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To cite this article: P. M. Rozing, W. H. Bohne & J. Insall (1982) Bone Scanning for the Evaluation of Knee Prosthesis, Acta Orthopaedica Scandinavica, 53:2, 291-294, DOI: [10.3109/17453678208992218](https://doi.org/10.3109/17453678208992218)

To link to this article: <https://doi.org/10.3109/17453678208992218>



Published online: 08 Jul 2009.



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BONE SCANNING FOR THE EVALUATION OF KNEE PROSTHESIS

P. M. ROZING*, W. H. BOHNE** & J. INSALL**

*Department of Orthopaedic Surgery, University Hospital, Leiden, The Netherlands, and **The Hospital for Special Surgery, affiliated with the New York Hospital, Cornell University Medical College, New York, New York, USA

Twenty-six knees were scanned after total replacement to evaluate the relationship between bone scan, pain, the presence of a radiolucent line at the bone-cement interface and loosening. A radiolucent line was often accompanied by an increased uptake over the affected condyle, but there was no significant relationship with pain or loosening.

Key words: knee arthroplasty; radioisotope scanning; radiolucent line

Accepted 19.v.81

A radiolucent line at the bone-cement interface occurs frequently after total knee replacement. A recent evaluation of geometric knee replacements revealed a radiolucent line in 70-100 per cent of the knees (Ilstrup et al. 1976). After duocondylar replacement, radiolucency was seen in 76 per cent of the knees (Ranawat et al. 1976). The clinical significance, especially with regard to loosening and infection, is still unknown. When radiolucency is accompanied by pain, one faces the difficult decision of whether or not to revise the knee prosthesis in view of possible loosening or infection.

After total hip replacement, bone scanning is considered to be a useful aid in early detection of loosening and infection (Bauer et al. 1973, Feith et al. 1976).

The purpose of this study is to evaluate the relationship between radiolucency, pain, loosening, and bone scan results.

PATIENTS AND METHOD

Twenty-six knees in 21 patients were studied. The average age at operation was 62 years.

There were 8 geometric and 18 duocondylar knee prostheses. The average follow-up time was 4 years ± 10 months.

Before and 1 year after the operation, and at follow-up, all the knees were clinically and radiographically evaluated, and scored according to the score sheet of the Hospital for Special Surgery (Ranawat et al. 1976). We defined a radiolucent line as the radiolucency one can see on the radiograph of the knee between the radiopaque cement and the bone. A thin sclerotic line may be seen in the bone around the lucency.

The radiolucency was assessed on radiographs taken at regular intervals after the operation. The width and extent of the radiolucency is dependent on the projection of the knee on the radiograph. By comparing the radiographs taken at different intervals after the operation, the extent of the radiolucency of the tibial component can be reliably assessed. The radiolucency of the femoral component can not be accurately assessed because of the metal femoral component.

A measurable alteration in orientation of the components on the radiograph was regarded as loosening which was confirmed at operation.

All knees were scanned with Technetium 99 m-labelled EHDP at follow-up.

RESULTS

Pain

The maximum score for pain is 30 points, which means no pain when walking (15 points) and no pain at rest (15 points).

Eleven knees scored 10 points less at follow-up than at 1 year after the operation.

These knees were considered to have worsened. The other group consisted of 15 knees which scored higher, the same or only 5 points less than 1 year after the operation.

Radiolucency

In 18 out of 26 knees, the tibial component showed a radiolucent line occupying more than 50 per cent of the cement-bone surface. In 8 knees this radiolucency occupied less than 50 per cent, including only 3 knees without radiolucency.

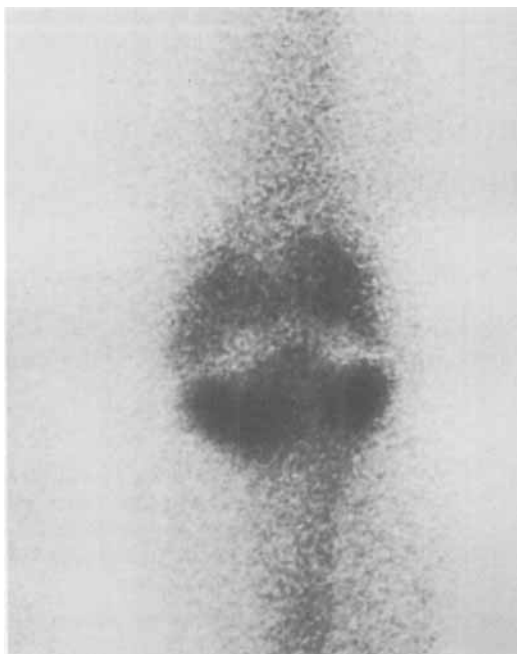


Figure 1. Roentgenograph of a knee 4 years after insertion of a duocondylar prosthesis. Radiolucent lines around the tibial component had been present for 3 years.



Figure 2. Scintigram of the knee shown in Figure 1. There is a high uptake over the tibial plateaus.

With bone scanning, the medial and the lateral tibial plateau can be assessed separately (Figures 1 and 2). The radiolucency was therefore also assessed separately for the medial and the lateral tibial plateau.

In the 26 knees, 34 plateaus had a radiolucency occupying more than 50 per cent, and in 18 it occupied less than 25 per cent. The width of the radiolucency was dependent on the position of the knee on the radiograph and was difficult to assess. All radiolucent lines measured less than 2 mm.

Scanning

Scanning was done with Technetium 99 m-labelled EHDP.

Nineteen of the 26 knees showed a high uptake over the tibial component. In 11 knees the uptake was high over the medial as well as the lateral tibial plateau, in 6 knees only over the medial tibial plateau, and in 2 knees only over the lateral tibial plateau.

Loosening

Loosening of the tibial component was confirmed at surgery in 3 knees. The indication for revision was increasing pain in knees which on the radiograph showed an alteration in orientation of the components.

One knee with a definite alteration in the position of the tibial component and a fracture of the femoral component has not been revised as yet, because the patient has no complaints of pain.

In this knee the prosthesis is considered to be loose.

The 4 knees with a loose prosthesis had an increased uptake at bone scanning and a radiolucency around the tibial component.

Pain and radiolucency

Of the 18 knees with a radiolucency occupying more than 50 per cent of the bone-cement interface of the tibial component, 8 became more painful and 10 remained the same.

Of the 8 knees with a radiolucency occupying less than 50 per cent, 3 were more painful and 5 were unchanged. There was no significant relationship between pain and the presence of radiolucency.

Radiolucency and loosening

Eighteen knees had a radiolucency occupying more than 50 per cent of the bone-cement interface of the tibial component. In this group 4 knees developed a loose tibial component, and the radiolucency had been present for 4 years. In the other 14 knees the radiolucency had existed for more than 2.5 years. In this group none of the prostheses showed an alteration of the position of the tibial component and none of them was regarded as being loose.

Radiolucency and positive scan

The radiolucency of the tibial component was assessed separately for the medial and the lateral tibial plateau. In 34 tibial plateaus there was a radiolucent zone occupying more than 50 per cent of the bone-cement interface of the tibial

component. Out of this group, 27 showed a high uptake over the plateau and 7 showed a low uptake.

Of the 18 tibial plateaus where the radiolucency occupied less than 25 per cent of the bone-cement interface 15 had a low and only 3 had a high uptake. Of these three plateaus, 2 had a radiolucency occupying 25 per cent and one showed severe wear of the tibial component. There was a significant relationship between the presence of radiolucency and a high uptake ($P \times 2 < 0.01$; Fisher's probability test).

DISCUSSION

The presence of a radiolucent line at the bone-cement interface of the tibial component is not always associated with pain or a measurable alteration in orientation of the components on the radiographs.

The radiolucency can exist for a long time (at least for a follow-up time of up to 4 years) without these signs of loosening becoming evident. Scanning of the knee with a radiolucency with Technetium 99 mm-labelled EHDP is of limited value for the detection of loosening, because there is an increased uptake over the area with the radiolucency in most cases. This is probably caused by increased bone metabolism at the bone-cement interface.

Bone scanning is more useful in knees with a painful prosthesis but no abnormality on the plain radiograph. When there is no increased uptake over the prosthesis, it is unlikely that there is infection or loosening.

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Correspondence to: P. M. Rozing, Afdeling Orthopaedie, Academisch Ziekenhuis, Rijnsburgerweg 10, 2333AA Leiden, The Netherlands.