Editorial

WALKING ON AIR

We have known for a long time what we were looking for. Now at last the plastics industry seems to have come up with a material to meet our need. To prevent trophic ulcers the pressure forces of walking must be softened and spread over as wide a surface of the foot as possible. To do this we have needed either a soft material, to cushion each step, or a material that could be moulded and shaped to the foot so that every part of it shared the weight of the body. Best of all would be a material that would be both soft and easy to mould. For world-wide use it has to be inexpensive as well.

Foam rubber, sponge rubber, and foam plastic such as polyurethane foam, are all soft materials whose softness depends on the fact that they are full of air. But such material is a mass of air-bubbles which connect with each other, so that when the foam is squeezed the air escapes and the material is compressed or flattened. The result is that when thus flattened it is no longer soft.

A great advance on the foam or sponge is the closed-cell system of tiny bubbles of air or nitrogen which are formed in rubber by a chemical reaction. Because these air-cells do not connect with each other, the air cannot escape when the rubber is squeezed. Thus, when a foot presses down on a sheet of microcellular rubber, the material is not flattened and the foot floats on the compressed air in the tiny air-cells. Microcellular rubber is a great advance on earlier materials and is still to be recommended for routine use as an insole for the protection of insensitive feet.

When a patient's feet are deformed as well as insensitive, there are often points of high pressure which may become ulcerated in spite of the soft insole. For such feet it is necessary to have a moulded insole which is shaped to all the irregularities of the foot and allows equal pressure everywhere. If microcellular rubber is to be used for this, it has to be carved or shaped with great skill and any mistakes may result in unequal pressure, for this material cannot be moulded directly on to the foot. There are materials that can be moulded directly on to the sole of the foot, such as mixtures of cork-dust and rubber latex, and these are quite good, but they are not soft. Polyethylene is a plastic material which softens with heat and which can be moulded directly on to the foot while soft and which gives a perfectly moulded insole. This material was tried in Kano, Nigeria, 12 years ago, but it has two disadvantages—first, the heat required to soften the plastic may burn the foot, so that direct moulding presents problems; second, when the moulded insole sets it becomes hard.

Now industrial chemists have discovered how to produce a system of bubbles in polyethylene plastic. This is a closed-cell system like that of microcellular rubber so that the air cannot escape. This product is better than rubber, however, because it can be heat-moulded directly to the foot, and it does not burn the foot because the air-cells do not conduct heat well. As a final advantage, this material is cheap and easy to work. In a rather coarse large-celled form it has beeen used for some years for making life-belts and flotation equipment. Now it is produced in fine-celled sheets, made by Expanded Rubber and Plastics Limited, and has been placed on the market for medical use by Smith and Nephew Ltd., under the trade name of Plastazote.

Used as a flat insole, Plastazote probably has no advantages over microcellular rubber. Its value is as a moulded insole suitable for the deformed foot or the foot which has re-ulcerated even when using a regular soft sandal. Thus, Plastazote must always be moulded and it is therefore essential to have an oven in the workshop. A small home-made oven heated by a primus stove or a gas burner is suitable so long as baffle plates divert direct heat from the flame.

The temperature must be kept between 140° and 150° Centigrade, but a thermostat is not needed. A projecting thermometer allows the shoemaker to do his own regulating.

Unfortunately, some of the instructions that accompanied early samples of Plastazote suggested that patients should stand on the warmed material to make the mould. While this certainly shapes the material to the foot, at the same time it flattens the air-cells under the prominent parts of the foot and thus takes away the softness and the resilience where it is most needed. The proper way to use Plastazote is to have the patient seated in front of a large block of really soft rubber foam or polyurethane foam at least 6 in. (15 cm) thick. A sheet of Plastazote, $\frac{1}{2}$ in. (1.25 cm) thick, is cut to shape a little larger than the foot and put into the oven for 5 minutes. It is then placed on the block of soft foam and the patient's foot placed on it. The shoemaker tells the patient to press his foot down into the foam without flexing his toes. The foam will bulge around the foot and shape the Plastazote so that it cups the heel and follows all the contours of the foot. A small card may be placed under the toes to prevent the Plastazote curving up around the ends of the toes and restricting their movement in the shoe. In 3 minutes the insole will be set and will be of even thickness everywhere. The only remaining problem is to support the shape from below, because the material is not strong enough to maintain its shape under heavy weights. A paste of sawdust or cork dust and rubber latex may be used to fill in the hollows between the insole and the undersole and to support the edges of the insole where they form a rim to cup the foot. A problem with any cupped insole is that dust and small stones may lodge in the hollow, whereas they might not stay on a flat insole. Patients should be warned about this.

The question is bound to be asked: "Can moulded Plastazote insoles be used to heal trophic ulcers as well as to prevent them?" The answer is that nobody should be allowed to walk on a trophic ulcer unless the foot is fully splinted, as in a plaster cast. However, when plaster casts cannot be used, or are refused, a moulded Plastazote insole on a rigid undersole or clog may allow a well localized ulcer to heal even though the patient continues to walk. The fact that Plastazote is washable is an added advantage in this type of case.

While further experience will certainly define further problems, and suggest improvements, there is no doubt that a new advance has been made in the war against trophic ulceration. So with thankfulness we move forward, walking on air.

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