The Use of a Bilateral Canadian-Type Hip-Disarticulation Prosthesis for Congenital Absence of Both Lower Extremities

A Case Report

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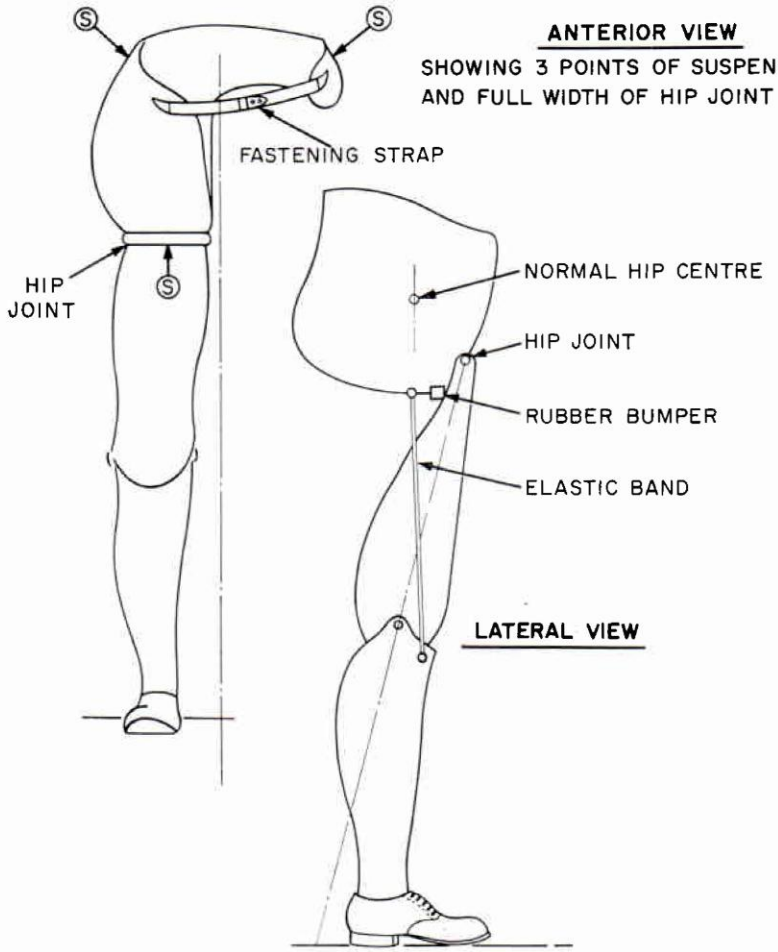
Rehabilitation of the amputee after hip disarticulation has long been delayed by inadequate prosthetic appliances. Until recent improvements, the



FUNCTIONAL FEATURES OF CANADIAN HIP DISARTICULATION PROSTHESIS

Fig. 1

A line projected through the centers of the hip and knee joints passes posterior to the heel. Modified version of drawing appearing on page 4 of The Canadian Type Hip Disarticulation Prosthesis by James Foort and C. W. Radcliffe. Prosthetic Devices Research Project, Institute of Engineering Research, Series II, Issue 28. Berkeley, The University of California, 1956.

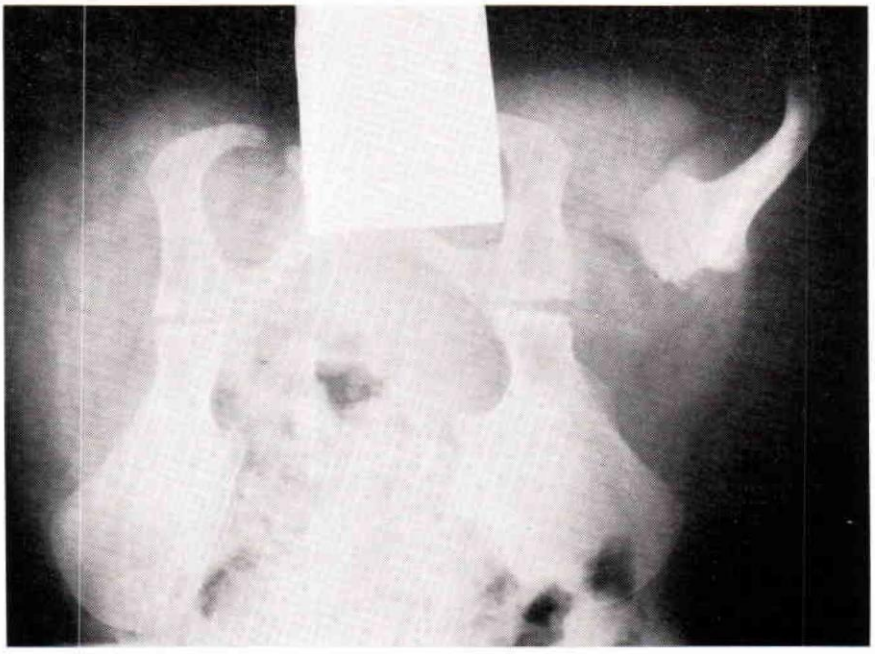
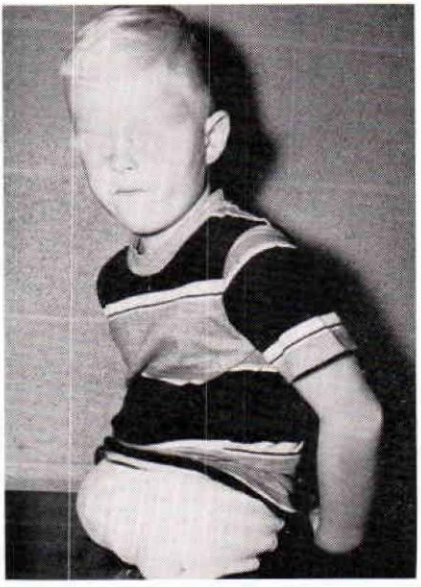


Fig. 2
Anteroposterior view of the pelvis.



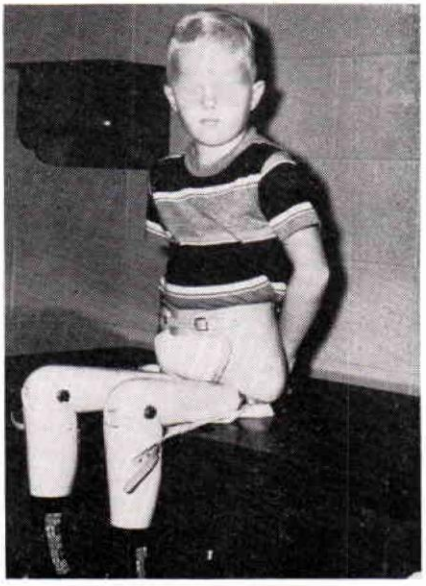


Fig. 3: Five-year-old boy with congenital absence of both lower extremities shown without the prosthesis.

Fig. 4: View of the prosthesis with the patient sitting.

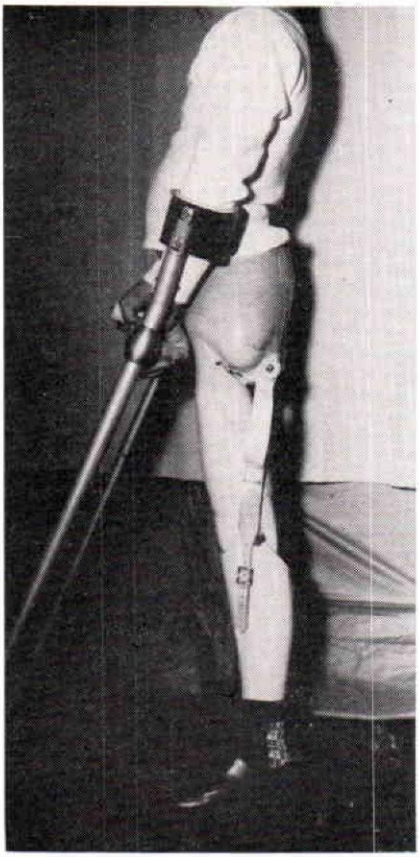


Fig. 5

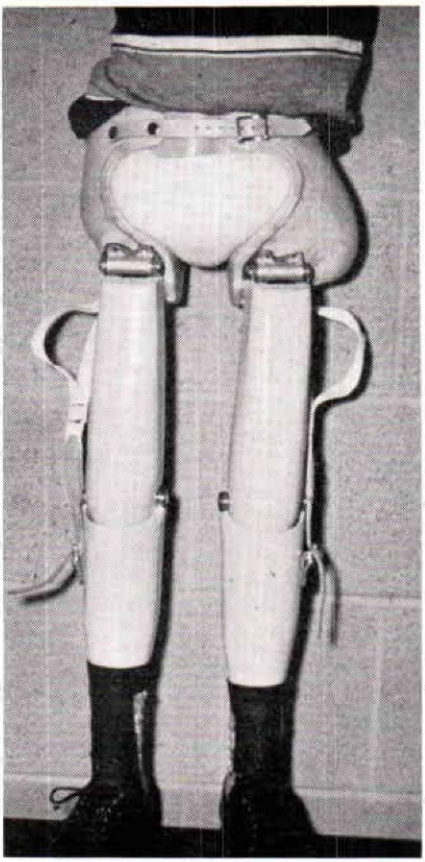


Fig. 6

Fig. 5: Lateral view of the patient standing wearing the prosthesis. There is forward placement of the hip and posterior placement of the knee.
Fig. 6: Front view of the prosthesis with the patient standing.

prosthetist's armamentarium was limited to the tilting table or the saucer socket prosthesis. Both of these devices required the use of a pelvic belt and manually controlled hip lock. It was difficult or impossible to achieve an acceptable gait with either of these prostheses, and motions of sitting and standing were hampered because of the necessity to engage and release the hip lock.

These difficulties are, of course, increased in the case of the amputee with bilateral hip disarticulation. These factors prevented the successful application of a prosthesis to the patient reported here until the advent of the Canadian-type hip-disarticulation prosthesis.

The Canadian prosthesis was developed and reported by McLaurin in 1954. The Prosthetic Devices Research Project at the University of California in Berkeley popularized this prosthesis in the United States. Briefly, the prosthesis was designed to stabilize the hip and knee by alignment of the weight-bearing line posterior to the prosthetic hip joint and anterior to the knee

axis with the patient standing (Fig. 1). Foort and Radcliffe gave a detailed account of the prosthesis; specific information concerning evolution, construction, and experience with the prosthesis is available. Successful demonstrations at the University of California at Los Angeles prompted the use of the Canadian prosthesis in the patient reported.

K. R. S. was seen in the Amputee Clinic sponsored by the Kansas Crippled Children's Commission in December 1956. The child's age at that time was four years and nine months. He had congenital absence of both lower extremities and congenital absence of one finger of the right hand. He had excellent control of both upper extremities and good function of the right hand in spite of the relatively minor congenital deformity of the hand. Normal alignment and control of the trunk was present. A short, deformed atavistic femur was present on the left with dislocation of the head out of the acetabulum to a position against the upper portion of the ilium (Fig. 2). On the contralateral side no femur was present.

The child had been fitted elsewhere with a pair of shortened prosthetic appliances designed to provide balance and some elevation of the trunk from the floor. In September 1956, these appliances had been lengthened and a foot and ankle assembly had been added. The mother stated that the result was unsatisfactory because the child was unable to maintain his balance, and discomfort resulted from contact between the projecting stub of the femur and the prosthesis on that side. The child was unable to stand or walk with the prostheses because of discomfort and subsequently they were discarded.

In January 1957, the construction of the bilateral Canadian-type hip-disarticulation prosthesis was undertaken by the prosthetist, Mr. F. L. Lake, in cooperation with the author. Fabrication and fitting of the socket was done according to the method described by Foort and Radcliffe. The length of the prosthetic limbs was determined by reference to height charts of normal children, and the ratio of the thigh to the leg was derived by measuring other children in the amputee program. The two sides of the socket were connected by a flexible leather hinge posteriorly and by a strap and buckle anteriorly. A check socket was used in the original fitting of the prosthesis. The final socket had an initial satisfactory fit and did not require alteration in nine months of follow-up study. The actual construction of the prosthesis was delayed some months while an effort was made to learn of any previous experiences with the Canadian-type hip-disarticulation prosthesis for bilateral amputees.

In September 1957, the prosthesis was delivered and training of the child in the use of the appliance began. Out-patient training was conducted in the Physical Therapy Department of St. Joseph Hospital, Wichita. Originally, the training periods were daily; within one month they were reduced to three times a week; and after two months they were discontinued. The child was taught to walk with Canadian crutches which could be easily disengaged in the event he fell. He was also instructed to use a walker.

In December 1957, the child went to school for the first time and was able to attend on a half-day basis for the remainder of the school year. At the time of writing, he wore the prosthesis for three-hour intervals for a total of six to eight hours during each day. He walked with a four-point gait with crutches or a walker. He accomplished this by lifting the trunk slightly with the hands and by a combination of flexion and internal rotation of the pelvis to initiate the swing phase of gait. His gait was cosmetically acceptable, but slow. The child could also walk well with a swing-through gait using the walker. He was able to walk approximately one-half block with crutches,

but he exerted more effort than was necessary with the walker. He could walk approximately one block with the walker before requiring rest. He was unable to climb stairs or step off curbs and did not play actively wearing the prosthesis.

Nine months after the delivery of the prosthetic appliance, the child was able to put the legs on after breakfast and wear them throughout the morning. He rested without the legs during lunch hour and during a period in the afternoon. The prosthesis was again fitted late in the afternoon and for the evening meal. The child's mother stated that he was becoming more proficient in the use of the prosthesis, and it is the opinion of the prosthetic team that no undesirable habits have appeared thus far in the relatively short follow-up period. The child has not complained of pain and has had no evidence of skin irritation at the point of contact between the prosthesis and the stump. No shoulder harness or other harness above the waist was required. He was able to sit in a balanced position and, without assistance, could sit down from a standing position. He was also able to stand up in the walker from a sitting position without assistance. The child was also able to stand alone and balance without supporting himself with crutches. In school, he has been able to stand up from a sitting position in a kindergarten chair by holding on to a table or other object.

The basic design of the prosthesis is that described by Foort and Radcliffe with modifications required because of the presence of bilateral deformity. Although the follow-up time has been short, the use of this device has, in my opinion, enabled this child to attain a degree of independence which has previously been impossible. It is expected that the present socket will require revision within the year because of growth of the child. The construction and fitting of the prosthesis did not entail as many difficulties as were anticipated. In gait-training, an effort was made to encourage the child in the use of a four-point gait with the walker.

Note: The author is indebted to Mr. F. L. Lake, C.P.O., of the Hanger Artificial Limb Company for the technical design and fabrication of the prosthesis used in this instance. Suggestions from Mr. John Bray, prosthetics instructor at the University of California at Los Angeles, were also utilized in the final design of the prosthesis. Training was supervised by Miss Naomi Wesson, Physical Therapy Department, St. Joseph Hospital, Wichita.

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Postscript:

FITTING BI-LATERAL CANADIAN HIP-DISARTICULATION PROSTHESES

By F. L. LAKE, C.P.O.

This boy was nearly 5 years old when we first examined him in a Prosthetic Clinic. He had been previously fitted with pylon type prostheses, (no knee joints) but due to excessive weight, and loose fitting sockets, he was unable to stand or walk with any degree of comfort, and required help at all times.

Canadian type limbs were prescribed by the clinic, in January, 1957. Before proceeding with the fabrication of the prostheses, we had some very valuable advice on socket design from John Bray, Prosthetic Instructor at U. C. L. A.

Fitting was a very slow process. The patient had built up a strong antagonism due to the discomfort experienced on the old limbs, and this had to be overcome gradually.

This was a clinic team project. The results show how much more can be accomplished by the close cooperation of the team. Most of the credit should go to Dr. Hensley, Miss Naomi Wesson, RPT., and to Herman Ellis, of my staff.

COURSE IN REHABILITATION CARE OF THE CHRONICALLY ILL PATIENT

A one-week course for physicians, devoted to the rehabilitation care of the chronically ill patient, will be held November 16-20, 1959 under the auspices of the Department of Physical Medicine and Rehabilitation, New York Medical College—Metropolitan Hospital Center. The course will offer a review of the principles and techniques in the medical care of the chronically ill to meet the needs of the clinician, medical administrator and Public Health physician. Course content will include: Physiology and Pathology of Chronic Diseases, Nutrition and Dental Care, Management of Bedridden and Incontinent Patients, Home Care Programming, Community Needs and Resources, Public Health Aspects, Self-Care Activities, Prosthetic Devices and Psychological and Social Aspects.

The tuition fee is $100.00. Traineeships for tuition, maintenance and travel are available through funds provided by the U. S. Office of Vocational Rehabilitation. Applications for the course and traineeships can be obtained directly from Dr. Jerome S. Tobis, Chairman, Department of Physical Medicine and Rehabilitation, New York Medical College, 1 East 105th Street, New York 29, New York.