Safe Transportation for Children With Disabilities

Janet D. Stout, Marilyn J. Bull, Karen Bruner Stroup

Key Words: child, handicapped • equipment design • transportation

Few guidelines are available on providing safe transportation for children who cannot use conventional auto restraints. This article discusses the misuse of restraints and reviews several modified car seats and other restraints that have been tested and that meet safety standards.

Motor vehicle accidents are the leading cause of death among children in the United States. The proper use of car seats reduces the risk of fatality by an estimated 71% and the risk of serious injury by 67% (Kuhane, 1986). All 50 states require that infants and young children be secured in car seats or seat belts, but few guidelines are available on providing safe and accessible transportation solutions for children whose disabilities make the use of approved car seats and standard automobile seat belts inadequate. Such disabilities may be temporary or permanent and include very low birth weight, lower extremity or hip casts, spina bifida, Pierre Robin sequence, and cerebral palsy.

U.S. safety standards do not regulate methods or devices for transporting a child with disabilities (National Highway Traffic Safety Administration, 1979). Federal Motor Vehicle Safety Standard (FMVSS) 222, which established safety requirements for school bus interiors, pertains only to children with no disability. FMVSS 213, which set rigorous design and performance standards for child restraint systems, applies only to children weighing up to 50 lb. Children with disabilities often cannot be accommodated by these standard seats and may need a restraint system after their weight exceeds 50 lb.

Pressure for improved transportation resources for medically fragile children is most likely to come from health professionals aware of the problems and available solutions. Occupational therapists have an interest in wellness and disability prevention, as well as direct access to children with special needs, and should assume a leadership role in this area. Therapists need to ask about seating systems their patients use in the car and school bus. If they know the advantages and disadvantages of various systems, they can make recommendations regarding equipment and justify third-party reimbursement.

This article presents some guidelines and outlines current resources for the transportation of children with disabilities (see Table 1). The purpose of the article is to enable occupational therapists to recommend safe alternatives for children requiring non-conventional restraint systems.

Neurologically Impaired Children Weighing More Than 50 lb

Pediatric therapists frequently must recommend safe car seating for neurologically impaired children. There are several options that have performed satisfactorily in dynamic crash testing for children who weigh more than 50 lb and who no longer fit in the standard car seat but who do not have the head and trunk control to use a booster seat or lap/shoulder belt safely. Two possibilities are the Special Seat (formerly called the Britax Handicapped Child Safety...
Table 1

Devices for Transporting Children With Disabilities

<table>
<thead>
<tr>
<th>Disability</th>
<th>Potential Solution</th>
<th>Suggested Supplier</th>
<th>Institutional(^{1})</th>
<th>Retail (^{1})</th>
<th>Weight Range (lb)</th>
<th>Height Range or Waist Size (in)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight</td>
<td>Regular infant car seat without shield(^{a})</td>
<td>Wherever car seats are sold</td>
<td>-</td>
<td>$30-$60</td>
<td>≤20</td>
<td>≤26</td>
<td>Modify with blanket rolls if necessary.</td>
</tr>
<tr>
<td></td>
<td>Dyn-O-Mite Infant Car Seat</td>
<td>Wherever car seats are sold</td>
<td>$25</td>
<td>$30</td>
<td>≤20</td>
<td>≤26</td>
<td>Reclined position may be beneficial for apnea-prone infants, flat position not recommended.</td>
</tr>
<tr>
<td></td>
<td>Swinger Car Bed</td>
<td>Evenflo, Piqua, OH</td>
<td>$175</td>
<td>$299</td>
<td>≤20</td>
<td>≤26</td>
<td>May be useful for infants at risk of apnea and hypoventilation in standard car seat.</td>
</tr>
<tr>
<td></td>
<td>Swinger Car Bed</td>
<td>Evenflo, Piqua, OH</td>
<td>$175</td>
<td>$299</td>
<td>≤20</td>
<td>≤26</td>
<td>Reclined position may be beneficial for apnea-prone infants, flat position not recommended.</td>
</tr>
<tr>
<td></td>
<td>Dyn-O-Mite Infant Car Seat</td>
<td>Wherever car seats are sold</td>
<td>-</td>
<td>$30</td>
<td>≤20</td>
<td>≤26</td>
<td>May be useful for infants at risk of apnea and hypoventilation in standard car seat.</td>
</tr>
<tr>
<td></td>
<td>STC No. 900 Series Travel Chair</td>
<td>Safety Rehab Systems, Inc., Elyria, OH</td>
<td>-</td>
<td>Varies</td>
<td>Varies</td>
<td>15-90</td>
<td>Requires installation of an additional Department of Transportation approved seatbelt. Not the same as Tumble Forms Positioning Seat.</td>
</tr>
<tr>
<td></td>
<td>Ortho Kinetics Travel Chair</td>
<td>Ortho-Kinetics, Inc., Waukeha, WI</td>
<td>-</td>
<td>Varies</td>
<td>Varies</td>
<td>30-54</td>
<td>Requires installation of an additional Department of Transportation approved seatbelt. Not the same as Tumble Forms Positioning Seat.</td>
</tr>
<tr>
<td></td>
<td>Carrie Car Seat</td>
<td>J. A. Preston Corporation, Clifton, NJ</td>
<td>-</td>
<td>$545-$695</td>
<td>20-130</td>
<td>30-68</td>
<td>Can be custom modified for larger or smaller person.</td>
</tr>
<tr>
<td></td>
<td>Strolee 612(^{1})</td>
<td>Stroke of California, Inc., Rancho Dominguez, CA</td>
<td>-</td>
<td>$32</td>
<td>$64</td>
<td>≤40</td>
<td>Use of top tether (provided) is encouraged for increased crash protection.</td>
</tr>
<tr>
<td></td>
<td>Speccast (modified Kantwe 410) child restraint</td>
<td>Jerome Koziatek and Associates, Hinckley, OH</td>
<td>-</td>
<td>$85 plus freight</td>
<td>≤40 (not including cast)</td>
<td>≤40</td>
<td>Use of top tether (provided) is encouraged for increased crash protection.</td>
</tr>
<tr>
<td></td>
<td>Regular car seat with no shield, equipment secured separately(^{c})</td>
<td>Wherever car seats are sold</td>
<td>-</td>
<td>$40-$60</td>
<td>≤40</td>
<td>≤40</td>
<td>Use of top tether (provided) is encouraged for increased crash protection.</td>
</tr>
</tbody>
</table>

\(^{1}\) Dash means that the company does not offer the item at a reduced cost to institutions.


\(^{b}\) Shaw (1987).

\(^{c}\) Bull, Weber, & Stroup (1986).

\(^{d}\) Shaw, Wylie, & Bull (1987); Shaw (1987).
Seat), imported and distributed by Fabrication Enterprises, and the Orthopedic Positioning Seat, distributed by Columbia Medical Manufacturing. These seats are designed for children up to 60 in. tall and fit all cars, buses, and vans. The Special Seat comes with a tether for use with the 50- to 105-lb child.

Other companies have also revised their positioning seats to perform satisfactorily in dynamic crash testing. Preston’s Carrie Car Seat (not to be confused with their nonapproved, less expensive, Tumble Forms Positioning Seat) requires the use of a tether and a standard lap belt or a lap/shoulder belt with locking clip. Two tethers are provided with the seat for easy use in two different vehicles (see Figure 1). Although a tray is included with the Carrie Car Seat for use as a positioning seat, the tray should not be used while the Carrie Car Seat is serving as a child restraint system. The Ortho-Kinetics Travel Chair meets the excursion limits of FMVSS 213 and may be used as a positioning stroller or as a car seat. It does not need a tether, but does require the use of a lap/shoulder belt and the addition of an approved lap belt in the vehicle for separate restraint of seat and occupant. Ortho-Kinetics has produced this chair since October 1983, and retrofitting is available for older chairs. The Ortho-Kinetics Travel Chair can be safely tied down and transported in a bus or van with the Q'STRAINT system (manufactured by Q'STRAINT of Buffalo, New York) or the Protector System (distributed by Ortho Safe Systems, Inc., Trenton, New Jersey). The child and chair are separately fastened with no dependence of one on the other. This provides the same degree of safety available to automobile passengers.

Safety Rehab Systems’ STC II 900 Series Travel Chairs, used in conjunction with the STC No. 15073 Positioning/Restraint System, performed satisfactorily in dynamic crash testing and were well within the head and knee excursion limits set by FMVSS 213 when crashed at 30 mph (20 G force). An STC Travel Chair can support a power pack or ventilator equipment, but these would require separate securement during vehicular transportation. The E-Z-On Vest, by E-Z-On Products, Inc., is another option for providing trunk support or restraint for the neurologically impaired child or the child with a behavior problem.

Low-Birth Weight Infants
Advances in health care have made it possible for many premature infants weighing less than 2.2 kg (5 lb) to go home from the hospital. A standard infant car seat is appropriate for a small infant, but the fit of the seat may be improved by adding rolled blankets at the infant’s sides and between the crotch strap and the infant to prevent the child’s hips from slipping forward (Bull & Stroup, 1985). Seats with shields should not be used with low-birth-weight infants. Health care professionals should emphasize to parents that it is safer for the baby to travel correctly restrained in an approved safety seat than in an infant carrier or a parent’s arms.

Some low-birth weight infants at risk for apnea may be subject to hypventilation in standard car seats (Willett, Leusch, Nelson, & Nelson, 1986) and require transportation in a prone or semireclined position. The Dyn-O-Mite infant car seat, which offers several semireclined positions, is one alternative. The Swinger Car Bed (see Figure 2), distributed by Fabrication Enterprises, provides another safe alternative for such infants weighing up to 20 lb (Bull, Weber, & Stroup, 1988). A zippered bunting holds the baby in the car bed, and rolled blankets placed at the sides can provide additional support. Although FMVSS do not apply to car beds, the bed performed satisfactorily in crash tests conducted at the University of Michigan Transportation Research Institute.

Ventilator-Dependent Children
Safe transportation for ventilator-dependent children is another growing need. Although a wheelchair is
often used to carry the child and ventilator equipment, a wheelchair offers less protection than an approved car seat or seat belt while riding in a van or other motor vehicle. If the child weighs less than 50 lb, he or she should be in a restraint that meets FMVSS 213, and the wheelchair and ventilator equipment should be secured separately (Stroup, Wylie, & Bull, 1987). In addition, children with tracheostomies should not travel in car seats with shields.

Children in Casts

In many cases, an orthopedic patient cannot be secured safely in a car seat or seat belt because of the configuration of a cast or brace. Gardner (personal communication, June 1986) reported that 41% of the disabled children he surveyed had difficulty using conventional restraints or could not be adequately restrained after surgery, usually because of casting. In addition, he found that parents are usually unaware of options to improve the situation unless they are informed by therapists or other professionals. Feller et al. (1986) described the importance of a multidisciplinary approach for health professionals in developing and instituting guidelines for assisting parents.

Several options are available to accommodate young children in hip spica casts. Bull, Weber, and Stroup (1986) described how to modify car seats to meet the needs of this population. The Strolee 612 has been modified and has performed satisfactorily in dynamic crash testing. A modified Kantwet 410 was tested with positive results (Stroup, Weber, & Bull, 1987) and is now available commercially as the Special Pelvic Cast (Spelcast) child restraint (see Figures 3 and 4) from Jerome Kozatiek and Associates.

The E-Z-On Vest, typically used by the child who has head control but needs trunk support or restraint, has been modified to accommodate patients in body and hip casts (see Figure 5). The vest was modified according to specifications by the Automotive Safety for Children Program of Riley Hospital for Children. Crash testing indicates that the vest does provide effective restraint. The child is placed in the vest and lies supine on the vehicle’s seat. The vest is secured by two lap belts, and an auxiliary belt wraps around the knee closest to the seat back. To reduce lateral movement further, padding is added around the head and between the front and rear seats.

Misuse of Positioning Devices

As a result of misunderstanding, parents often misuse positioning devices as car seats or use approved car seats improperly (Kuhane, 1986). When providing positioning devices, therapists should inform parents that these devices do not provide adequate transportation safety.

For example, Preston’s Tumble Forms Positioning Seat, a positioning device, is not a recommended car seat. Dynamic crash testing at 30 mph revealed an interaction between the seat and the lap/shoulder belt of the vehicle. This interaction could cause injury to the child or unintentional buckle release.

Figure 2. Swinger Car Bed and bunting.

Figure 3. Front view of the Spelcast with child in hip spica cast.
The Special Seat and the Carrie Car Seat, both suitable for children over 40 lb, are safety-approved and available options.

Wheelchairs used in motor vehicles are another example of positioning devices being misused as restraints. Wevers (1983) and Schneider (1981) reported that most persons traveling in wheelchairs in motor vehicles are at high risk of injury because wheelchairs are not designed to withstand crashlike forces. Therefore, a child should transfer from a wheelchair to a bus, van, or auto seat and use an approved belt or restraint. According to Schneider (1981), many wheelchair securement systems, including systems that secure wheel rims, are inadequate, and sideways orientation of a wheelchair in a vehicle is unsafe for the passenger. Shaw (1987) reviewed wheelchair securement systems and concurred with Schneider.

Conclusions
The current literature suggests three general rules to follow in recommending how to transport a disabled child safely. First, select and use an approved car seat as recommended by the manufacturer. Second, if a modification is needed, be sure the modified seat has passed a dynamic crash test before recommending it. For example, straps should not be cut or resewn without testing. Third, if the disability is temporary, encourage the parents to return the child to a regular car seat for optimal protection as soon as appropriate.

Further research is needed to test and improve wheelchairs, adapted seating systems, and modified car seats for use as occupant restraints in moving vehicles. Crash testing will be a critical part of such research.

Acknowledgment
We express our sincere appreciation to M and K Photography for the photographs used in this article.

References


