Adjustable Knee or Elbow Extension Orthosis: A New Orthotic Development

By THORKILD J. ENGEN*

New materials, modern technology, and skill combined with a better understanding of the multiple problems confronting the Orthotist contribute toward constant improvement of present equipment and consequently lead to new designs of orthotic devices. With this concept in mind, the author of this article will describe the demand, the design, and application of an "Adjustable Knee or Elbow Extension Orthosis".

Successful and ideal rehabilitation of the severely disabled patient demands the close attention of a co-ordinated team headed by a qualified physician. The Orthotist plays an important part on this team because through him the patient obtains the custom made orthotic devices needed to further the program leading toward maximum functional restoration.

Flexion contractures of the knees or elbows is a complex problem in patients suffering from rheumatoid arthritis and paraplegics with reflex muscle spasm. Treatment of the progressive deformities in these patients requires continuous attention of the rehabilitation team. The therapeutic achievement of these patients stimulated the development described here.

Figure 1 shows a 33-year-old white female who suffered from rheumatoid arthritis. Since the onset of her disease in 1954, she has been confined to a bed or wheel chair. Because of pain, major joint flexion contractures developed in the convalescent stage of the disease. She was first seen in our rehabilitation screening clinic in June, 1960. The first four months of the therapeutic program in the hospital included lower extremity compound traction with periodical inter-articular injection of procaine and hydro-cortone and daily physical medicine. Bilateral opponens orthoses with corrective finger extensor assists were used.

Figure 2 graphically illustrates a goniometric record of joint motion during treatment. These measurements were taken at monthly intervals during a seven month comprehensive hospital care. Once correction of flexion contractures of the knee had reached a point where the femoral condyle and tibial plateau articulating angle was within the weight bearing functional limit, the necessity for a special orthotic device became obvious. This was designed and applied after three months of hospitalization. The principle of the extremity extension assist is based on a three point adjustable force which can be easily increased or decreased by a simple strap arrangement as shown on Figure 3. This device allowed the progression of a functional standing and walking program to begin. Due to the contractures of the elbows, special crutches (Figure 4) with forearm troughs and finger grips were made to give her adequate stability when ambulating.

Figure 5 shows the patient after a seven month rehabilitation program. Her posture and ability to move about are still improving. The physician's

* Mr. Engen is Director of the Orthotic Department, Texas Institute for Rehabilitation tion and Research, Houston, Texas, and Clinical Instructor in Orthotics, Department of Rehabilitation, Baylor University College of Medicine.

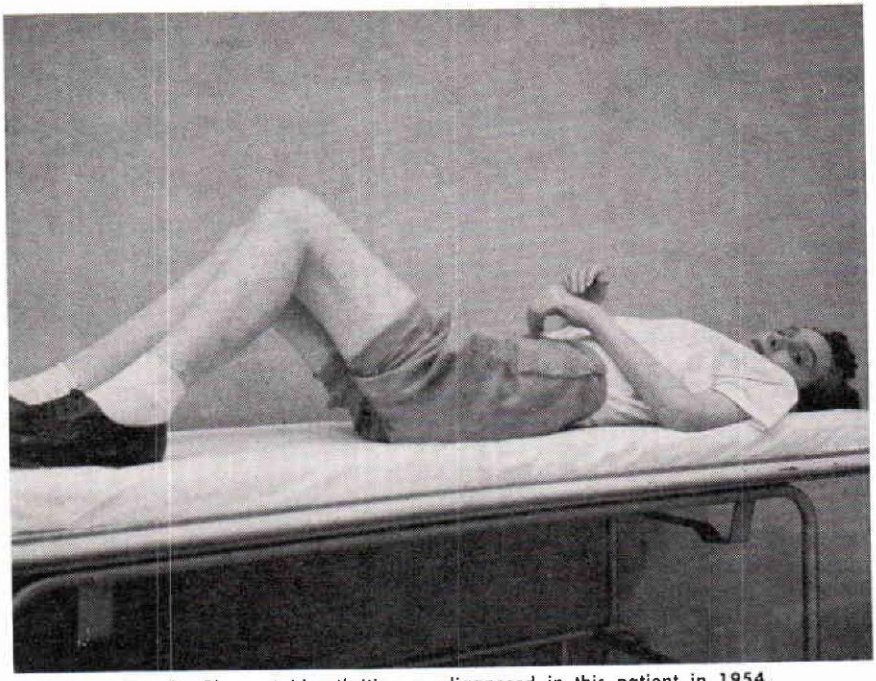


Fig. 1—Rheumatoid arthritis was diagnosed in this patient in 1954.

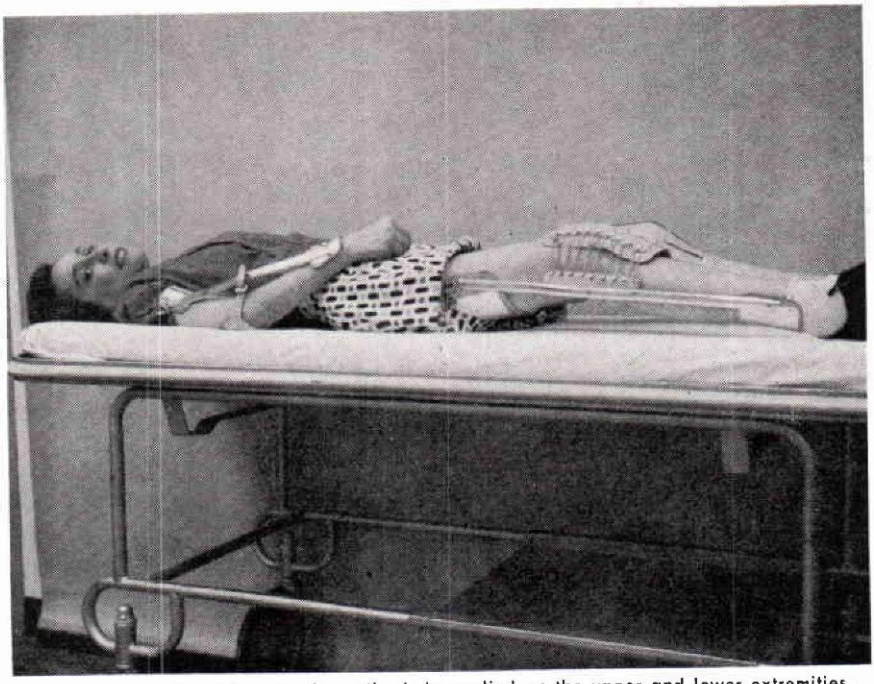


Fig. 3—An adjustable extension orthosis is applied on the upper and lower extremities.

prognosis at this point is that she may discard all her supportive equipment in a few months.

Figure 6 shows a fifteen-year-old white male who has been diagnosed as spina bifida since birth. He has increased muscle tonus of the right upper extremity, mild sensory loss, and multiple skeletal deformities. He was first seen in our screening clinic December, 1960. Extensive therapeutic treatment along with the application of the extension orthosis on the right upper extermity was prescribed for this patient. On initial examination, the patient had a 30 degree flexion contracture of the right elbow. The last evaluation revealed a limitation of only 10 degrees from complete extension. He is still receiving treatment on an out-patient basis.

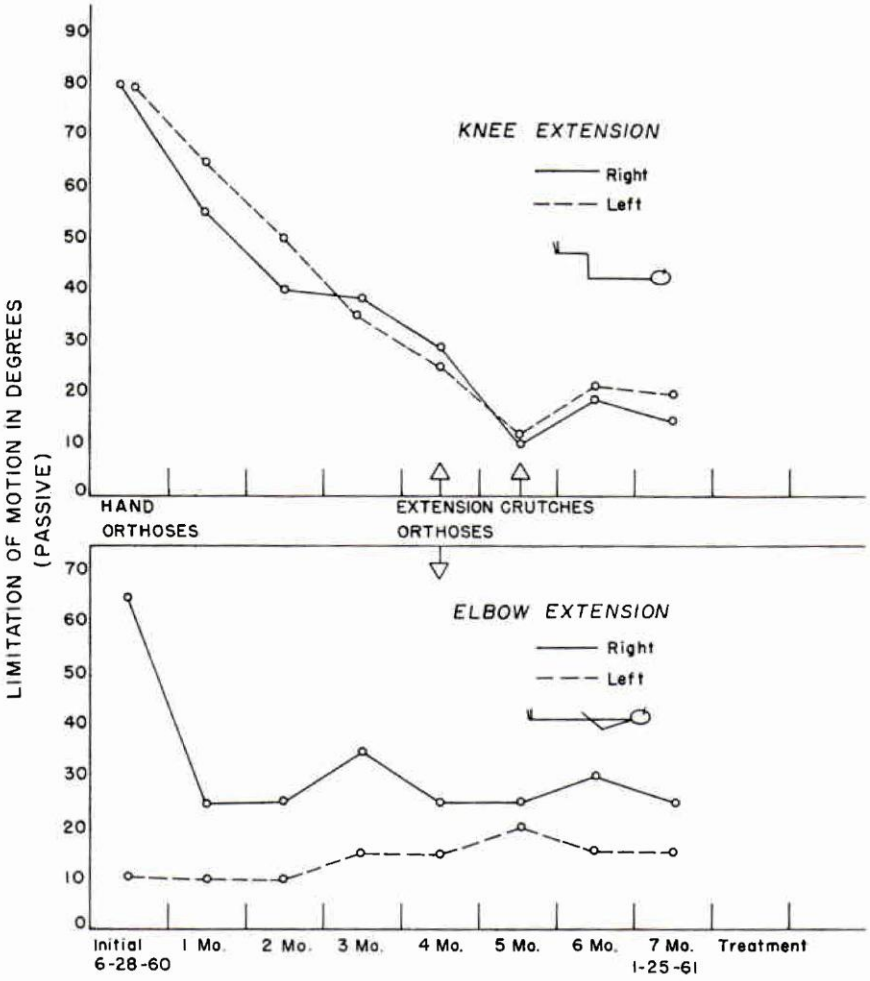


Fig. 2—Goniometric record of joint motion during 7 months of comprehensive hospital care.

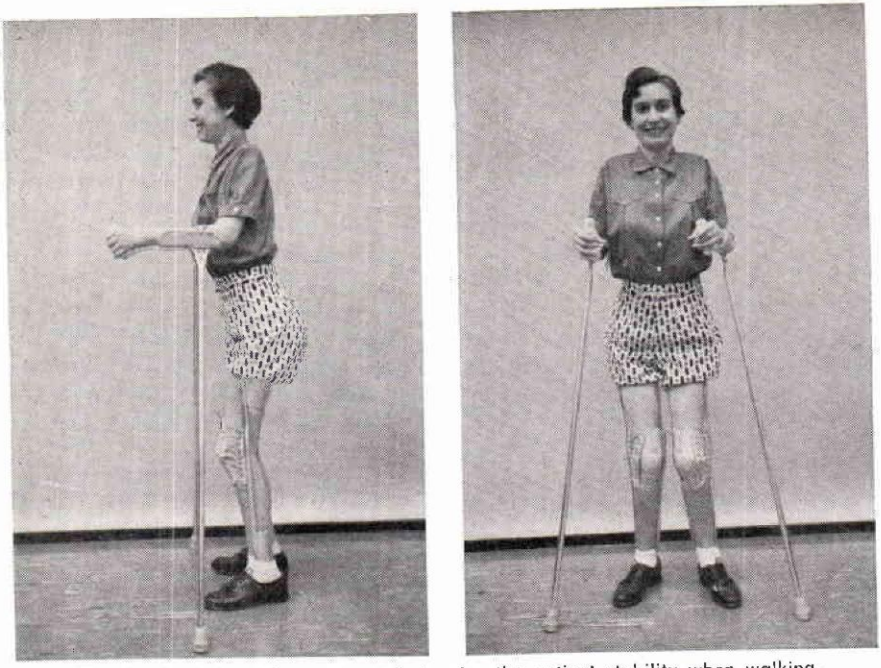


Fig. 4—Special crutches were made to give the patient stability when walking.

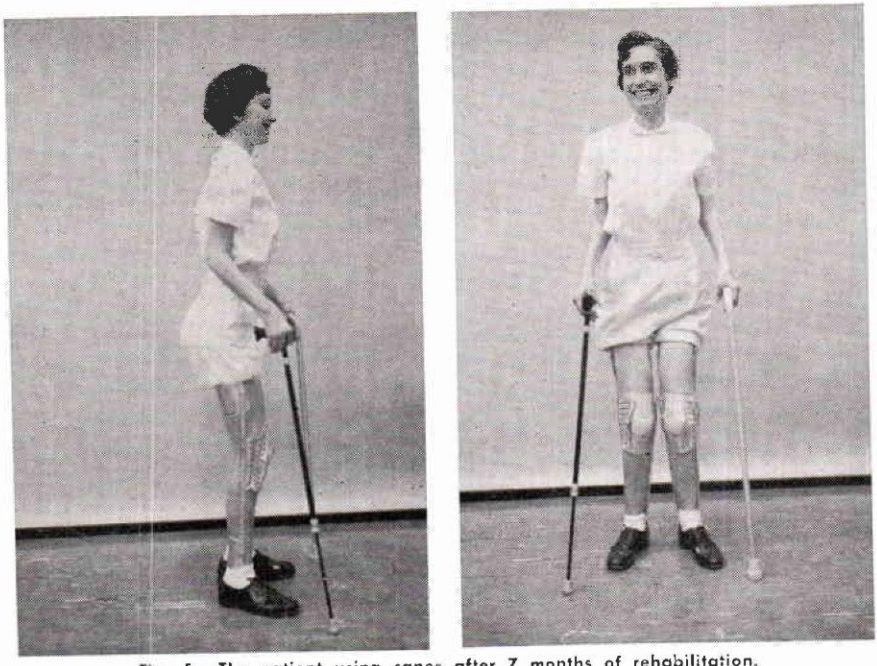
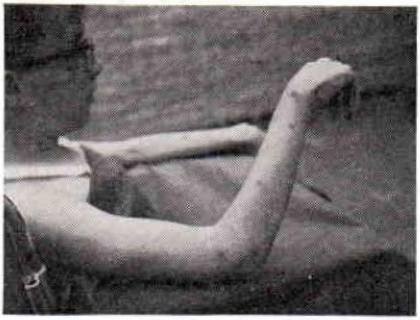


Fig. 5—The patient using canes after 7 months of rehabilitation.



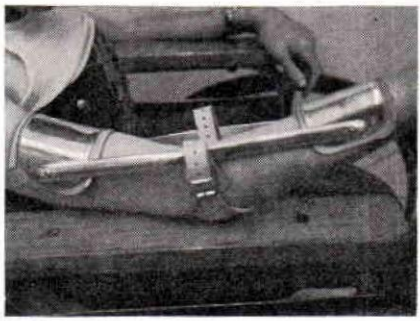


Fig. 6—This patient had 30 degrees flexion contracture of the right elbow. In two months it was improved to 10 degrees from complete extension.

Construction

The orthosis consists of two ½" half round aluminum extrusions made adjustable in length. These are attached to an upper and lower aluminum band with a 3/16" monel rivet on each side so that the bands will swivel freely and follow the contour of progressive extension of the extremity.

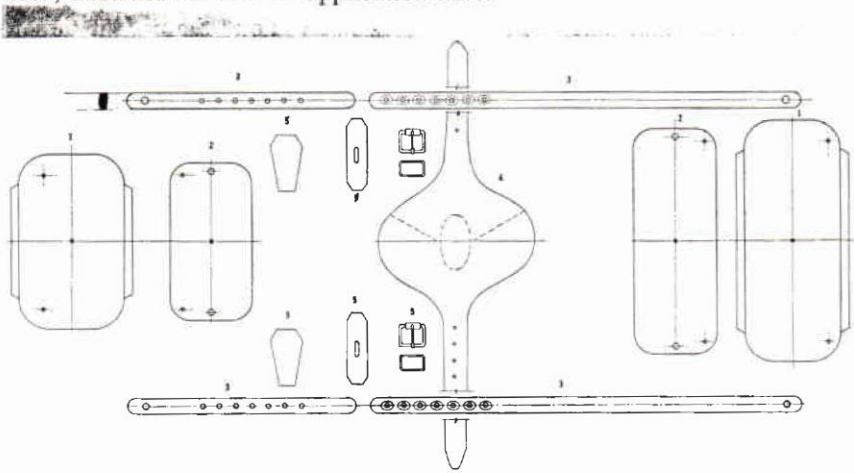
An adjustable leather pad made to fit the knee or elbow joint is attached on the side bars between the swivel bands. The bands are finally lined with leather and napa.

Figure 7 shows the drawing of the finished orthosis and a view of the parts involved. A list of numbers corresponding to each part is listed below.

Part #1) Leather lining for upper and lower swivel metal band.
Part #2) Upper and lower swivel metal band. O.72 20-24 ST. Alum.
Part #3) ½" Half round aluminum extrusion made adjustable. 8/32" screws.
Part #4) Elbow or Patella strap.
Part #5) Buckle assembly.

Discussion

Five adjustable extension orthoses have been applied to major joint contractures. This equipment has assisted in completing the total rehabilitation program of the patient. The designer of this device has described the need, construction and its application here.



ACKNOWLEDGEMENT

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COMMENTS

In every severely involved chronically diseased patient with deformities, the question of rehabilitation is primary. The ultimate restoration of maximum function must include physical, sociological and psychological goals. The physical restoration must proceed first. The success of the total program lies in the accomplishment of this first objective. The Orthotist can play a very important role in this most critical phase of rehabilitation medicine.

*Paul R. Harrington, M.D., F.A.C.S.

In the treatment of those patients with flexion contractures of the knee or elbow that are not reversible by the usual program, we have found this adjustable knee or elbow extension orthosis very successful in their rehabilitation. The orthosis has several factors that the physiatrist considers important; that is, easily adjustable, simple in construction but very effective in action; can be applied by any member of the team or of the family; good skin tolerance; dynamic in action, and still allows the patient to continue many activities of self-care.

Flexion contractures involve the musculo-tendinous structures of the involved extremity and joint and increases in range of motion are often slowly acquired by physical therapeutics. This orthosis maintains such gains, as well as assists in increasing extension daily as the patient acquires the tolerance of wearing the orthosis several hours each day. This orthosis can be applied with equal success to many other patients with flexion contractures of varied etiology.

Those of us responsible for the rehabilitative care of patients always welcome the initiative and originality of new orthotic equipment and the active participation of the orthotist in the team.

*Lewis A. Leavitt, M.D.

* Clinical Associate Professor, Division of Orthopedic Surgery, Baylor University College of Medicine and Assistant Professor, Department of Rehabilitation.

* Lewis A. Leavitt, M.D. Professor and Chairman, Dept. of Physical Medicine and Professor, Dept. of Rehabilitation, Baylor University College of Medicine.