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A New Bed-Frame Device to Minimize Halo Malalignment

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INTRODUCTION

The halo orthosis evolved in the 1950's in response to an increasing number of cervical spine injuries and operative procedures. The previously available body cast provided an insecure grasp of the body and head, thus limiting their effectiveness in stabilizing the cervical spine. Despite extremely careful application and molding, the body cast (Minerva jacket) limits the motion of the cervical spine but does not fix it in a given position, nor does it offer any distraction of the vertebral column.

Head fixation soon became a troublesome problem. The thin scalp and skull tolerates only minor force without skin breakdown or pain. The cranial roundness provides a less than optimal surface for attaching fixtures.

Hoen[3] in 1936 introduced skeletal traction via paired wire loops. His system was soon replaced by Crutchfield tongs, which had been described three years earlier, since the tongs were technically easier to apply.[2] Modifications of the tongs by Vinke[5] and Barton[1] reduced the slippage inherent in the original device. However, all of these systems were limited to single-plane fixation, thus limiting the amount of positioning that the staff and patient would be able to exercise. The halo orthosis was a fusion of many well-known fixation devices, including Bloom's facial body traction. Its prototype, the halo-plaster body cast, was first described by Perry and Nickel in 1959[4] and has subsequently evolved into the plastic and metal orthosis known to us today.

The halo orthosis, unlike other cervical traction devices, offers six distinct advantages:

- precise positioning in all three planes
- adjustable longitudinal traction
- simple application
- minimum patient discomfort
- relatively inflexible stabilization
- fewer complications from surgery or prolonged confinement to bed

These advantages may be negated by forces within the halo orthosis itself,[6] or by poor positioning of the patient in the conventional hospital bed. The subsequent text reviews our experience with the halo orthosis, its advantages, and a particular fault in positioning that may be remedied by a simple footboard device.

DISCUSSION

The Department of Neurological Surgery at Stony Brook University Hospital (New York) is a regional center for the acute

treatment and stabilization of patients with cervical spine injuries and their associated neurologic deficits. Our therapy consists of rapid stabilization of the fracture/subluxation in hopes of minimizing permanent neurologic involvement. After sufficient stability is achieved, the patient is transferred to a rehabilitation facility.

Although our patients do include those who are ambulatory, the majority are not. In either case, the halo orthosis has been the appliance of choice, for it maintains proper cervical alignment and distraction while offering the mobility for both in-house physical therapy and subsequent transportation to the rehabilitation facility and further therapy.

Initially, the patient's cervical spine is stabilized in Gardner-Wells long traction on a Roto-Rest Kinetic Treatment Table.™ When proper reduction of a fracture/subluxation site is realized, and the patient is medically stable, the patient is placed in the halo orthosis and transferred to a standard hospital bed.

After their transfer to the hospital bed, patients characteristically complain of 'tightness' in the distal anterior aspect of the thoracic jacket. This may also be accompanied by added difficulty in breathing and pressure on the spinous process of the scapula. In addition, the cervical spine x-rays show deterioration in alignment. Initially, these symptoms were attributed to greater mobility of the patient during therapy and in the hospital bed. However, reducing the patient's activity did not appreciably reduce these symptoms. Further adjustments in the fit of the jacket failed to relieve the symptoms as well.

A subsequent review of patients has indicated that the position of the bedframe pivot joint for torso elevation on the standard hospital bed is not located properly for the average adult, especially those in the halo device. When the average adult is positioned customarily in bed, the break in the mattress at the pivot joint of the flexed bedframe is located at the mid-thoracic re-

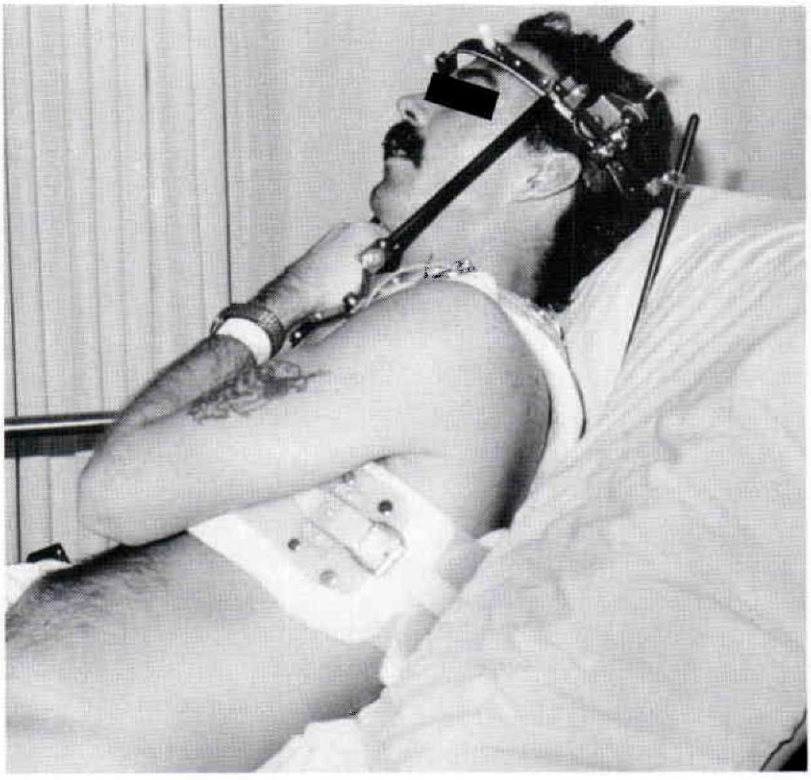

Figure 1. Halo patient in hospital bed in flexed position. Note break in bed at thoraco-lumbar area of spine.

gion instead of the anticipated sacro-gluteal region. Consequently, the patient is forced into a flexed thoracolumbar position (Figure 1).

In this situation, since the halo thoracic jacket extends only to the mid-torso, the thoracic spine is flexed, forcing the anterior distal aspect of the jacket against the lower ribcage, causing excessive distal anterior pressure and difficulty in breathing, as described by most patients. Posteriorly, the scapular spinous process is exaggerated and protrudes against the proximal posterior aspect of the jacket. This flexion appears to extend into the cervical spine itself, thereby disrupting alignment and stabilization that was purportedly intact. This flexion of the cervical spine may be substantiated by x-rays of patients in neutral (Figure 2) and flexed-bed position (Figure 3), where the distal pelvic girdle rests on the mattress, allowing the entire torso to lie against the elevated portion of the mattress.

Figure 2. Cervical spine x-ray of halo patient in neutral position afforded by bed-frame device. Note alignment.

Figure 3. Cervical spine x-ray of patient in flexed bed without proper positioning in bed. Note anterior subluxation of spine at lower cervical area.

DEVELOPMENT

Despite proper positioning by the staff, patients were unable to maintain that location but instead, migrated toward the foot of the bed. A positioning device was constructed to maintain the proper pelvic position at the mattress fold. The device consists of two 2′ × 1′ half-inch thick pieces of plywood covered with leatherette and attached to a Z-type frame of $1\frac{1}{4}$″ by $\frac{3}{16}$″ steel strapping.

The long arm of the frame lays along the mattress while both upright bends serve as attachment bars for the wood platforms (Figures 4 and 5). One platform rests against the footboard of the bed, while the other serves as a foot rest. The surface of the foot rest has Velcro® hook material attached to it to accept the Velcro® pile material of positioning boots worn by patients to prevent footdrop (Figure 6).

After patients were properly positioned in bed using this new footboard device, complaints and alignment problems were virtually eliminated. Figure 7 shows the patient in proper alignment with the posi-

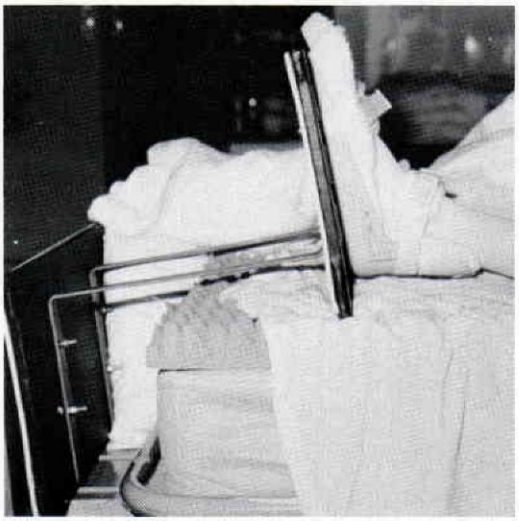

Figure 4. Bed frame device with positioning boots in place.

Figure 5. Positioning boots and bed frame device. Note Velcro® attachments on footboards.

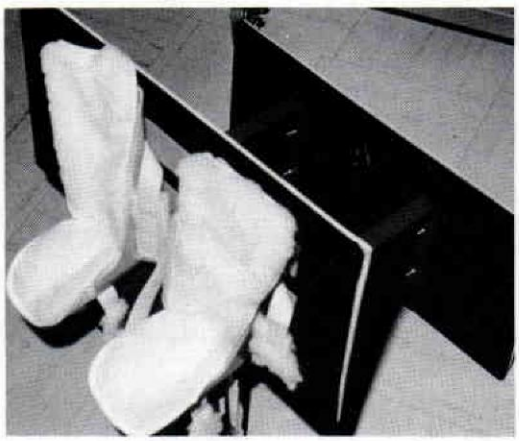

Figure 6. Bed frame device shown with positioning boots. Unit is easily removed and stored by nursing personnel.

tioning device. Note that this unit was made specifically for this patient's height and leg length. However, adjustable length units are easily constructed for general positioning purposes.

Figure 7. Halo patient properly positioned in bed with flexion at the hips and pelvis.

CONCLUSION

Clearly, the proper positioning of a patient in a standard hospital bed is a significant contributing factor to proper orthosis alignment and maintenance. Proper alignment cannot be maintained unless the hospital staff and patient are alerted to positioning criteria. In addition, a positioning device should be employed to attain and maintain the desired result.

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