

GAIT FACILITATION BY PLANTAR PUNCTATE PRESSURE STIMULATION IN SPASTIC PARAPARESIS

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ABSTRACT. In some patients with spastic paraparesis the strength of the voluntary retraction of the leg was found to be increased when punctate pressure was applied to the planta. A brief preliminary account is given of the favorable effects on their gait obtained when they were supplied with individual arch supports built up with pads at sites corresponding to the parts of the planta yielding the optimal effects.

In the course of an analysis of the individual reflex patterns of patients with spastic parapareses we found that the strength of the voluntary retraction of the lower limb (flexion of the hip and knee and dorsiflexion of the foot) can be appreciably increased by application of moderate pressure to the planta; concomitantly, the electromyographic activity in individual flexor muscles is enhanced. The effect is more or less pronounced as different parts of the planta are stimulated, and the sites yielding the optimal effect may vary widely among different subjects. Primarily, the result is apparent as a wider range and/or a faster speed of the voluntary movement, which the patient experiences as a reduction of the effort needed for the movement, but measurements performed in single groups of muscles have also revealed that there is an increase in the voluntary isometric contraction power.

The observations thus made prompted a closer investigation to find out whether, in cases of gait disorders arising from the patient's difficulty lifting his leg and dorsiflexing his foot, it might be profitable to transfer part of the normal pressure on the planta during the stance phase to areas which, when subjected to pressure, give a facilitation of the flexors of the lower limb. The effects of such punctate pressure stimuli have now been studied in seven patients with spastic parapareses due to different types of spinal lesions and result-

ing in pronounced gait disorders. The optimal areas for application of the pressure stimulation were determined in each single case by exploring the planta with the examiner's finger or a blunt probe, and conventional arch supports were supplied with pads of rubber, felt or leather (Fig. 1) at sites corresponding to the parts of the planta to be stimulated (Fig. 2). These supports have now been used by the patients in their ordinary shoes almost every day for one up to three months, and their effects on the gait have been evaluated by measuring each patient's walking speed and maximal uninterrupted walking distance when supplied with and when not supplied with the supports but otherwise under reasonably uniform conditions. The patients have also been requested to report their personal impressions of the effects.

The results obtained in the cases studied so far have been favorable, the gait of the seven patients being markedly, in some cases very markedly, improved. When not using the supports, their maximal uninterrupted walking distance ranged between 50 and 400 meters, and all had difficulty clearing the toes from the floor when swinging the foot forward. When supplied with the supports, two patients could walk a three times longer distance, two more than the double distance, and one patient an about 50% longer distance; five patients increased their walking speed by 10-100%. They all found it easier to lift the foot from the floor in the swing phase when using the supports and could then more easily avoid toe dragging. Although most of the patients had good plantar sensibility, no untoward effects were observed except a slight tenderness during the first few days in the part of the planta subjected to the pressure stimulation. The gait pattern of six

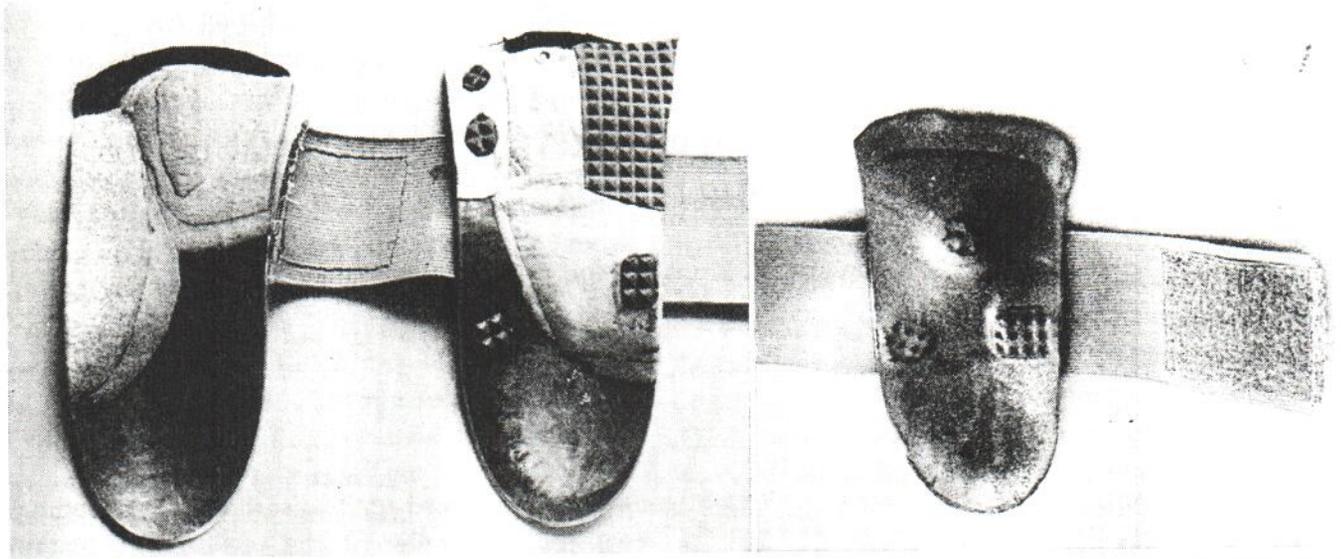


Fig. 1. Three different arch supports in various stages of preparation. The support to the left, with felt pads pasted onto the metal at the areas to be stimulated, was made for the left foot in Fig. 2 A; that in the middle, with rubber pads of tread-grip type pasted onto the felt or directly onto the metal to increase the pressure, was made

for the right foot in the same figure. The support to the right, covered with leather and shown ready for use, was made for the right foot in Fig. 2 B. Straps with velcro tape were sometimes used to keep the supports in place.

of the patients when using and when not using the supports was studied by means of interrupted-light photography, and in five of them the planta was found to be more elevated in the swing phase when they were supplied with the supports.

Arch supports of the type described above should prove useful as an alternative to foot raising braces, particularly since they should make it possible for the patient continually to train the flexors of the lower limb.

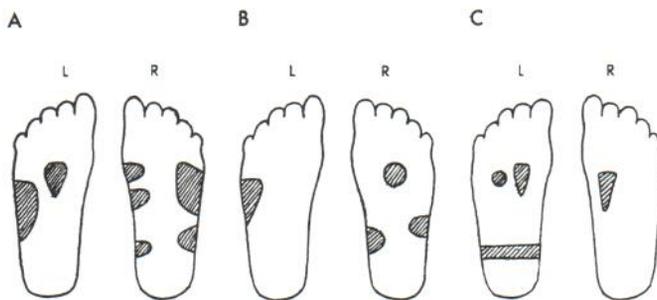


Fig. 2 A-C. Plantar areas yielding optimum facilitation of leg retraction in three patients. Drawing from dorsal side of foot.

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