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Radiographic Examination of the Feet

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The standardization of radiographic techniques assists in the demonstration of bony abnormalities. This paper describes simple devices which provide easy methods of obtaining comparable radiographs of the feet that will aid in the early diagnosis of lesions and in the planning of effective treatment.

Chronic ulceration of the anaesthetic foot is one of the greatest hindrances to the rehabilitation of leprosy patients. The scarred foot is ulcer-prone because scar tissue is less able to withstand the forces that act upon it in walking than is normal healthy skin.

The recurrence of ulceration may also be due to internal trauma caused by periosteal and bony irregularities. The latter may have resulted from infection and damage to the bones themselves, or may be caused by the laxity of ligaments and tendons associated with paralysis and paresis, or with increased mobility of joints after peri-articular bone damage.

In gross deformities, the roughness and irregularities of the bone may be felt by a sensitive palpating finger. In less obvious lesions, unsuspected roughness may sometimes be visible on a suitable radiograph. When the bone is examined at surgical operation, the actual damage may be found to be worse than the radiograph had suggested.

For adequate assessment of bone lesions of the feet, at least 2 radiographic positions are necessary. The view commonly ordered—the anterior-posterior (A.P.) (Kleiger, 1963)—is often taken in such a way as to show only the distal portion of the foot anterior to the cuneiform bones. This view can include the toes and the talus head, if carefully placed; both feet can be fitted on one 8 x 10 in (20 x 25 cm) radiographic film. However, in this view the small tarsal bones tend to overlap one another and so cannot always be clearly defined. To eliminate this problem, the anterior-posterior-oblique (A.P.O.) view is preferred. In this view, the radiographic beam is at right angles to the skin of the dorsum of the foot so that it strikes the film at an angle of 15° in both planes (Clark, 1956). The difference in the clarity of the tarsal bones as seen in these 2 views is shown in Figs 1 and 2.

A simple holder has been devized to provide the required constant angle so that the radiographic beam could be set vertically to give comparable pictures (Fig. 3). This holder has a rhomboid base, and a sloping square top (Fig. 4) on which the cassette rests. The construction of this device should present no difficulty to a competent carpenter. It has been found easier to cut out the base first. The rhomboid shape can be made by marking out the diagonal C-D (Fig. 5) 17 in (43 cm) long, and fixing the other angles at the intersecting point of arcs made

Fig. 1. Tarsal bones as seen in AP view.

with a compass at a radius of 11.6 in (29 cm) centred on the points C and D. The 4 sides are then cut: 2 of them are mirror images, as in Fig. 6, and 2 as in Fig. 7. These sides are mirror images and not identical because the corners have to be bevelled. Since the base is a rhomboid and not a square, the angle of bevel will vary. The bevels at point C and D will be at an angle of 43°, and those at A and B of 47° (Fig. 8). It should not be necessary to use a protractor to obtain these angles, provided it is remembered that the outer length of the sides is 11.6 in (29 cm, i.e. the same as the base) and that the sides must be exactly vertical to the base. When the sides are all attached to the base, it will be found that they will support the top, which should be a 12 in (30 cm) square, whose diagonal of 17 in (43 cm) is the same as the original diameter (CD) of the base, and whose sides are inclined at an angle of 15°. Projecting lips have now to be added to the lowest corners to prevent the cassette slipping off this inclined plane.

With this device, the patient sits on a stool with the foot to be examined resting on the top half of the cassette, the lower half of which is protected by lead sheeting. For the second foot, the cassette is rotated through 90°, as shown by the footprints superimposed on Fig. 4. For routine examination a K.V. is selected which will slightly under-expose the talus and slightly over-expose the toes, but with experience both can be adequately seen.

The second view is the lateral view of the tarsals. This view does not show the phalanges, but reveals many of the tarsal-bone lesions which are not shown in an

Fig. 2. Tarsal bones as seen in APO view.

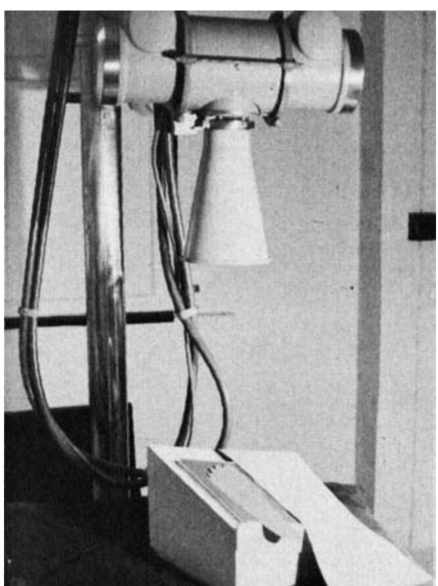

Fig. 3. Device for APO view showing head of radiographic machine, position of cassette and lead cover.

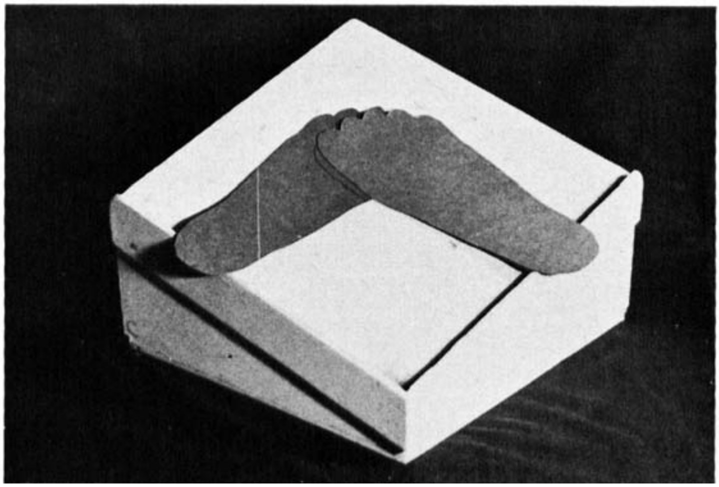

Fig. 4. Device for APO view.

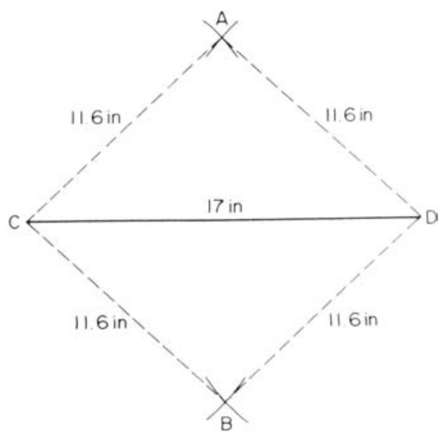

Fig. 5. Diagram for construction of the base.

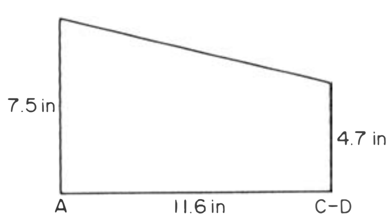

Fig. 6. Diagram for construction of sides A-C and A-D.

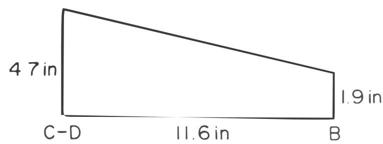

Fig. 7. Diagram for construction of sides B-C and B-D.

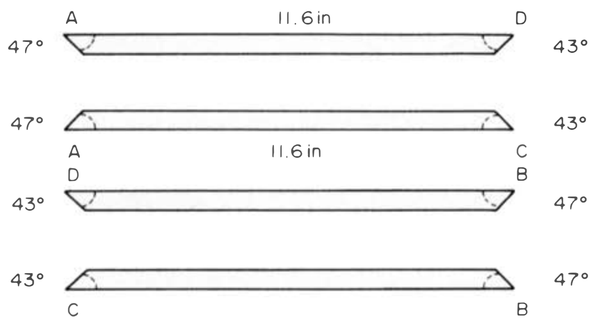

Fig. 8. Diagram to show the bevels of the sides so that they will form a rhomboid.

Fig. 9. Appearance of tarsal bones as seen in sitting lateral view.

AP or APO view. It is also of great value in indicating roughness of the bones of the foot that may cause ulceration due to trauma within the foot itself. Standard descriptions are for the lateral view to be taken in the sitting position, but this frequently results in a degree of obliqueness, so that the ankle-joint and the sole of the foot are not accurately visualized. It may also result in consecutive films that are not really or strictly comparable because of a difference in position.

Fig. 10. Appearance of the same foot in standing lateral view. N.B. cuboid pressure.

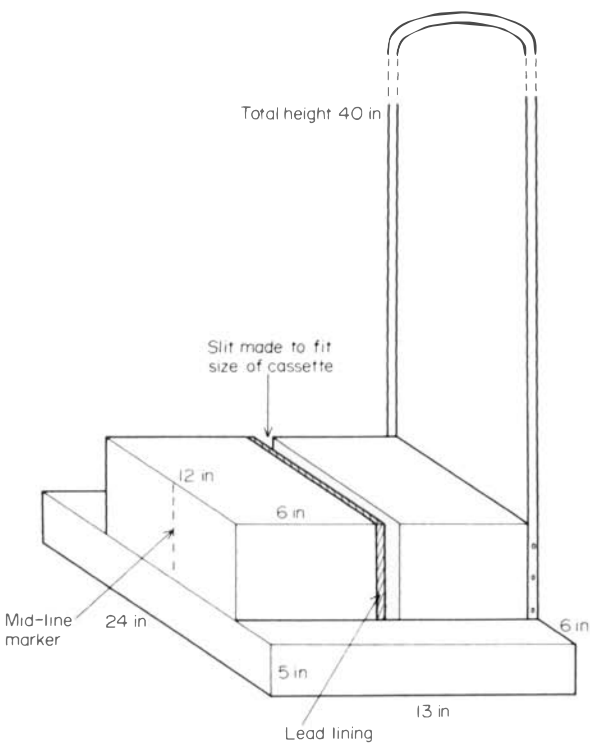

Fig. 11. Construction diagram for holder for standing lateral view.

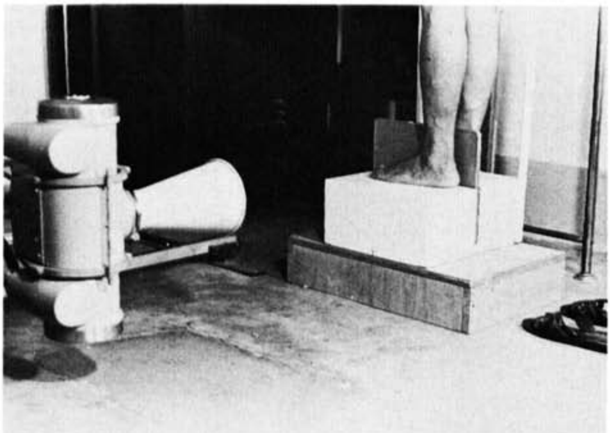

Fig. 12. Holder and cassette in use for standing lateral view.

Ideally, this radiograph should be taken in the weight-bearing position, which in the normal foot provides a true lateral view. A standing lateral position also reveals any irregularities of the weight-bearing surface, as well as any deformity that may occur during weight-bearing that is due to laxity of joints or ligaments. This is seen in Figs 9 and 10, in which a chronic ulcer was present over the mobile cuboid bone, which, however, appeared in a normal position in the sitting view.

To achieve a uniform lateral view with minimal inconvenience, a simple wooden holder (Fig. 11) was made to hold the cassette vertically (Fig. 12). The lower half of the cassette was shielded from exposure by a lead sheet incorporated into the holder, so that first one foot could be radiographed, and then the patient and the cassette turned round and a radiograph of the other foot taken. In this way the 2 feet can be fitted, sole to sole for ease of comparison, on to one 8 x 10 in (20 x 25 cm) film, or an APO and a standing lateral view of the same foot can be fitted on to one film.

In grossly deformed feet it may not be possible to take a standing lateral view, but the provision of a hand-rail makes it possible to take the same view without actually involving weight-bearing in patients in whom this is not desirable. In these feet, however, it will be necessary to order specific views required for each different stage or correction.

The standing lateral view also provides a free view of the anterior and posterior portions of the tibia and talus, as well as the best view of the posterior tarsal bones.

Ideally, for each patient control radiographs of both feet, in both views, should be available at diagnosis for the early detection and treatment of bone lesions, since many of these lesions develop insidiously (Warren, 1971). However, where films and funds are in short supply, 2 views of an affected foot can be fitted on to one film 8 x 10 in (20 x 25 cm). Although the diagnosis of minor lesions is easier when the radiographs of both feet are available for comparison, even these lesions can, with a little practice, be detected from one radiograph so that early and efficient treatment can prevent or minimize future disability.

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