A Novel Concept in Fitting Bilateral Above-Knee Amputees: A Case History

William R. Svetz, C.P.O.

In March, 1982 we saw Mr. R.S.B., a twenty-three year old male with bilateral traumatic above knee amputations secondary to a railroad accident. These residual limbs were not ideal for prosthetic fitting.

The left limb was approximately seven inches in length and twenty-two inches in circumference at the ischial level. The entire anterior surface of the limb was covered with scar tissue and grafts from the inferior margin of the Scarpus Triangle to the distal end of the femur. There were also open areas permeating the graft area. The flexion angle was five to ten degrees and the abduction angle approximately fifteen to twenty degrees when relaxed, but this could be passively reduced to approximately five degrees of abduction. We had good extensor power to neutral, but some resistance to extension due to the anterior grafting.

The right limb was approximately three inches in length from the perineum and twenty-two inches in circumference. We had good viable tissue on this limb with minimal scarring. The problem would be to keep this limb in the socket and to stabilize the patient on this side during ambulation.

The usual prescription in a situation like this is a lock knee on the right side, safety knee on the left, and single axis feet to enhance the stability of the safety knee. In addition, quadrilateral sockets, hip joints, pelvic bands and split pelvic belt would be prescribed.

I personally have never been impressed with the majority of bilateral above knee prosthetic wearers. In most cases, the patient complains of a sensation of falling backwards. To compensate for this, they attempt to establish the center of gravity as far forward as possible. This is accomplished by an excessive amount of lumbar lordosis and hip flexion. The stance is similar to that of a parapalegic who has been treated orthotically. With this posture, an excessive amount of energy is required to maintain balance. Many times the patient must use both upper extremities to stabilize himself. This limits the ability of the patient to function bimanually in a standing position.

When walking, the bilateral above knee patient demonstrates an excessive amount of shifting and hip elevation to clear the floor during swing phase. This again is quite energy-consuming, and limits the distance the patient can travel. Also, pinching and discomfort can occur in the perineal region. These are some of the problems we want to eliminate, or at least decrease, in managing the problems of a bilateral above knee amputee.

Quite by coincidence, at the same time we were evaluating R.S.B., we were also fitting a Spina Bifida case with the L.S.U.

Reciprocating Gait Orthoses, which incorporated reciprocating hip joints.* In managing this paraplegic, I was impressed with the way the cable and solid pelvic belt kept the pelvis from rotating anteriorly, but allowed a reciprocating gait.

Fundamentally, the coupling of the hip joints with a cable permits one hip to extend when the other flexes, but prohibits bilateral hip flexion. Unlocking or uncoupling the cable permits free flexion for sitting. It is possible, therefore, to permit flexion and extension for walking, but at the same time provide adequate stability for standing. This lessens the energy required to maintain standing balance and allows the patient more freedom with his or her hands in standing activities. The pelvic band is fit low posteriorly, pressing on the sacrum, for increased control of pelvic rotation.

It was felt that these same features would be beneficial in meeting the needs of R.S.B. and, in addition, that the solid pelvic band would also enhance the medial and lateral stability that we would need, especially with his short residual limbs.

Therefore, bilateral above knee prostheses with endoskeletal construction and a solid pelvic band and reciprocating hip joints were prescribed. We chose Otto Bock # 3R20 polycentric type knees because of the stability characteristics, ease of motion, and mechanical elevation provided to increase floor clearance during swing phase. We also elected to use SACH feet. We decided to align the sockets in abduction as described by Goralnik and Scheinhaus.[1]

At the time of initial fitting, the scar tissue on the left lower limb had open areas and was draining. Wearing of the prostheses did not seem to traumatize these areas. I feel that increased stability and the action of the reciprocating units in controlled pelvic rotation were the reason. Balance and stability were easy to establish. However, excess reduction of the lumbar lordosis increased the patient's feeling of falling posteriorly. Rotation of the pelvic band on the proximal section of the reciprocating hip joints quickly eliminated this problem.

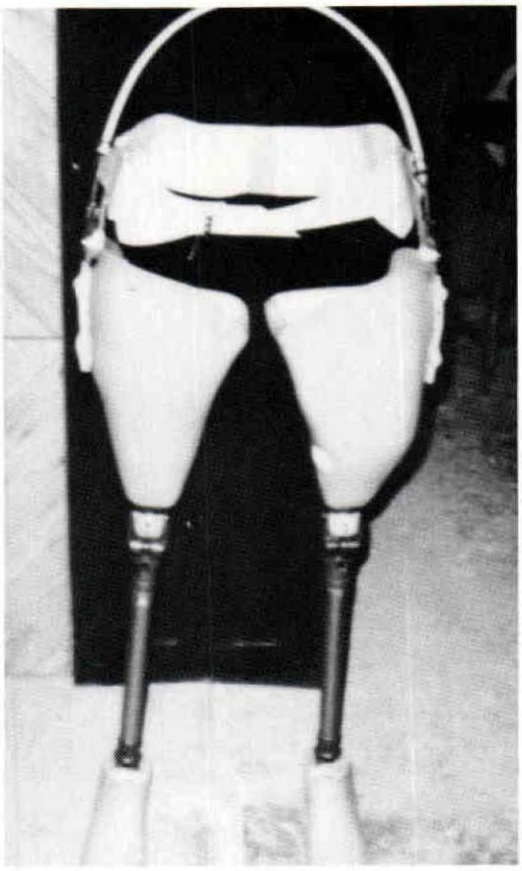

Figure 1. The completed prostheses.

The abducted alignment of the sockets along the solid pelvic band seemed to eliminate the problem of pinching and pain at the proximal medial areas of the sockets. The use of a solid pelvic band and hip joints gave superb medial and lateral stability with minimal limitation to function. The use of the reciprocating hip joint system and abducted socket alignment was greatly enhanced by the use of the 3R20 polycentric knee joints. The ability to fine tune the stability of the knees with the ease of knee flexion during gait and the extension assist made it much easier to dynamically align the prostheses.

After two weeks of therapy, R.S.B. was able to traverse six lengths of the parallel bars unassisted. There was still no complaint of pubic pinching or pressure, and

*Parts manufactured by Durr-Fillauer Medical, Inc., Orthopedic Division, Chattanooga, Tennessee.

Figure 2. After two weeks of therapy, R.S.B. could traverse six lengths of the parallel bars unassisted.

Figure 3. The solid band enhanced medial and lateral stability.

Figure 4. R.S.B. experienced much less medial lateral shifting of the trunk.

no problems whatsoever with knee stability. There was much less medial lateral shifting of the trunk than I have observed with other bilateral above the knee patients at this point in their training. I feel this is due to the solid band which enhanced the medial and lateral stability, especially on the three-inch side, and the polycentric knees which increased floor clearance during knee flexion.

By using the cable, it was possible to use the extensor power of the stronger left side to augment the force necessary to flex the socket and initiate knee flexion on the right side. With the larger pelvic band and proper placement of the hip joints, displacement in the sockets was never a problem. From a sitting to a standing position, and during ambulation, the sockets stayed closely oriented to the patient with almost no pistoning. The prostheses were completed and delivered, and R.S.B. was discharged from the rehabilitation unit in May.

Subsequent follow up revealed that R.S.B. was not using the prostheses. In one

Figure 5. From a sitting to a standing position, and during ambulation, the socket stayed closely oriented to the patient with almost no pistoning.

instance, the sockets had to be modified because of a gain in weight. The patient also complained of the weight of the prostheses, due primarily, we feel, to the modular construction and polycentric knees. Later on, R.S.B. underwent grafting procedures for revision of the scar tissue. A few months after the operation, R.S.B. was scheduled for follow up and possible prescription of new sockets.

In this instance, prescription of bilateral above knee prostheses incorporating reciprocating hip joints cannot be called a total success. The presence of scar tissue and grafts has been a major complicating factor. Nonetheless, we feel the concept has considerable merit and we advance the concept for your consideration in meeting the need of these patients.

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NOTES

[1] Harmarville Rehabilitation Center Patient Management and Training.

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AUTHOR

Mr. Svetz is Executive Vice President of the Union Artificial Limb & Brace Co., Inc., 3401 Liberty Avenue, Pittsburgh, Pennsylvania 15201.