

Case Study: The Use of Bail Lock Knee Joints in the Rehabilitation of the High Level Spinal Cord Injured Below-Knee Amputee

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INTRODUCTION

Prosthetic treatment for a Spinal Cord Injured (SCI) patient has always been, at best, considered to be only cosmetic in design. But when considering the total concept of treatment requirements of the SCI patient, the necessity for standing, simple transfers and the daily maintenance of bodily functions, a prosthesis can be of great value in preventing bone deterioration and assisting in bowel and bladder functions. When viewing the total rehabilitation process of this SCI patient, and removing primary emphasis on ambulation and cosmesis, prosthetic treatment requirements take on a whole new process.

CASE HISTORY

On March 3, 1985, this facility was presented with a 30-year old male, six feet tall, weighing 153 pounds, who had multiple trauma as the result of electrical shock from contacting a high powered wire in early October, 1984. The patient exhibited C7 Myelopathy, incomplete, with neurogenic dysfunction of bowel and bladder.

He also had a below-knee amputation on the right resulting from infection secondary to electrical burns, and a partial foot with loss of the first and second toes of the left foot due to injuries received from the exit of the electrical charge.

Upon examination, the patient demonstrated good upper extremity strength, except for weak hand intrinsics. A good grip was exhibited, and it was noted that, because of upper extremity strength, future attempts at ambulation in parallel bars with assistance could be attempted.

The below-knee amputation, performed November 6, 1984, was well healed and of a proper condition for prosthetic consideration. However, a great degree of knee flexor spasticity was present, requiring large amounts of medication. A 90° flexion contracture manually reducible to 45° was also measured. The contractures were of sufficient strength and duration as to pull the patient completely out of a wheelchair. At first, attempts were made to reduce the right below-knee contracture by using a soft knee immobilizer, with no success. A plywood seatboard with an extension was fabricated to maintain extension of the

right below-knee amputation during sitting. Even with four inch foam padding, the rigid surface stimulated the contractures and was withdrawn, and similar treatments disregarded. Serial casting was suggested and accepted on condition that the patient would be closely monitored due to the lack of skin sensitivity, resulting from the level of injury. After initial application of the plaster negative mold, the patient complained of moderate discomfort. The cast was bivalved, and Velcro® adhesive straps were attached for frequent self-examination by the patient.

After two cast changes, results were considered minimal, and the contracture seemed to be fixed. At that time it was hoped that there was no calcification of the joint, and that the contracture was of soft tissue only. At that point, an above-knee amputation was considered to improve and lengthen sitting time and ability. After referral to the Rehabilitation Medicine department for consideration of phenol blocks to limit spasticity, the contracture was measured and determined to be set at 40q. The Rehabilitation Medicine physicians suggested surgical release of contracture after x-rays showed no bony involvement. After evaluation by and consultation with the General Surgery department, the patient himself requested surgical release of the contracture, in hopes of becoming a candidate for prosthetic treatment.

Orthotic and prosthetic lab personnel counseled the patient at great length in an attempt to educate him to the many possibilities and various consequences affecting any degree of prosthetic treatment of SCI patients. After lengthy discussions, it was felt that the patient's expectations were realistic, and a general surgeon released the contracture on July 11, 1985.

The Semi-Membranosus was isolated and resected, as was the Gracilis. The sartorius and biceps femoris were both sectioned. After completion of the surgical procedure, a 30° contracture remained. But the surgeon anticipated full extension after aggressive physical therapy.

The Physical Therapy department continued treatment of the patient after sur-

gery with short term goals consisting of strengthening the lower extremity muscles and lengthening standing time on the Blatnik table. With his strength increasing, the patient was referred to the orthotic and prosthetic lab for formulation of a treatment regimen.

ORTHOTIC AND PROSTHETIC TREATMENT

In order to enable the patient to stand with minimal assistance on the Blatnik table, and to prevent any future contracture, he was fit with an ankle-foot orthosis (AFO) with metal bilateral uprights and double action ankle joints on the left. A continual reduction of the right below-knee flexion contracture was also noted at this time. Two weeks later, the patient was transferring to and from his wheelchair, using a slide board with minimal assistance.

One month after fitting of the AFO in preparation for prosthetic care and in anticipation of gait training, the patient was fit with a knee-ankle-foot orthosis (KAFO) on the left lower extremity. The KAFO used bilateral steel uprights with Becker* bail locks and limited motion ankle joints, a full thigh corset, and a soft foam filler for the partial foot amputation.

Simultaneously, the patient was also fit with a PTS temporary below-knee prosthesis (Figure 1). The temporary limb was constructed using standard impression methods and modification principles. It consisted of a vacuum formed Surlyn® socket with a United States Manufacturing** adjustable below-knee Pylon, SACH foot, distal pour pad, full thigh lacer, and Becker bail lock knee joints (Figure 2). Using the PTS design with the full corset combination, we achieved a high level of suspension and medial lateral stability at the knee for this SCI patient.

*Becker Orthopedic Appliance Co., 1776 South Woodward Avenue, Birmingham, MI 48011.

**United States Manufacturing Co., 180 N. San Gabriel Blvd., P.O. Box 5030, Pasadena, CA 91107.

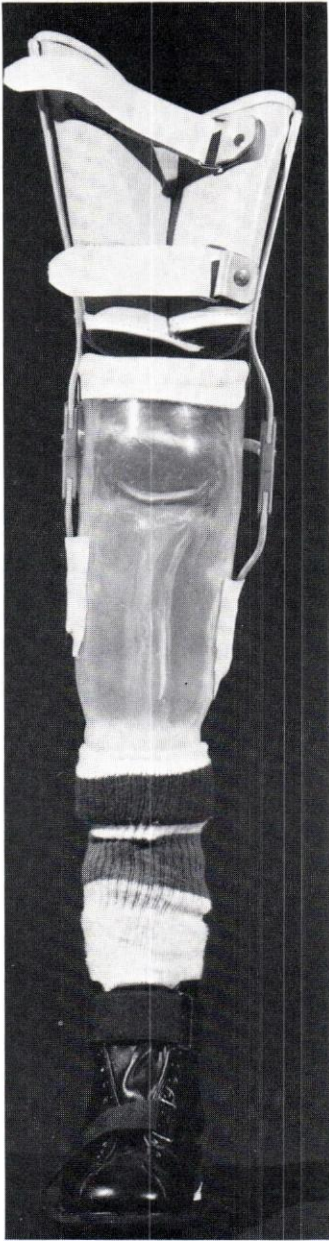


Figure 1. A PTS temporary below-knee prosthesis.

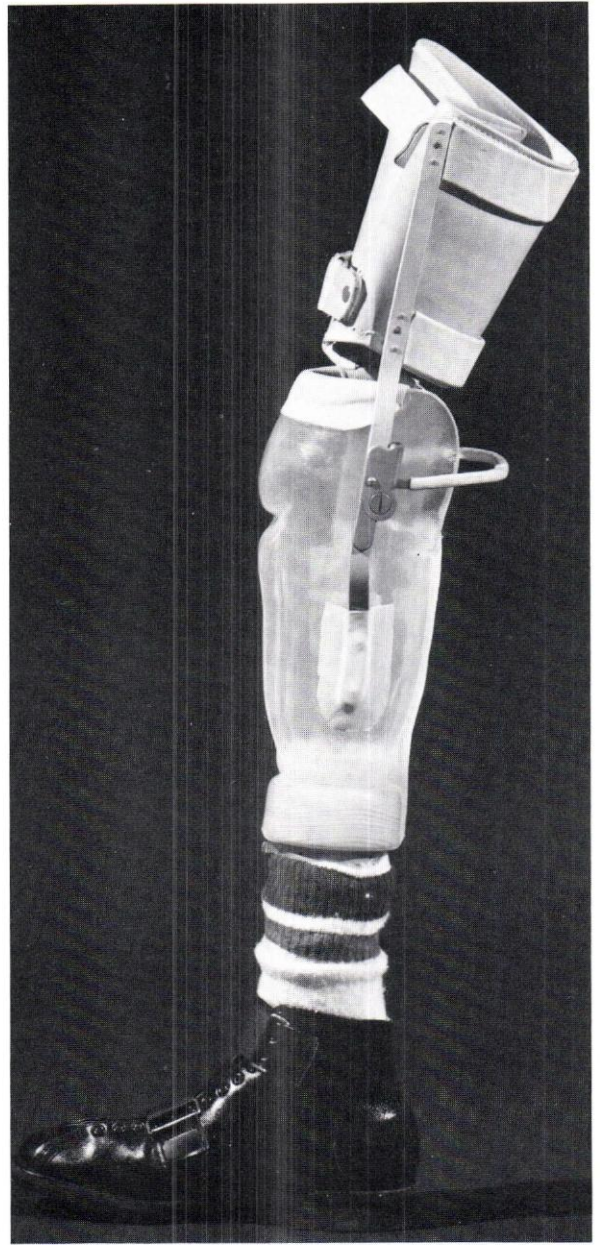


Figure 2. The PTS prosthesis consisted of a vacuum formed Surlyn® socket with a USMC adjustable below-knee pylon, SACH foot, distal pour pad, full thigh lacer, and Becker bail lock knee joints.

RESULTS

The patient accepted the orthotic and prosthetic devices and aggressively pursued physical therapy. Long range goals were to prepare the patient for a definitive prosthesis and to achieve an acceptable amount of independent transfers, in addition to lengthening the period of time in standing and ambulatory exercise. Functional gait was not considered at this time and stress was placed on those protocols which were required for the SCI patient. Although prosthetic treatment of an SCI patient is usually approached with a large degree of caution, this patient experienced minor problems during the fitting and follow-up periods of prosthetic care. However, aggressive physical therapy, extremely high patient motivation, and daily follow-up by orthotic and prosthetic lab personnel all contributed to the ability of a high level SCI amputee to take his first steps on the path of his individualized rehabilitation program.

CONCLUSION

When considering prosthetic treatment of the SCI patient, caution must be exercised, due to the inherent problems of lack or total absence of muscle activity and skin sensitivity. However, with high levels of patient motivation and total commitment of in-house rehabilitation staff, these difficult cases can be attempted with much more success than historical precedents would indicate.

AUTHORS

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