FOOTWEAR AND THE PREVENTION OF ULCERS IN LEPROSY

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The footwear to be described in this paper has been developed at Oji River during the past four years. It is the result of pooling of ideas and experience from many different sources including Mr. Paul W. Brand's Institute in Karigiri where the author was privileged to hold a WHO Fellowship in 1960.

The paper is divided into three parts. Section I describes the general characteristics and construction of (a) the sole of the shoe and (b) the upper. Section II describes the indications at present being used for prescribing different types of footwear and Section III gives details of sources of supply of materials.

The sole of the shoe

The trauma of walking, which is the immediate precipitating factor in almost all cases of plantar ulceration in leprosy patients, can be resolved into three components: friction, flexion and impact.

(*i*) *Friction.* Friction acts between the sole of the foot and the walking surface at all stages of walking roll. It is reduced to an acceptable minimum by any type of well made and well fitted footwear. The principal features to look for are:

(*a*) A snug fit in the heel and across the forefoot to prevent chafing inside the shoe.

(*b*) A free space of approximately half an inch between the tip of the toes and the end of the shoe. However well made the upper, during walking the foot oscillates backwards and forwards inside the shoe.

(*c*) Complete absence of rough stitching, nails and other irregularities inside the shoe.

(*ii*) *Flexion.* Flexion acts almost entirely at the metatarsophalangeal joints (PRICE, 1959) and is responsible for a high proportion of plantar ulcers. It can be controlled absolutely by means of a rigid sole and nothing better has yet been suggested for this than the clog sole (PRICE, 1960).

The essential features of the clog sole are illustrated in Fig. 1. To be comfortable and effective it is essential for the clog sole to fit the foot accurately and this is so even though the majority of our clogs now have a resilient insole.

The insole cast must not be so great as to produce excessive dorsiflexion of the toes. This is of great importance in cases where the toes are deformed or where there is any tendency of rigidity at the metatarsal phalangeal joint.

Bridging of the foot in the shoe (Fig. 2) is the result of too much insole cast and will cause ulcers at the tips of the toes.

There must be an effective arch support incorporated in the sole or added later as part of the insole (TURNER, 1961). In a properly made hand carved Lancashire clog much of the weight of the body is borne on the instep and the wearer rocks forwards on to his metatarsal heads only during walking.

The clog soles are carved for us here by a self-taught wood carver (Fig. 3), using traditional and locally made tools and traditional wood—*Rauwolfia macrophylla*. The traditional wood used for clogs in Britain is *Alder*, but most modern clog soles are made of *Beech* and any type of timber which is reasonably light and durable and well seasoned, is suitable.

Clog soles can be purchased ready made, but, though we have found them a little less costly to use than hand made clogs, we prefer hand made clogs principally because it is easier to get a good fit with the hand made sole. The carver should never make a sole without seeing the patient and in many cases a plaster-of-paris cast of the foot is taken to guide him throughout the carving process (Fig. 4). The clog sole can be shod either with split pieces of motor tyre or special clog irons. If it is desired to simplify the clog sole, the heel shank can be left out, but the cast is absolutely essential and should approximate to the standard dimension for Lancashire clogs. For size 8 clogs this is one and a half inches, other sizes in proportion (Fig. 5). Certain categories of patients do not need or will not accept such absolute rigidity as the clog sole provides; for them, we use a simple sandal with microcellular rubber insole; it does not completely eliminate flexion but somewhat reduces it (Fig. 6).

(*iii*) *Impact*. The trauma of impact may be reduced by means of a resilient insole. We have experimented with a number of different materials and have concluded that microcellular rubber of approximately 15 to 20 degrees shore, as recommended by Mr. Paul Brand, is the best general purpose material (ANDERSEN, 1961).

As an insole material for clogs, industrial grade "Rubazote" of half an inch thickness is proving satisfactory here in a pilot trial. We are also experimenting with a sponge rubber insole which can be cold cast to fit the most badly deformed foot accurately. This is an Imperial Chemical Industries product known as 'Silcoset' Foam Rubber.

The Upper

We find the open type sandal upper (Fig. 7a) most satisfactory as it

requires very little skill to make it and is quite cheap and easy to repair.

The clog uppers must be fixed to the sole with braised nails as ordinary nails rust too quickly. We have also found button clasps (Fig. 7b) a useful substitute for buckles for patients whose hands are too badly deformed to be able to use the buckle fitting.

Indications for Footwear

(a) *The foot with no previous ulceration.* This is the most important foot to care for. Fortunately it is not necessary to provide all leprosy patients with protective footwear. Although it is not possible to be dogmatic, the following indications have proved of practical value:

(i) Feet showing misreference (WEDDELL, G.) of more than 2 cm. (Fig. 8).

(ii) Feet with oedema and tenderness over the metatarsal heads (PRICE 1959).

(iii) Feet with atrophy of the skin associated with lepromatous leprosy.

The great majority of feet in the above categories can be protected from ulceration by a pair of microcellular rubber slippers. A few feet in category (ii) may need rigid sole shoes. The patients are on the whole rather resistant to wearing the rigid sole shoes and, as these shoes are considerably more costly to make than the simple micro-cellular rubber sandal, our policy is to issue these patients with the simple sandal. After the initial treatment by bed rest, we watch them carefully at weekly intervals. Later, clogs are made if necessary.

The microcellular sandal consists of exactly the same material as the insole material described in Section I (a) (iii) (Fig. 6).

(b) *The Rigid Foot.* Flexion is no longer a problem in this type of foot and re-ulceration can, in most cases, be controlled by simple micro-cellular sandals (Fig. 9). If the plantar surface of the foot is so grossly scarred and so deformed that weight is borne on one or two prominent points (Fig. 10), then, rigid footwear with a soft insole accurately filled to the contour of the foot is essential.

Formal surgical correction is not often possible in these feet, but "tidying up operations", for example, the removal of the deformed and twisted toes are well worthwhile if the patients can be persuaded to accept them.

(c) *The Scarred but still Mobile Foot.* Even following the surgical correction of paralytic deformities, this type of foot must be shod with rigid sole shoes preferably with a soft insole, even if the patient has had only one ulcer. This statement holds good for the first two years after the ulcers heal. After that, if the patient has learned to care for his foot, he may then be able to remain ulcer-free using microcellular rubber sandals.

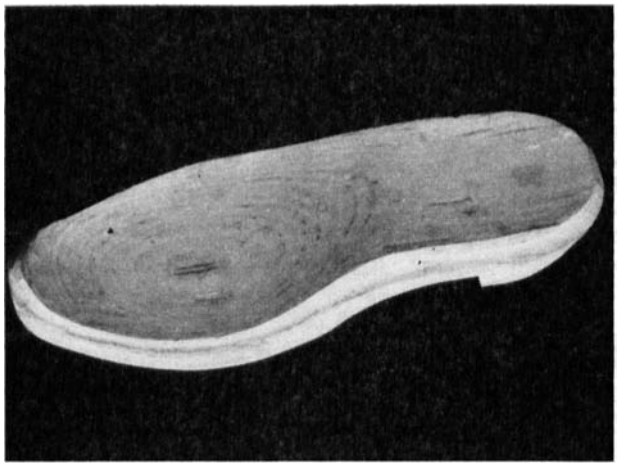

FIG. 1. Photograph of Lancashire clog. Sole made by R. Turner of Clitheroe. The cast, i.e., the amount of turn up of the toe is 1½ inches. The upper surface is slightly concave from side to side and there is a carved in arch support. The groove round the upper edge of the sole is called the "grip" and is only required if a boot type upper with a waterproof joint is needed.

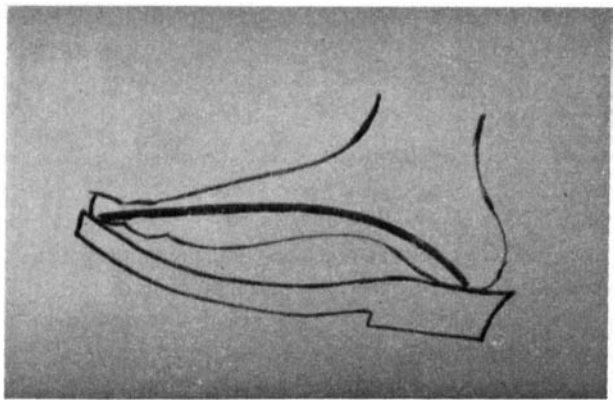

FIG. 2. Diagram to illustrate "bridging". This occurs if too steep an insole cast is used with a rigid or deformed foot.

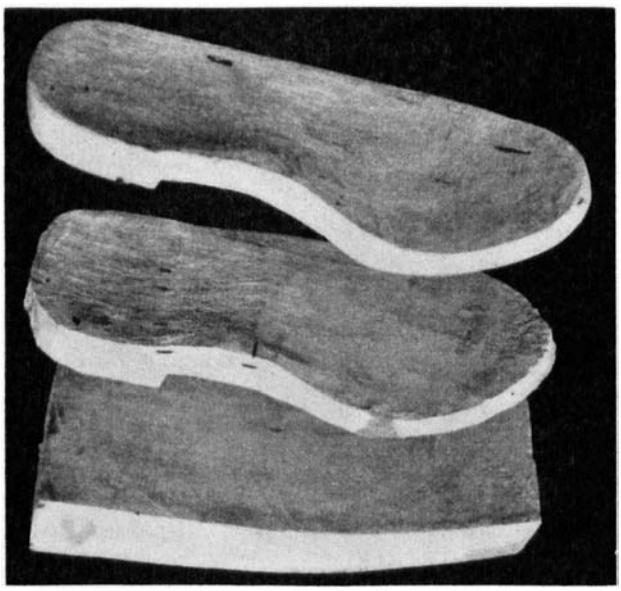

FIG. 3. Photograph to show three successive stages of clog making:
i. The wooden block. ii. The rough carved sole. iii. Finished sole.

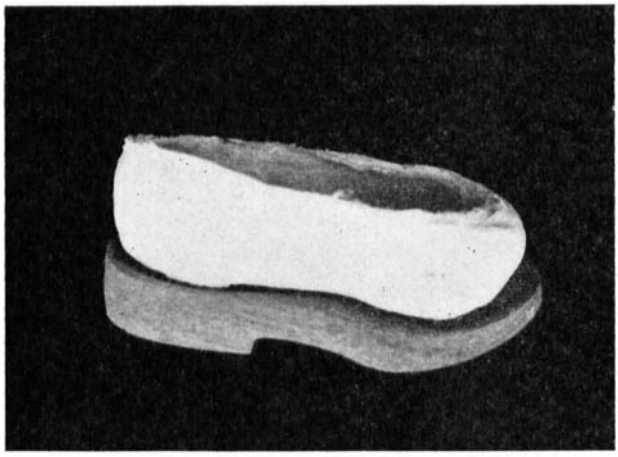

FIG. 4. Photograph to show Plaster-of-Paris cast used to guide the carver in making a special carved clog for a deformed foot (PRICE 1959).

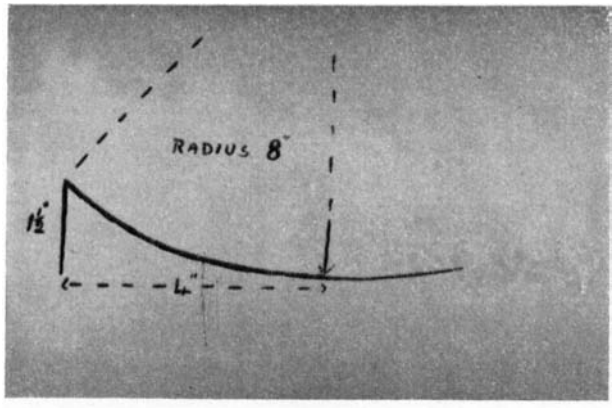

FIG. 5. Diagram to show the cast. The under sole curves smoothly upwards from the mid-sole to the tip of the clog.

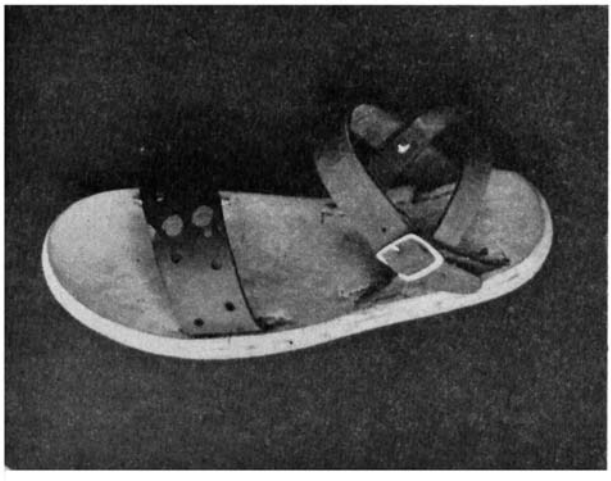

FIG. 6. Photograph of the microcellular rubber sandal. In this case the upper is made of rubber (strips cut from inner tubes). Leather or canvas strips can also be used.

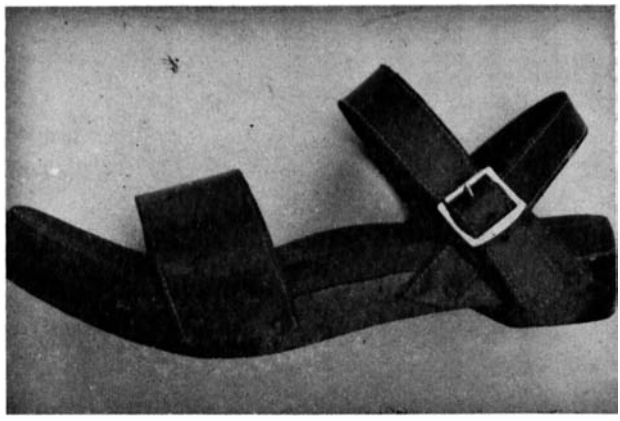

FIG. 7A. The clog. This clog has a "Rubazote" insole. The upper is of leather.

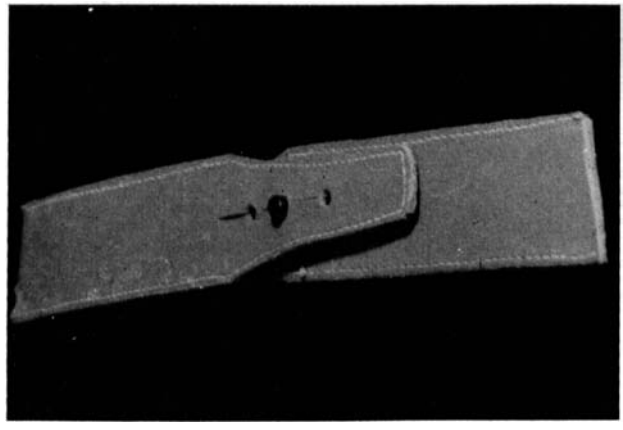

FIG. 7B. The button clasp. A simple studlike device which can be manipulated by badly deformed hands.

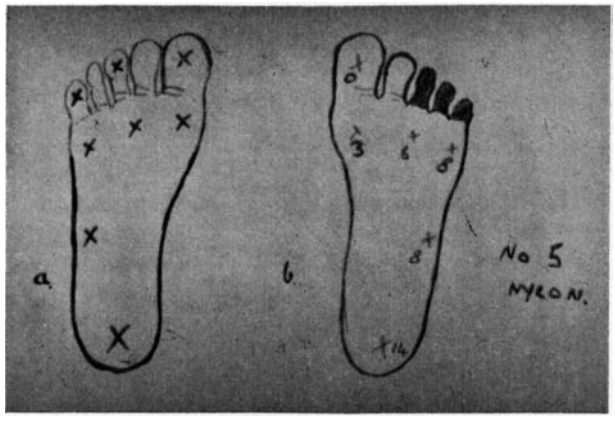

FIG. 8. (*a*) Diagram to show the plan used to record misreference quickly. Standard points marked X are tested in random order and degree of misreference if any recorded in centimetres. (*b*) Misreference map be taken from case records.

FIG. 9. Foot print (Harris and Beath Mat) of a patient with scarred but broad based foot successfully treated with microcellular rubber sandal.

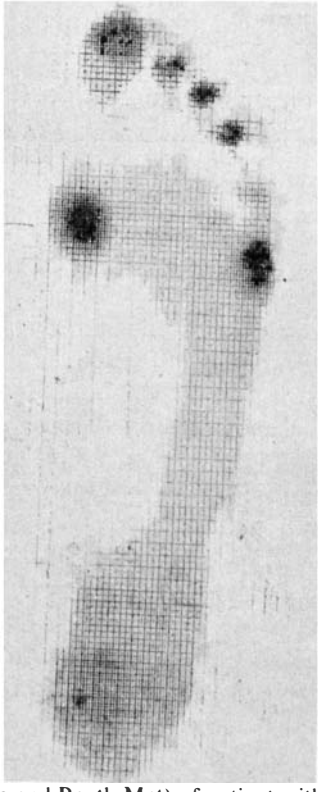

FIG. 10. Foot print (Harris and Beath Mat) of patient with rigid foot and spots of high pressure needing special carved clogs.

(d) *The Healed Heel Ulcer.* "Patients who have had heel ulcers must have rigid sole footwear with resilient insoles" (WARD, D.). For practical purposes, this dogmatic statement is, in my experience, true and although a few patients with heel ulcers can get away with wearing microcellular rubber sandals, the large majority have to continue to wear rigid sole footwear.

Sources of Supply

(a) *Microcellular Rubber:* Nigerian Shoe Factory Limited, P.O. Box 141, Kano.

(b) '*Rubazote*': Expanded Rubber Company, Mitcham, Croydon, England.

(c) *Buckles, Button Clasps and Irons for Clogs:* James Horsefield Limited, 26 Paradise Street, Sunbridge Road, Bradford.

(d) *Braised Nails:* Charles Lane and Sons Limited, Leeds Nail Works, Leeds 10.

(e) *Manufactured Clog Soles:* British Clog Manufactures Limited, Snaithe, Goole, Yorkshire.

(f) '*Silcoset*' *Rubber:* Imperial Chemical Industries Limited, Hexagon House, Blackley (P.O. Box 42), Manchester 9, England.

(g) *Adhesives:* An excellent adhesive can be made in countries where rubber is produced by dissolving smoked rubber sheet in petrol.

(h) Technique of hand making of clogs (R. Turner, 82/86 Lowergate, Clitheroe, Lancs.)

Appendix

The footprint mat was obtained through the courtesy of Dr. Harris of Toronto who invented the mat (Hardy and Clapham). The mat has a smooth upper surface, the under surface bears a set of intersecting rubber ridges of different heights designed to give an indication of the pressure over the sole as a whole. A study is being made of foot prints in normal people and in leprosy patients with or without anaesthesia and will be published in due course. It is our impression that this is going to be a most useful clinical instrument for helping to assess the type of footwear needed by leprosy patients.

Acknowledgements

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