

Developments in modern orthopaedics for children

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During the past three decades my generation has seen a fundamental structural change in the field of orthopaedics. At the time of our youth, one-third of orthopaedic patients suffered from tuberculosis of the joints, i.e. from tuberculosis of the bones, another third suffered from the sequels of poliomyelitis, while the remaining third included all other orthopaedic diseases. In the interim, the first two groups have disappeared almost completely and their places have been taken by other orthopaedic defects.

Patients with Meningomyelocele

Due to the technical advances of modern paediatric surgery almost all new-born suffering from rachischisis or meningomyelocele, who almost always have a complete cross-sectional paralysis as well as total incontinence of bladder and rectum, are now kept alive by immediate plastic resection whereas before they died within a few days from the decubital ulcers associated with ascending spinal meningitis. Today, these new-born children are transferred, after just a few weeks, from paediatric surgery to orthopaedics where they are given further medical and orthopaedic-mechanical therapy which continues throughout their lives. The therapy consists firstly of the fitting of mechanical devices with individualised complementary corset structures, and secondly, of later orthopaedic-surgical treatment, either by means of stabilisation of the hip through corrective postural osteotomy and iliopsoas translocation, or stabilising plastic surgery of the spine in the region of the defective vertebrae.

Of particular interest in this field is the treatment of children suffering from rachischisis with mechanical devices enabling them to achieve an upright position and subsequently

to walk. It is the first task of orthopaedic technique to help rehabilitate these "problem children", enabling them to assume the basic *orthostatic* posture with the help of a mechanism for standing erect. By providing a mechanically achieved upright position through a posture and motion device that supports the affected lower part of the skeletal segment of the spine and the lower limbs, the functions of the internal organs, such as the heart and the circulatory, digestive and renal systems, are adapted gradually to the orthostatic posture of *homo erectus*. In this way, phylogenetic programming achieves by mechanical means an upright position of the human skeletal system which otherwise would be impossible from the ontogenetic standpoint.

The mechanical devices which the orthopaedic workshop of Herbert D. Stolle at Barmbek General Hospital in Hamburg, working together with the Orthopaedics Department of the Head Physician of Provincial Self-Government, Dr. Bernbeck, have developed for total cross-sectional paralysis, are very simple in their basic concept and design (Bernbeck 1954 and 1974). They are light in weight, quickly adjustable, easy to maintain, and inexpensive to manufacture. Plastic materials such as low-density polyethylene (Resur) and low density polyethylene foam (Plastazote) are mainly used.

After a plaster cast has been made, which should be done with a slight allowance for correction of limbs and trunk, the plaster matrix for the construction of the device is moulded and traced. Two-thirds of the total surface of all parts of the body that require to be supported and immobilised are covered by the plastic material. The flexibility of the material makes it easy to don the device. Areas that are especially pressure-sensitive are covered with a double layer of Plastazote. The open one-third of the body parts is protected by kneecaps and Velcro fasteners, or by a partial denim corset, or by wide leather straps at the level of the trunk. These are inter-connected by alu-

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minium or steel strips, with or without articulation. Because such cases are generally associated with deformations of the foot, these devices must be equipped with compensatory foot pieces to ensure stability. Before they are attached, they are machined roughly and then fastened to the parts of the foot by means of polyester cement.

If the devices are too flexible in themselves they are reinforced with strips of Resur, welded

lengthwise, or with riveted aluminium strips. For children who are 1.20 to 1.40 m tall Resur of 4 to 6 mm and Plastazote of 5 mm thickness is used (Fig. 1).

Only after a child who has been cross-sectionally paralysed from birth has become used to orthostatic conditions of life will locomotion from one place to another become possible, initially by the release of one hip joint only. Following an appropriate period of training, it will be possible in most cases to release the second hip joint for hinge-like movement. A gluteal traction device is applied as an additional safeguard against the forward-bending of the trunk. Its advantage consists in the individual release of the movement in the hip joint.

Since in most cases trunk and upper limbs have normal function and strength, it is possible almost always to teach walking on the stabiliser or in a mobile wheeled walker—at first, however, always in the presence of an attendant (Fig. 2).

Further mechanical care will perhaps consist of the traditional fitting of a device like the one used for the after-effects of poliomyelitis. I say "perhaps" deliberately because I am of the opinion that new materials and the experience gathered with prostheses using outside forces, and which operate and are controlled by means of pneumatic, myo-electric or hydraulic energy, show us better possibilities and offer means of more effective help.

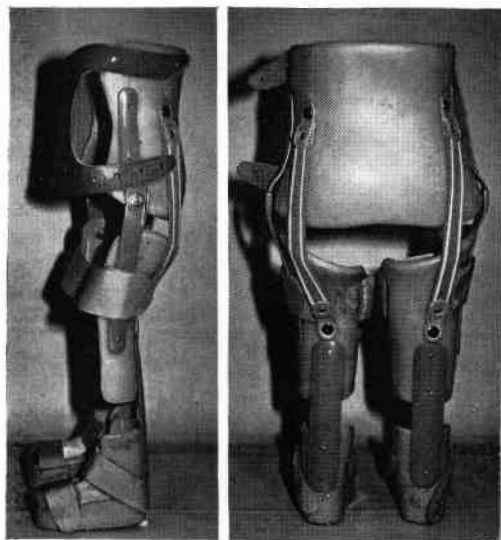


Fig. 1. Lateral and posterior view of plastic orthosis for meningomyelocele patients.



Fig. 2. Views of meningomyelocele patient with and without the orthosis.

It should be considered seriously whether prefabricated parts, that is, ready-made parts, and semi-prefabricated parts, that is mass-produced parts, be used more than they have been heretofore in the design and construction of devices. They could fill a role in our programme of custom-made devices and save time and expense. Our whole endeavour should be to carry these considerations out into practice, since we are seeing more and more new materials and mechanical-orthopaedic devices with anatomically prescribed shapes as they are being developed by our orthopaedic physicians, by the specialised industry in our field, and by ourselves. The building-block system as developed by Helmut John of Hanover, and the system of complementation and interchangeability of standardised structural members as practised by the firm of Otto Bock at Duderstadt are only the beginning of this development.

Scoliosis in Infants

Recently the problem of scoliosis in infants was moved into the foreground of orthopaedic interest, in particular by the pertinent publication of Mau and Gabe (1962), and by the interesting modern concept of Lübke (1971), paediatrician at Hamburg. In contrast to the Schede (1958) principle that uses direct mechanical redress by a load applied against the vertex of the curvature, Lübke places the scoliotic infants into a unilateral oblique supine position by means of a padded wedge which is placed under the flattened concave side of the back. The convex side of the costal arch presses against the support, so that the redress effect is achieved by the infant's own body weight. At the same time the region of the cervical vertebrae with the head and also the pelvic region move downward, and this too, has a redress effect, correcting the axis.

In order to be able to apply this method in ambulant orthopaedic treatment to older and larger infants, Wilhelm (1966) of Hamburg, orthopaedic physician, places the infants on a modified scoliosis board. The infant is held by vertically placed slats at the sides of trunk and head. Openings are produced for arms and shoulders. The upper arm of the convex side and the pelvis are fixed by means of one strap each. A wedge of foam rubber is placed, in accordance with Lübke's basic idea, under the flattened side of the back (Fig. 3 and Fig. 4).



Fig. 3. Posterior view of infant with scoliosis.

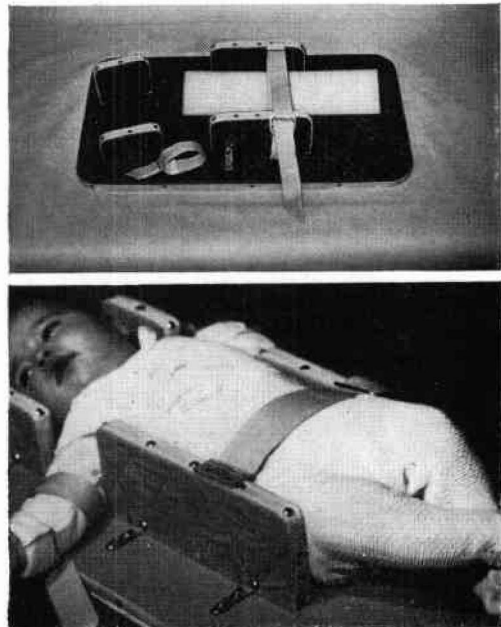


Fig. 4. The scoliosis board.

The scoliosis board has proved its value particularly with active children. At the same time it ensures the correct position, can easily be adjusted to allow for the growth of the infant, and may be transported readily. We have manufactured these scoliosis boards for more than ten years. Figure 5 shows the successful results that may be obtained by using these simple devices.

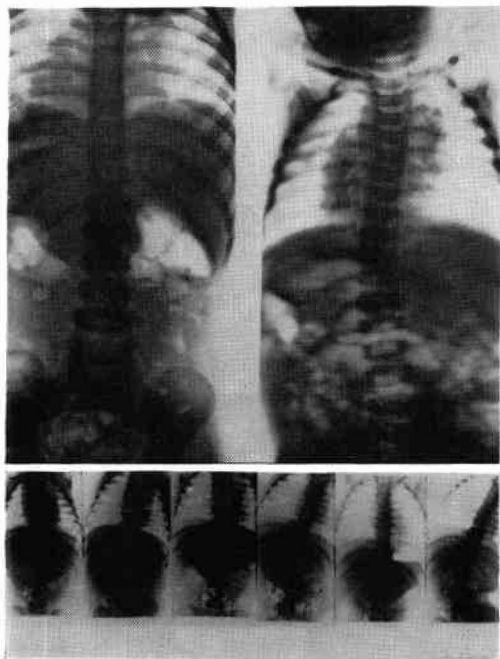


Fig. 5. Some results from use of the scoliosis board.

Some Foot Problems in Infants

Another current topic in orthopaedics is the undesirable results of the prone position of infants which is advocated generally today. Twisting of the neck, lordosis, and an unfavourable development of the hip joint are discussed as secondary symptoms of the prone position. The last-named symptom occurs particularly in the case of congenital dysplasia of the hip due to forced traction. Various deformations of the foot are believed also to be due to the prone position, as a result of the straining effect of the anterior part of the foot. Changes amounting to a flat-foot with abduction of the anterior part of the foot, *pes abductus*, and also rotation defects of the axis of the leg in the nature of an inward rotation (inward rotation walk) have been observed (Fig. 6). The treatment of growth

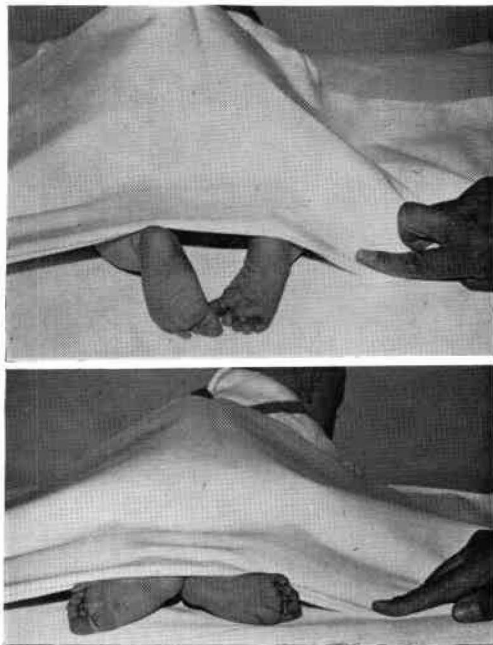


Fig. 6. Some defects of the feet of an infant resulting from the prone position.

defects of this type, consists either in the application of "annular ankle cuffs" or, to obtain a simultaneous favourable spreading of the hip joint, padded wedges for the lower leg are applied, fastening the lower legs or, perhaps, merely the ankle region, by means of straps at appropriate intervals. These padded wedges are manufactured at the suggestion of Professor Bernbeck.

The padded wedge for the lower leg consists of firm foam rubber, in the following sizes:

Small: knee-to-foot length 10 cm, width 20 cm, height 7 cm

Large: knee-to-foot length 15 cm, width 30 cm, height 7 cm (Fig. 7).



Fig. 7. The padded wedge for correcting certain defects in the infant's feet.

The legs are held by Velcro straps. The intermediate wedge is held by a Velcro fastening. Thus the wedge may also be used for the supine position. In such a case, the high part of the wedge is placed under the backs of the knees. This is a simple but effective device.

By way of concluding these subjects which have been touched upon briefly, I want to call attention to a special development in our profession. In orthopaedics for children, orthopaedic technicians have taken a larger role in the rehabilitation team. We are confronted with orthopaedic problems earlier than used to be the case, and more with the problems of precautionary or preventive measures than with those of ultimate appliances. Whereas orthopaedic-mechanics used to form the end of medical rehabilitation, it is used today right at the outset.

This calls for a readjustment of our thinking and our actions inasmuch as we must develop and design simple inexpensive orthopaedic devices for short-term use, which must be highly effective and afford rapid and maximum help and relief to the handicapped person during every phase of his life.

It is our duty to help the handicapped

throughout their life by means of orthopaedic-mechanics. Consequently, we must do what we can as early as possible so that we may not face insoluble technical problems that arise later solely from neglect during childhood.

Contacts within a rehabilitation team will have to be strengthened, since the scope of our function keeps increasing all the time. Our mechanical-orthopaedic tasks of caring for the handicapped commence, more and more, in early infancy and extend to old age. We should remember at all times that precautionary and preventive measures are better than the best orthopaedic-mechanical device.

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