AN IMPROVED PROSTHESIS FOR HEMIPELVECTOMY

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Editor's Note: This article is reprinted by permission from the December 1957 issue of the "Archives of Physical Medicine and Rehabilitation." This is the official publication of the American Congress of Physical Medicine and Rehabilitation. The article was read at the Thirty-fifth Annual Session of the Congress in Los Angeles, September 12, 1957.

Hemipelvectomy, or interinnomino-abdominal amputation, is an extensive surgical operation, usually for malignancy involving the upper femur, hip joint, pelvis, and the surrounding soft tissue. This operation was first performed by Billroth in 1891;[1] the patient survived only a few hours. Gordon-Taylor,[2] in a review of 50 cases of hemipelvectomy performed at the Middlesex Hospital in England between the years 1922 and 1950, found the operative mortality before 1940 was 36 per cent and after 1940 was 18 per cent. Pack[3] reported 8 cases of hemipelvectomy in 1947; there was no immediate operative mortality. King and Steelquist[4] reported 6 cases in 1943;

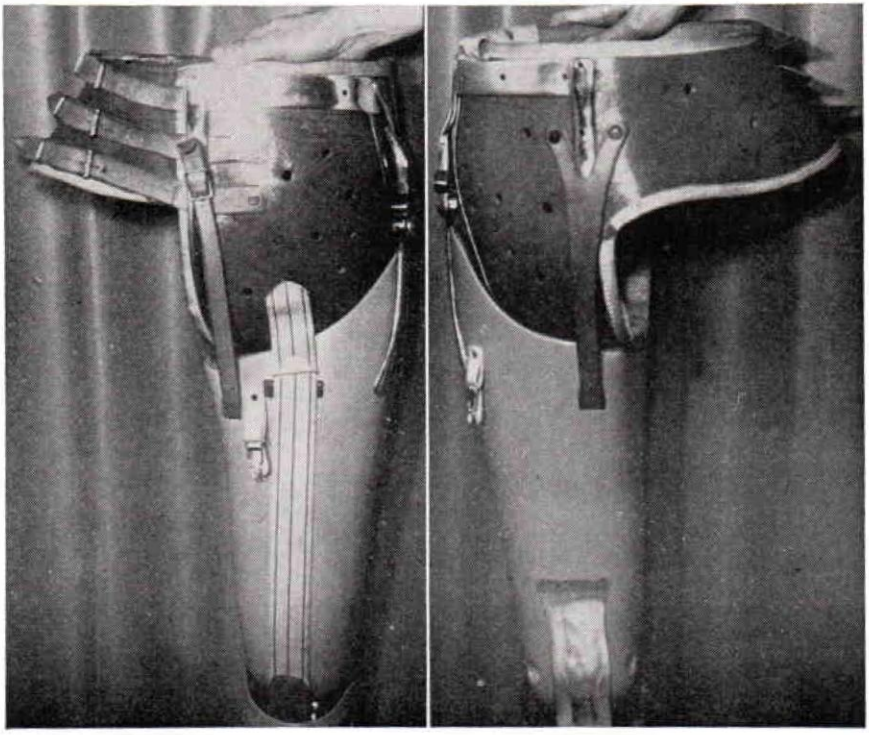

Fig. 1—Hemipelvectomy prosthesis with large leather bucket and abdominal belt—front and back view.

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there was one operative death. Thus the high operative mortality has been markedly reduced and the operation is being performed more frequently, with the result that the problem today is one of rehabilitation, particularly the development of a suitable, comfortable and functional prosthesis. Morton[5] in 1942 wrote: "No prosthesis can be fitted early in this stump. The patients quickly learn to use crutches, and get around well by this means. They learn to adapt themselves to sitting on the involved side. The younger patients, according to reports, adjust themselves more quickly and successfully." Even as recently as 1947, reports in the literature complain of the lack of a good prosthesis.

The early prosthesis consisted of a large leather bucket to support the lower abdominal tissue.[6] Figure 1 shows this type of prosthesis. A wide abdominal belt was used to fasten the bucket, and a shoulder strap was installed in some for additional support. The difficulty with this prosthesis was excessive telescoping of the soft tissue into the bucket, in some cases, allowing an excursion of four inches or more. Due to lack of support, excessive pressure was exerted in the groin and perineum.

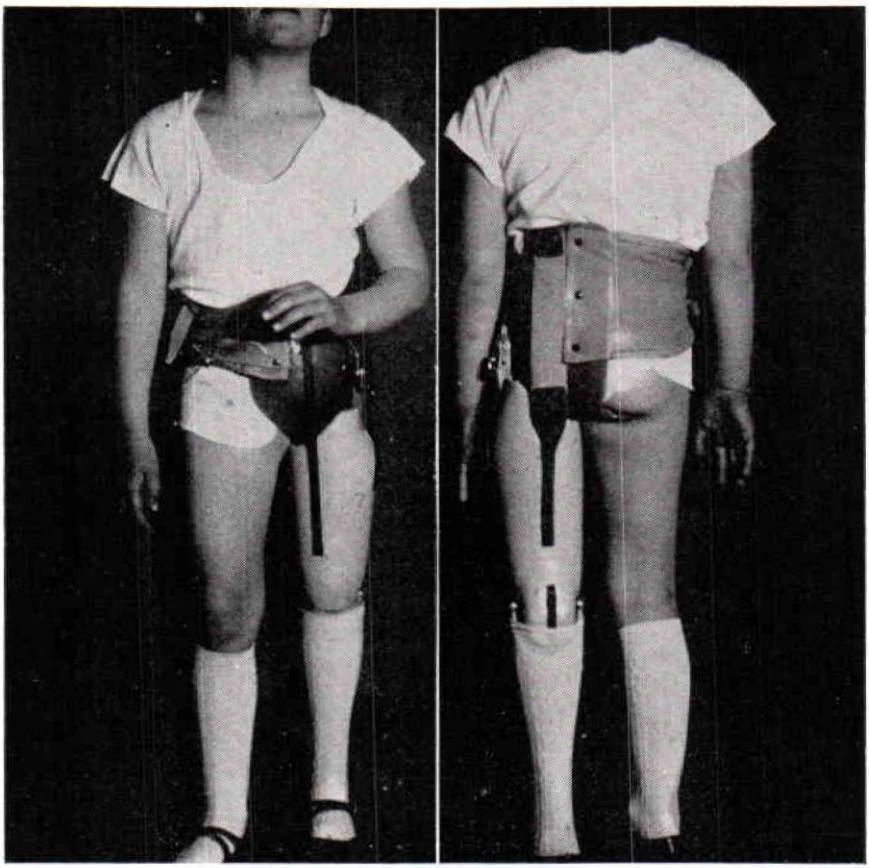

Fig. 2—Hemipelvectomy prosthesis with molded plastic bucket and bridge extending to the other side.

Our experience in the use of molded plastic in prosthetic devices led to the exploration of the use of this material in a hemipelvectomy prosthesis. Attempts were made to combat the disadvantages of the early leather prostheses. Plastic molded buckets were made to fit the stump, which consists essentially of soft tissue. In addition, a bridge extending from the lower part of the bucket across the midline to engage the remaining ischial tuberosity, or heavy muscle groups, took over a portion of the weight bearing. The bucket extended above the costal margin, and a wide pelvic belt was well fitted over the crest of the remaining ilium. Repeated adjustment was often necessary to relieve pressure of the bucket upon the ribs and the remaining sacrum. A regular prosthesis was attached to the bucket by a regular hip joint; roller castings were added to the upper portion of the thigh piece to give additional stability to hip attachment. Patients wearing this type of prosthesis felt considerable increase in their sense of balance, thus improving gait pattern. The telescopic movements were largely eliminated. Figures 2 and 3 show this type of prosthesis.

When the prosthesis was completed, the patient was given a course in gait training. During the first week, the patient was instructed in putting on and removing the prosthesis, in standing-balancing exercises, gait training with parallel bars, crutch walking, and in walking with a cane. In the second week, the patient was allowed to take the prosthesis home and continue to practice at home, but still came in regularly for training. An average patient required approximately two to three weeks to complete the training.

Fig. 3—Internal lateral view of the molded plastic bucket showing the bridge extending across the midline to the other side.

Ten patients with hemipelvectomy were fitted with this type of prosthesis. Nine patients had been operated upon for malignancies and one patient had a congenital hemipelvectomy. Five patients were male; five were female. The longest followup has been two and one-half years. Among these ten patients, three learned, and continue to use the prosthesis all day. They found the plastic bucket was comfortable and they were able to carry on their daily activities. Two patients, both young adult males, were able to use the prosthesis all day, but they had to discontinue because of recurrence of the disease. One patient, a woman of 24, was able to use the prosthesis for 10 hours each day, but she complained of discomfort from the plastic bucket, especially when she was sitting down. One patient, a man of 48, was given a plastic bucket without the additional ischial rest; he complained of insecurity because, when he was standing or walking, the prosthesis had a tendency to give way laterally in spite of a strong abdominal belt and shoulder strap. He was able to use the prosthesis only a few hours each day, and crutches were used for additional support. Three female patients were unable to use the prosthesis at all. Among these three patients, the first, a woman of 68, complained of constant pain in the scar while she was wearing the prosthesis. A neuroma was removed later, but the patient retained her wheelchair existence, mainly because of her age. The second patient, a woman of 53, had trouble with control of her bladder. Each time she wore the prosthesis, she developed some urinary incontinence; she also found the plastic bucket uncomfortable, especially when she was sitting in a low chair or in a car. Therefore, she chose not to use the prosthesis. The third patient, a woman of 42 who had had rather extensive pelvic surgery, found the prosthesis to be uncomfortable and refused to use it. All three patients were inactive and leading sedentary lives.

Summary and Conclusions

Hemipelvectomy prostheses with plastic molded buckets were made for ten patients. Five patients were able to use the prosthesis fully. Two patients were able to use the prosthesis for a few hours each day; one complained of discomfort, and the other of insecurity. Three patients were unable to use the prosthesis because of discomfort and other complications, such as neuroma and urinary incontinence.

The advantage of this improved prosthesis was the elimination of the telescopic movements, more adequate support, relief of pressure in the groin and the perineum, and an additional sense of security. Some problems of comfort and utility still remain unsolved; for example: in toilet activities, the prosthesis has to be removed. Young and active male patients seem to accept the prosthesis well; however, female patients over middle age who lead a sedentary type of life do not do well with this type of prosthesis.

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FITTING TECHNIQUE OUTLINE FOR HEMI-PELVECTOMY SOCKET

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The following series of pictures clarify the socket fitting techniques which have been developed in Orthopedic and Prosthetic Laboratories of the Institute for the Crippled and Disabled. The technique is for the Hemi-Pelvectomy amputation as described by Dr. Shyh-Jong Yue and Mr. Charles Goldstine in the preceding article, "An Improved Prosthesis for Hemipelvectomy." The explanation of the procedure requires considerably more detail than space allows us to present at this time. The technician's time required is exceedingly high but results justify the extensive labors.

It is obvious that we are not attempting to explain the entire mechanical setup; however, the same procedures in socket fitting can be applied to the conventional or Canadian type prosthesis.

It is further assumed that the reader is totally familiar with the fabrication procedure to successfully laminate the plastic socket. It cannot be emphasized enough as to the importance of obtaining a perfect plaster check socket so as to assure a totally satisfactory final plastic socket.

Figure 1 indicates the severity of the amputation. In addition, it shows the frequent distortion of anatomy in the stump area. This must be considered by the prosthetist in the design of the socket.

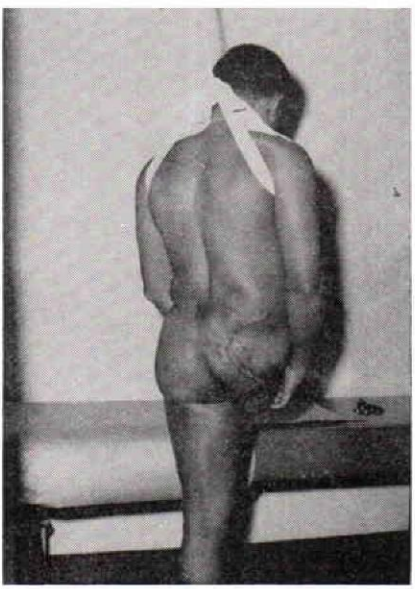

Figure 1. Fitting Technique Outline for Hemi-Pelvectomy Socket.

Figure 2. Fitting Technique Outline for Hemi-Pelvectomy Socket.