Incorporating Continuous Passive Motion in the Rehabilitation of a Patient With Guillain-Barré Syndrome

Mary L. Mays

Key Words: movement therapy • rehabilitation

Guillain-Barré syndrome is an acute, symmetric, ascending polyneuropathy that usually occurs after viral infection or immunization (Gilroy & Holliday, 1982). Patients initially show paresis or muscle weakness in the lower limbs, followed rapidly by flaccid paralysis of the peripheral muscles and eventually of the muscles of the trunk and upper extremities. Because of autonomic nervous system involvement, urinary problems—distension of the bladder from urine retention—occur in about 25% of the cases (Gilroy & Meyer, 1979). Respiratory paralysis, a common symptom, can result in critical situations requiring a tracheotomy and close monitoring of respiratory functioning (Schunberg, 1981).

This synopsis provides a focus to discuss occupational therapy management of a patient with Guillain-Barré syndrome. In particular, this report will highlight the use of a continuous passive motion machine for treatment of the patient’s painful, nonfunctional hands.

Background

After an upper respiratory infection that had been routinely treated with antibiotics, a 67-year-old man noted numbness and tingling in his extremities that rapidly progressed to generalized weakness and ataxia. He was admitted to an acute-care hospital, but his condition deteriorated and required his transfer to the intensive care unit for treatment of increasing respiratory difficulties. Quadriplegia with bronchopneumonia followed, and the patient was placed on a respirator. The respirator was discontinued after 7 weeks, when his condition improved; however, the patient still required intermittent oxygen. He was returned to the general acute-care unit where he spent an additional recovery period of 2 weeks. He was then transferred to a rehabilitation unit, where he stayed for 3 months.

Occupational Therapy Assessment

The initial occupational therapy evaluation on the rehabilitation unit showed an alert man oriented to person, place, and time who communicated poorly because of a trachial tube. Oxygen was continued intermittently and the patient required constant suctioning. Proprioception was not evaluated because of the intense pain caused by movement of the joints. When a light touch stimulus was applied with a fingertip to the upper extremities (with the patient’s eyes occluded), it was found that there was no loss of sensation. Evaluation of stereognosis was not appropriate because the patient could not manipulate objects in his hands. Upper extremity active range of motion was severely limited (see Table 1). The pa-

Mary L. Mays, OTR, is Primary Occupational Therapist on a rehabilitation team at Grossmont Hospital, Rehabilitation Center, 5555 Grossmont Center Drive, La Mesa, California 92042.

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Table 1
Upper Extremity Range of Motion (Initial Evaluation)

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder flexion</td>
<td>20°</td>
<td>30°</td>
</tr>
<tr>
<td>Shoulder abduction</td>
<td>35°</td>
<td>0°</td>
</tr>
<tr>
<td>Elbow flexion</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>Elbow extension</td>
<td>WNL</td>
<td>WNL</td>
</tr>
<tr>
<td>Wrist flexion</td>
<td>10°</td>
<td>-5°</td>
</tr>
<tr>
<td>Wrist extension</td>
<td>20°</td>
<td>0°</td>
</tr>
</tbody>
</table>

Note. WNL = within normal limits.

Patient's hands had extremely limited active range of motion at all the joints. Flexion and extension appeared to be less than 10°. Passive movement was painful, so measurements were made with extreme care. In the left hand, passive range of motion in the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints was approximately 90°. In the right hand, passive range of motion was 90° for the metacarpophalangeal, 90° for the proximal interphalangeal (except the third finger, which was 30°), and 45° for the distal interphalangeal joints. The thumbs were adducted and painful to move, particularly at the carpometacarpal joint.

The patient's body appeared rigid, with little active neck or trunk movement. He was unable to bear weight on his legs. Testing of leg muscles revealed his strength to be 1 to 1½ out of a possible 5 points (a score of 5 is considered to be normal). Information received from the acute-care hospital indicated that he tolerated sitting in a reclined wheelchair for two 1-hr periods each day. He was totally dependent in his self-care.

Treatment and Patient Progress

The patient had been hospitalized for 2 months when he arrived on the rehabilitation unit, and there was concern that the lack of active movement in his upper extremities could lead to contractures. Akeson, Amiel, Abel, Garfin, and Woo (1987), in an article on joint immobility, indicated that mechanical joint incongruity results from a variety of problems, which may include inflammatory disorders resulting from autoimmune processes, degenerative processes, congenital disorders, and prolonged bed rest. Akeson et al. further stated that "the final common thread in the mechanisms that lead to contracture is a restriction in range of motion of the affected joint. It is this mechanical restraint, whether induced by pain, joint destruction or incongruity, or loss of motor power which leads to contracture" (p. 30). The occupational therapy treatment program focused on preventing upper extremity joint contractures and muscle wasting and on encouraging participation in activities that would use the existing active movement in the upper extremities.

The patient was seen for three half-hour sessions daily. The morning session involved activities of daily living: specifically, the therapist encouraged the patient to participate in bed mobility (i.e., rolling, shifting weight, or both) in order to assist in lower extremity dressing and to participate (with hands-on assistance) in hygiene and grooming tasks. The other two occupational therapy sessions included active assistive range of motion exercises and passive range of motion exercises, with special attention to the fingers. Dynamic splints were fabricated to increase active range of motion of the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints and to safeguard against extensor tendon shortening. Volar splints were worn on the forearms, and rubber bands were attached by hooks to the fingernails and secured on the forearm splint. The traction on the rubber bands was increased as the patient gained more finger flexion.

Tolerance to the splints was low at first. They were worn initially for 30 min twice daily, but wearing time increased to 1 hr on and 3 hr off as tolerance improved and progressed further to 1 hr on and 1 hr off. Active range of motion exercises were encouraged during the occupational therapy sessions when the splints were off; when the splints were in use, the rubber bands passively assisted the finger flexors and resisted the extensors.

Four Weeks

After 4 weeks, the patient could tolerate a deltoid aid for shoulder and elbow exercises. The deltoid aid was used daily from this point on in two clinic sessions for at least 15 min each session. Although the splints helped to maintain extensor tendon stretch and had slightly increased active range of motion in the metacarpophalangeal and proximal interphalangeal joints, the patient could not use his hands for functional activities. Passive range of motion exercise continued
two to three times daily, but the pain reactions were still intense and the hands became stiff in an extended posture immediately after the exercises.

More aggressive treatment was needed to increase the frequency of passive movement to all the joints and thus provide more lubrication and flexibility. It was decided at this time to try a continuous passive motion machine. In an article on prolonged stretch for correction of connective tissue shortening, Kottke, Pauley, and Ptak (1966) indicated that when normal motion is limited and the necessary tension provided by that motion is absent, contractures develop through shortening of collagenous connective tissue. However, collagenous tissue "shows plasticity in that it slowly elongates under moderate constant tension" (p. 348). These authors found manual stretching to be insufficient not only because of therapists' limited time, but because the proper amount of tension is difficult to maintain. The continuous passive motion machine, however, provides a slow, constant tension and can be used over a longer period of time than a therapist can allot to passive ranging exercises during the course of a day.

The continuous passive motion model chosen to augment the occupational therapist's treatment included a drive unit that attached to the palmar surface of the forearm with touch-fastener straps. Rubber finger covers were placed on each finger. A slender wire attached to the tips of the finger covers ran to the drive unit. The machine included an attachment for the thumb, but this was used at a different time in order to give full range of motion to the fingers.

A 24-hr schedule was established for use of the machine. The fingers of each hand were ranged for a 4-hr period and the thumbs for a 2-hr period. The machine was removed during occupational and physical therapy and at mealtimes. The members of the nursing staff were instructed in the application of the machine. The fingers of each hand were ranged for a 10 times and double-towel for approximately 20 min. The patient tolerated it well and reported a further easing of discomfort.

Six Weeks

After 2 weeks on the deltoid aid and 1 week on the continuous passive motion machine, the patient was able to bring finger food (a small piece of bread or banana) to his mouth with either hand. He was able to brush his teeth with the help of a universal cuff, although he required assistance to change the position of the bristles. He achieved some success in shaving, with minimal assistance, by using an electric razor with both hands. The inconvenience of wearing the continuous passive motion machine on his hands was accepted by the patient fairly readily because the benefits—most notably, pain-free range of motion—were immediately evident. The initial few seconds caused some discomfort, but it quickly resolved. The thumbs continued to be a problem even after stretching, however, and quickly adducted upon removal from the machine.

Salter et al. (1984) used a continuous passive motion machine for patients with synovial joint injuries and disorders and concluded, after 12 years of research, that the continuous passive motion was well tolerated by the patients in their study and seemed to be relatively painless. They explained that "the continuous generation of proprioceptive impulses from the continuously moving joint and their transmission to the spinal cord or brain may 'block' the transmission of pain impulses to the brain" (p. 541). Although their conclusion was based on work with persons with synovial joint injuries, it is interesting to note that the patient with Guillain-Barré syndrome in the present report also reported no pain from use of the continuous passive motion after the initial two or three movements of the joint.

Eight Weeks

After 8 weeks, the patient was able to bring food to his mouth with a fork and universal cuff if food was first placed on the fork for him. He was able to pick up and drink from a cup using both hands; he initially needed minimal assistance for placement because of the adducted thumbs. He now required minimal assistance with shaving and minimal to moderate assistance with dressing the upper extremities (excluding buttons). He was still dependent in dressing his lower extremities. In an attempt to resolve any residual stiffness in his hands, paraffin was added to the therapy program. Once a day, the patient’s hands were dipped in paraffin 10 times and double-towel for approximately 20 min. The patient tolerated it well and reported a further easing of discomfort.

Ten Weeks

After 10 weeks of therapy, the patient was able to scratch the back of his head with his left hand and brush his teeth without using the universal cuff. He

Table 2

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
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<tbody>
<tr>
<td>Self-feeding</td>
<td>Independent* after set-up</td>
</tr>
<tr>
<td>Hygiene/grooming</td>
<td>Independent* after set-up</td>
</tr>
<tr>
<td>Upper extremity dressing</td>
<td>Minimal assistance</td>
</tr>
<tr>
<td>Lower extremity dressing</td>
<td>Minimal assistance in bed</td>
</tr>
<tr>
<td>Bathing</td>
<td>Minimal assistance</td>
</tr>
<tr>
<td>Transfer to bath seat</td>
<td>Contact guard</td>
</tr>
<tr>
<td>Toilet transfers</td>
<td>Contact guard to raised toilet seat with versiframe bars</td>
</tr>
</tbody>
</table>

* No adaptive equipment required.
required occasional assistance with shaving and shaving set-up. He required minimal assistance with upper extremity dressing, excluding buttons, but remained dependent in lower extremity dressing. He was able to place food on a fork with 90% accuracy and feed himself.

The continuous passive motion machine was discontinued at about this time because both the therapist and the patient felt that the hands were more flexible and less painful than before, that the functional gains, as noted above, were evident, and that any further benefit from continuous range of motion would be minimal, because it appeared that active range of motion had plateaued.

**Twelve Weeks**

Two weeks later, the patient was discharged from the unit after a 3-month stay (see Table 2 for the patient’s self-care status at time of discharge). His upper extremity range of motion on discharge is shown in Table 3. In addition, he was able to walk 100 ft using a pick-up walker and contact guard. His sensation bilaterally was intact to light touch and proprioception. Stereognosis was absent.

On admission to the rehabilitation unit, the patient had minimal (below 10°) active finger flexion and extension in both hands. At discharge, active finger flexion had increased to almost normal limits at the metacarpophalangeal and proximal interphalangeal joints (see Table 4). Active extension at the metacarpophalangeal and proximal interphalangeal joints was normal. In both hands, passive range of motion at the metacarpophalangeal and proximal interphalangeal joints was within normal limits. Distal interphalangeal flexion was below normal, with a variation of 15° to 45° on the right and 15° to 55° on the left.

The patient had 30° to 35° of active movement in both thumbs at the metacarpophalangeal and interphalangeal joints. Because the thumbs still tended to adduct, he was discharged with thumb abduction splints, which were to be worn at night.

**Discussion**

Although time is an essential factor in recovery from Guillain-Barré syndrome, there were many aspects of the patient’s treatment plan that contributed to his improvement. Proper guidance from an occupational therapist in therapeutic exercises and functional activities effectively increased this patient’s chances for recovery and prevented permanent disability from contractures. It is also felt that the use of the continuous passive motion machine facilitated a more rapid recovery. Although this benefit was not scientifically proven, it is hoped that this case report will increase the options of those who have not thought of this particular therapeutic application, encourage those who have thought of it but not tried it, and stimulate further study and documentation.

**References**


Editor's Note. To continue the Case Report department, we need and welcome reports that document the practice of occupational therapy for specific clinical situations. Guidelines for writing case reports are available from the Editor.