure 1**

Table 1: Mean postoperative imaging time and radiographic scores following total hip and knee replacement surgery.

	Early films (days)	Late films (weeks)	Early films score	Late films score	P-value (for scores)
THR	1.5	15	4.54	6.87	< 0.001
TKR	2.2	17	5.84	6.83	< 0.001

**DISCUSSION**

The value of a good quality first postoperative radiograph can not be underestimated. If the first (baseline) image is of a poor quality, there could be serious misinterpretations of the subsequent follow up radiographs. The Knee Society

Total Knee arthroplasty scoring system can not be applied accurately on poor quality images (1). This system was developed for uniform evaluation of the radiographic results of total knee arthroplasty. The frequent observation of suboptimal early postoperative radiographs prompted us to conduct this study.

A study by Glaser et al which included 200 retrospectively evaluated knee replacement radiographs, demonstrated that only 36 % of them were of a sufficient quality to provide an accurate baseline for future studies. However, this study did not address the quality of the late films or compared them with early radiographs (2). The same study which included 750 patients with TKR (200 retrospectively and 550 prospectively) showed that the postoperative radiographs taken routinely before discharge do not alter the postoperative management. Our study has demonstrated that the quality of late post-operative radiographs following TKR is significantly better than that of the early postoperative films. Obtaining an early routine X-ray following uncomplicated primary total knee replacements does not change the early management and results in poor quality radiographs. We question the necessity of obtaining an early routine postoperative radiograph and recommend requesting it at the first post-operative follow up visit to the orthopaedic outpatient clinic. Requesting the X-ray at the first visit would result in better quality radiographs as they would be obtained in patients with less pain, better mobility, and improved range of movement over the prosthetic joint. This will lead to a better co-operation with the radiographer who can easily position the patient.

This study has also demonstrated that the late post-operative radiographs following THR are of better quality than the early ones. These early radiographs were of poor quality and we question their role as a baseline for further examinations. However, there is still no published evidence to suggest that early postoperative X-rays following THR do not affect the early patient management.

There are limitations in our study. The two practitioners who assessed the quality of the radiographs were not blinded to the objectives of the study as they are part of the team conducting it. They also knew whether the radiographs were early or late follow up images. This could have resulted in a degree of bias in scoring these images.

If the first postoperative radiographs were taken in the follow up clinic, this would result in a better quality radiograph, in a more comfortable patient easily positioned

by the radiographer. It will reduce the pressure on the radiology services as the patient would not need to have the X-ray during the hospital stay. It will also help in the logistics with in the hospitals as the patient would normally walk to the radiology department in the late postoperative period and would not need transport.

In conclusion, this study has demonstrated that there is a significant difference in the quality of post-operative radiographs in favour of the late films. We recommend obtaining the first image following primary uncomplicated knee replacements in the first follow up visit. Early postoperative radiographs in the pre-discharge period need to be requested only when they are clinically indicated. A study assessing the clinical value of early postoperative

radiographs following THR is needed before reaching the same conclusion for hip replacement surgery.

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