Modified Axillary Crutches for an Adolescent With Bilateral Congenital Transverse Deficiencies of the Radius and Ulna and No Hands

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This report describes the construction of modified axillary crutches for a patient who had bilateral congenital transverse incomplete deficiencies of the radius and ulna and no hands. Before physical therapy, the patient underwent a left pangenicular percutaneous epiphyseodesis of the distal femoral and proximal tibial physis, causing him to be temporarily non-weight-bearing on the left lower extremity. The patient lacked both hands; therefore, he was unable to use crutches. Traditional axillary crutches were modified with permanent bilateral casts at the axilla/arm region to facilitate use by the patient. Using the modified axillary crutches, he ambulated independently and climbed and descended stairs with contact guard assist, while maintaining the non-weight-bearing status of the left lower extremity.

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This report describes the construction of modified axillary crutches for a patient with bilateral congenital transverse incomplete deficiencies of the radius and ulna and no hands. The patient underwent lower extremity surgery, causing him to be temporarily non-weight-bearing on the left lower extremity.

The obvious choice of mobility for this patient would be a wheelchair. The patient, only a few weeks away from beginning his first year of high school, stated his preference was not to have to be in a wheelchair. There were then two options. One was to have the patient wear his prostheses and modify axillary crutches for a patient who had bilateral congenital transverse incomplete deficiencies of the radius and ulna and no hands. The patient's left elbow was fixed in extension, while the right elbow had minimal nonfunctional motion. He had a leg length discrepancy of approximately 2 centimeters, which indicated the surgical procedure of a percutaneous epiphyseodesis. Before surgery, the patient was an independent ambulator. He was able to eat and write with the combined efforts of both arms. The patient had shoulder harnesses above the elbow prostheses, but preferred not to use them.

Physical Therapy Evaluation

The patient was referred to physical therapy on the second day after surgery, while still in the hospital for gait training and transfer training.

After surgery, the patient's first physical therapy session revealed that he was independently able to position himself from supine to sitting by rocking the trunk along various horizontal axes. Through the use of his arms and abdominals, he was able to position his trunk vertically. The patient required assistance in lifting his left lower extremity because of the weight of the surgical dressings and brace during transitioning from sitting with his trunk vertically positioned and his legs extended to sitting on the edge of the bed. The physical therapist placed two hands on the patient's trunk to assist with a stand and pivot transfer from the bed to the wheelchair. Assistance to the patient's trunk was required for standing balance while independently maintaining a non-weight-bearing status on the left lower extremity. At this time, platform attachments for Loefstrand crutches were considered for ambulatory aide, but both failed because the suspension mechanism was inadequate for a patient with below-elbow congenital deficiencies. The patient and his family were instructed on proper transfer techniques and were independent with these tasks.

Initial orders were for the patient to be non-weight-bearing on the left lower extremity. Because of the patient's congenitally absent hands, he was unable to use traditional axillary crutches.

One consideration in the construction of modified axillary crutches was for the patient to wear above-elbow prostheses. Since the patient preferred not to wear the devices for daily function, they would have to have been attached to his crutches and donned only for ambulation. The attachment of the patient's prostheses to the crutches would not have been practical because he was only going to require the use of the crutches for approximately 3 months and would have risked damaging the prostheses. The patient and his family were consulted regarding the risks of using the modified axillary crutches without any research to back up the reliability of the piece of equipment. They agreed that the technique would be beneficial.
Before fabrication of the crutches, consent was granted by the patient's physician regarding the safety of application of weight on the patient's bilateral axillary region.

Intervention

The patient came to physical therapy on postoperative day 3, at which time the crutches were modified and the patient was instructed on their use.

The casts were constructed of fiberglass as opposed to a thermoplastic material because of its greater strength and durability. Both upper extremities were wrapped with the following materials, in order of application, from 2.5cm proximal to the elbow and 2.6cm distal to the axilla: 7.5cm stockinet, 7.5cm padding, two rolls of 7.5cm fiberglass per arm, and one roll of 5cm fiberglass per arm to attach the cylindrical cast to the crutches (fig 1).

Construction of the crutches took just under 2 hours.

The physical therapist instructed the patient in the use of the crutches, which were easily donned independently by the patient while sitting. One crutch was donned at a time by balancing the tip of the crutch on the ground and stabilizing the crutch against his trunk while sliding his arm into the snugly fitting cylindrical cast. With posterior-anterior rocking momentum of his trunk, he stood as the physical therapist placed one hand on the patient's back for assistance with balance. The patient performed this motion while maintaining a non-weight-bearing status of the left lower extremity. Once standing, he stood independently and ambulated with stand-by assistance for approximately 50 feet. The patient initiated movement with a swing-to sequence and progressed to a swing-through sequence. The patient ambulated up and down stairs with the crutches while one person's hand was on his back for approximately 25% balance assistance.

After an hour of practice with his new crutches, the patient did not show any redness from irritation from the modified crutches. The patient was discharged with the modified crutches.

He returned to physical therapy 12 days after receiving his new crutches. As before, physical examination revealed no signs of irritation at contact areas of the crutches. The patient reported he was independently performing all transfers and independently ambulating with the crutches. The patient’s only complaint concerned ascending and descending stairs due to his requiring greater than 25% assistance from his mother, who placed one hand on his back and one hand on his anterior chest during this activity. The patient demonstrated, using the crutches, independent ambulation for approximately 150 feet while maintaining a non-weight-bearing status of the left lower extremity. With the patient's mother placing one hand on his back in the event he required assistance, the patient successfully climbed and descended one flight of stairs, after 5 minutes of practice.

Three months after surgery, the patient was ambulating independently without any assistive device.

DISCUSSION

This case provides one example of how a traditional piece of equipment can easily be reconstructed into a functional tool for a patient who faces unusual circumstances. Performing a thorough evaluation before treatment represented a key element in the successful outcome of this case. Our patient was a physically strong person with a tremendous will to be independent. Not all individuals are this motivated or are as strong physically.

One concern in the construction of this piece of equipment is the issue of safety. In this case the concern was the possibility of falling. If the patient had fallen, a primary concern would have been whether he could get his arms out of the casts quickly enough to provide some protection from the fall. These issues were discussed with the patient, and in this case, his functional independence proved to outweigh the risks.