WEIGHT-BEARING PARALLEL-BEAM SCANOGRAPHY FOR THE MEASUREMENT OF LEG LENGTH AND JOINT ALIGNMENT

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New techniques of fixation combined with callus distraction allow the accurate correction of limb-shortening and deformity. Careful measurement of leg-length discrepancy is important and clinical methods have been considered to be more exact than some radiological methods (Eichler 1977).

Standing films from hip to ankle of both legs are commonly used with a 10 ft (3 m) tube-film distance. We also use 5 cm grid lines which help with the assessment of joint alignment. For measurement of leg-length discrepancy, however, the image distortion caused by the fan shape of the X-ray beam causes inaccuracy (Horsfield and Jones 1986). A better method is ortho-roentgenography (Green, Wyatt

and Anderson 1946) which uses individual exposures, centred over each joint, on a single film, but it is usually performed on a supine patient and gross discrepancy may necessitate a single film of each joint.

CT is more accurate (Huurman et al 1987), but minimal discrepancies in the placement of markers during the measurement procedure may produce errors. This technique has to be used with the patient supine and gives no information on weight-bearing joint axes.

Scanography is well documented and this involves movement of an X-ray tube with a slit diaphragm during the exposure (Kreel 1979).

Fig. 1

Fig. 2

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We have developed a method for standing examination with a simple fluoroscopic exposure which allows mechanical axes and precise leg-length to be displayed on a single film.

Method. The patient stands on the foot-rest of a remote screening table with an overcouch tube (Fig. 1) A 105 × 35 cm cassette with graduated screens is placed behind the patient with a 5 cm alignment grid in front of it. The feet are positioned so that the vertical axes of the femur and tibia are parallel with the film and are turned slightly inwards to

reduce distortion caused by the fan-shaped beam at its lateral margins. The tube collimator is then set so that a 1 cm wide transverse slit beam is produced, which just covers the cassette laterally.

The film is exposed by moving the tube from below the feet to the pelvic crests in one continuous movement during a screening exposure. The exposure can be banded to include only the ankle, knee and hip in order further to reduce the radiation dose. The fluoroscopic exposure factors are 5 mA and 95 kV. The only exposure variable is the speed of the tube movement, which is made much more slowly at the upper end, around the pelvis. This produces an evenly exposed image from ankles to pelvis (Fig. 2).

When there is a gross discrepancy in leg length, wooden blocks are placed under the shorter limb to achieve precise parallel positioning. Metal markers can be placed on the heels in order to include calcaneal height in the measurement. Flexion deformity is still a problem, but this can be solved by careful positioning, the measurement of knee flexion and object-film distance, and simple geometry to compensate for the parallax error.

The examination may also be carried out in the supine position when appropriate.

Discussion. We have used this method in over 70 cases, and tests using phantoms have shown an error of only 0.1% for leg length, corresponding to 0.9 mm in a 90 cm limb. Weight-bearing alignment is well shown and accurate calculations can be made for corrective osteotomies. The radiation dose is reduced by 50% compared with the conventional method.

We describe a safe and accurate technique which can be used at any centre with a suitable fluoroscopic table.

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TIBIAL STRESS FRACTURES IN TWO PROFESSIONAL GOLFERS

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Stress fractures of the tibia are well known in athletes and military recruits and have also been described in ballet dancers and waitresses. They are usually transverse, involving the diaphysis (Devas 1958). Longitudinal undisplaced fractures have been described, but only two spiral stress fractures have been reported (Spector et al 1983). Two complete distal tibial fractures in professional golfers are thought to have arisen from stress fractures.

Case 1. A 38-year-old professional golfer playing in a tournament had sudden severe pain in his left shin while making a drive from a tee and collapsed with an undisplaced spiral fracture of the distal third of the tibia (Fig. 1). In the preceding few months he had complained of shooting pains in his left shin.

He was treated in plaster and then a tibial gaiter, and was able to return to professional golf after nine months.

Case 2. A 40-year-old professional golfer with a three-month history of 'shin splints' treated by physiotherapy and made worse by ultrasound, felt a severe pain in his left shin. Witnesses reported hearing a loud crack. He had sustained a comminuted spiral fracture of the distal tibia and fibula (Fig. 2).

He was treated in a long-leg cast with a calcaneal pin, but the position deteriorated and he required locked intramedullary nailing. He returned to professional golf after ten months.

Discussion. Stress fractures have been described in many bones. The trabecular component fails during cyclical stressing causing microfractures which often involve only one cortex. Complete fracture may follow.

There is a correlation with decreased tibial bone width (Milgrom et al 1989), and a history of local pain on increased or prolonged exercise, relieved by rest, suggests the diagnosis. Radiology is often normal until periosteal reaction, endosteal thickening or a radiolucent line appear. Bone scintigraphy may help earlier diagnosis and thermography may provide reliable screening.

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