

The Chicago Insert: An Approach to Wheelchair Seating for the Maintenance of Spinal Posture in Duchenne Muscular Dystrophy

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INTRODUCTION

Scoliosis is a complication of wheelchair confinement in Duchenne muscular dystrophy.⁴ Such curves are rapidly progressive and are convex toward the side of the dominant hand because the patient usually leans toward the nondominant side to support the dominant arm.³ A variety of external spinal containment systems have been described which retard the rate of scoliotic progression by maintaining the spine erect. Wilkins and Gibson, studying 62 wheelchair-confined Duchenne dystrophics, noted that although many developed marked scoliosis and kyphosis, those with hyperextended spines and rigid paraspinal contractures had comparatively little lateral curvature.⁵ Locking of vertebral facets in exaggerated lordosis apparently inhibits the development of scoliosis. Wilkins and Gibson recommend orthotic management of wheelchair-confined patients to keep the pelvis level and the spine extended. This can be accomplished with a firm wheelchair seat and either circumferential or three-point torso support, preferably fabricated from orthoplast or Pelite-lined polypropylene or

polyethylene. Alternatively, a spinal containment orthosis in the form of a modified wheelchair seat may be used.² This method features a fiberglass shell, lined with custom-carved polyurethane foam upholstered with a modified urethane foam and a tricot double-knit covering. The patient's pelvis is snugly fitted and his thoracolumbar junction extended. The lumbar lordosis thus created is bolstered by the backrest, which also incorporates lateral flanges to support the sides of the chest. To further encourage lumbar extension, the backrest is inclined backward 15 degrees. Although offering a viable option in the prevention of scoliosis in wheelchair-confined Duchenne dystrophies, cost and availability of this system limit its wide application.

A wheelchair seating insert, referred to as the "Chicago insert", was developed by the authors. The insert was modeled on the design of Wilkins' and Gibsons' "Toronto spinal support system", and is prescribed when a patient with Duchenne muscular dystrophy is first wheelchair-bound (Fig. 1). For those who have already developed slight scoliosis, the device can correct seating imbalances to reduce lateral leaning. It can be fitted to any standard wheelchair.



Fig. 1—The Chicago insert fits in a wheel chair. The back is designed to hyperextend the lumbar spine. Lateral pads prevent leaning and do not interfere with arm movement.

FABRICATION AND FITTING

Measurements include the width of the wheelchair, vertical height at the waist with the patient seated on a flat surface and a snug measurement at the waist. A plaster mold is not required. Construction begins with a hinge spring steel frame, over which wide bands of rubber are stretched. A block of ethafoam, a close-cell polyurethane, is used for the seat and is cut to give a 15 degree posterior tilt. One inch Temper foam is glued to the seat for comfort. The entire seat is then covered with plastic. (Fig. 2). The back of the insert is angled posteriorly 15 degrees superior to waist level in order to provide thoracolumbar hyperextension. Lateral control pads attach at the hinge of the seat, flaring upward with the apex at waist level and the superior border at the level of the lower two ribs. These are formed using 3/16" polypropylene as a base, with carved ethafoam for shape and, again, one inch Temper foam for comfort. The entire orthosis is then covered with nylon tricot, which does not restrain the conforming actions of the foam.



Fig. 2—Fabrication of the seat. Wide rubber bands are stretched across the back. Ethafoam and temper foam are used to pad the seat and lateral pads.

During fitting, the lateral control pads must be adjusted so they do not impinge on the arms. The height of the apex of the pads and correct placement of the extension bend should be checked. Usually, a slack back has to be applied to the patient's existing chair to allow full extensions of the insert.*

Posterior tilt of the seat fits the patient against the back of the device, encouraging extension and guiding the lumbar spine into lordosis, thus locking the lumbar facets. The firm seat keeps the pelvis level, while the lateral control pads help center the patient in the chair and discourage lateral leaning. The "Chicago insert" provides some of the benefits of the "Toronto spinal support system" and is more cost effective.

*Further fabrication and fitting details available from North Shore Orthopedics, 2041 Green Bay Road, Highland Park, Illinois 60035.

References

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