

Protecting child passengers

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When a motor vehicle is involved in a crash, there are actually a series of collisions. When the vehicle collides with another object, the bodies of the passengers continue to move at the precrash speed. If a person is properly restrained, his/her body will impact against the restraining device (seat belts or other restraint) very soon after the primary collision. If not restrained, the body will continue moving until it collides with the interior of the vehicle or with the ground or other object outside the vehicle. And lastly, the internal organs will then impact against bony structures which enclose them (brain and skull, lungs and ribs, etc.), which can be lessened somewhat by the degree of proper restraint by seat belts, airbags, and padding.

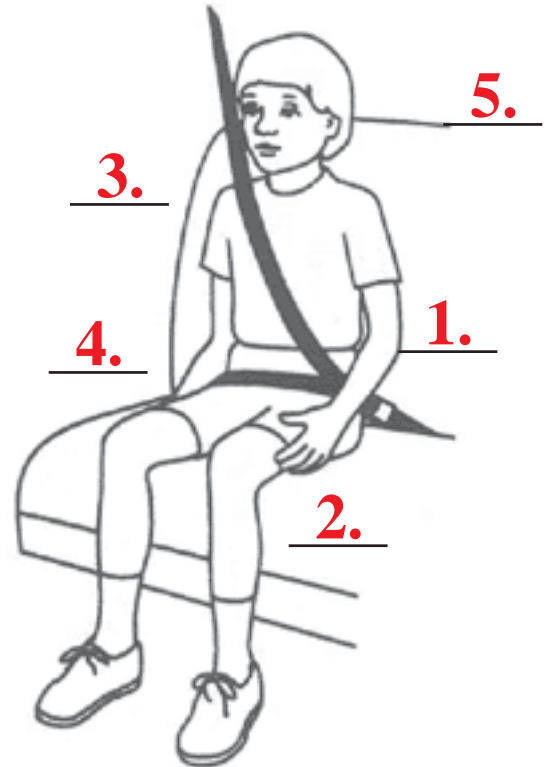
The objective goal in choosing and using restraining devices should be to reduce the chance of these impacts and, at the same time, reduce (as much as possible) potential injury by the restraining device itself by using it properly. Vehicle design, airbags, and snug fitting seat belts (with shoulder harnesses) all assist in protecting the adult body during the crash. The tighter the seat belts are adjusted prior to the crash, the lower the body's overall deceleration, thereby reducing potential rate of impact between the skeleton and internal organs (including the brain against the skull). (Weber 2000) Additionally, distributing the load of impact as widely as possible and onto the strongest body parts (in adults, primarily the shoulder and pelvis, and, secondly, the chest) optimally reduces impact injury.

When being transported in motor vehicles, the immature bodies of children have special protective needs which change as the child's body grows. In the early stages, before bones, ligaments and muscles offer enough support, rear-facing car seats help prevent cervical, head and spinal cord trauma. As the body matures sufficiently to better withstand the severe tensile forces associated with deceleration, forward-facing restraints can be employed.

The type of restraint needs to be age-appropriate and must be re-evaluated as the child's body matures. An

adult seat belt can be safely used without other restraining devices when 5 conditions are met simultaneously:

- 1) the child can sit with lumbar spine and upper buttocks fully against the seatback;
- 2) knees bend at a 90 degree angle at the seat edge;
- 3) shoulder belt fits across the shoulder;
- 4) the lap belt fits over the thighs or bony pelvis;
- 5) the child is mature enough to sit reasonably still during the ride. (Sachs & Tombrello 2000)



Since the younger child (either backward or forward facing) is buckled into a restraining device by a harness or shield and then the child restraint device itself must also be buckled down, great care must be taken to assure that both systems are tightly fastened to avoid excessive movement or ejection of the child or child with car seat during a crash. Weber (2000) notes 'A large observation study in four states found that about 80% of child restraints were not being used as intended (Decina & Kneobel 1997).....Clearly a failure to anchor the CR

[child restraint] or to harness the child is about the same as nonuse, but there are many other opportunities to do the wrong thing.' These mistakes may include inadequate tightening of the harness which holds the child or of the seat belt which restrains the car seat, or the use of the wrong type of seat belt for that particular restraining device.

When the child matures to (about) 4 years old and 40 lbs and child's height or weight surpasses the upper end limits recommended by the manufacturer (many manufacturers use different weight and height limits so read instructions carefully), many adults erroneously conclude that the child should be advanced to adult seat belts. At this stage, the child's body is still too small to properly fit the adult belt. Proper placement of the seat belt includes the lap portion of the belt fitting snugly across the bony portion of the pelvis and with the shoulder strap fitting across the midsternum and crossing the shoulder about half way between the neck and the arm. With the child's body (especially upon impact), the lap belt rides up into the fleshy abdomen and the shoulder strap onto the anterior cervical region, often resulting in serious (including spinal cord) injuries. (Weber 2000) Equally or more dangerous is the practice of placing the shoulder portion behind the child or under the arm to avoid irritation to the neck, resulting (upon impact or even during hard braking) in the child submarining under the belt or being ejected over it, leading to serious injury or fatality. The child who cannot achieve a proper fit of both lap and shoulder belt should ride in a booster seat specifically designed to adapt the adult seat belt to the child's body.

Weber reports (2000), 'A lap belt that is placed or rides up above the hips can intrude into the soft abdomen and rupture or lacerate internal organs (Rouhana 1993, Rutledge et al 1991). Moreover, in the absence of a shoulder restraint, a lap belt worn high can act as a fulcrum around which the lumbar spine flexes, possibly causing separation or fracture of the lumbar vertebrae in a severe crash.....A belt-positioning booster (BPB) raises the child so that its body geometry is more like that of an adult and helps route a lap/shoulder belt to fit that body size.'

The National Highway Traffic Safety Administration (NHTSA 2000) is responsible for developing a comprehensive 5-year strategic plan to reduce deaths and injuries caused by failure to use the appropriate booster seat

in the 4-8 year-old age group. NHTSA notes that in February 2000 they launched their 'Don't Skip a Step' national booster seat campaign to educate parents about the risks of improperly positioned adult seat belts and the effectiveness of belt-positioning booster seats for children ages 4 to 8 years.'



Since proper installation of a child restraint system is critical to its protective features and since many seat belt systems in automobiles vary (sometimes 5-6 different types of seat belts in one automobile), it is suggested that each booster be checked by a trained professional for proper installation and for tips on its appropriate use.

To have your current child restraint system evaluated for its safety and your accuracy of installation, make an appointment at a local inspection site (often available at Fire and Rescue stations). This step only takes a few minutes and can reinforce to you and your child why using a booster seat is important.

The technology of restraining the occupants in motor vehicles (and particularly infants and children) is ever changing and advancing to improve the possibilities of survival of impact without serious injury or fatality. It is important that the latest information be accessed and passed on to the public (especially parents and caregivers) through health care providers and educators. The following contact sources are provided to assist in

this task. These websites are packed full of information regarding these as well as other safety issues. There are many other websites available as well which can be found by a topic search.

Contact Resources:

American Academy of Pediatrics - www.aap.org (great information for typical and atypical children)

Center for Injury Prevention www.cipsafe.org (to order car seats online)

Insurance Institute for Highway Safety - www.highwaysafety.org

National Highway Traffic Safety Administration - www.nhtsa.dot.gov

SafetyBeltSafe USA - www.carseat.org

University of Michigan Transportation Research Institute - UMTRI Research Review (newsletter-\$35/yr subscription)-www.imtri.umich.edu

parents to consider consistent, appropriate use of child passenger protection devices. "No one ever plans for a tragic injury to happen to their child. Most think 'it will not happen to us', but it can and does happen to people just like us - without warning. Plan for the best outcome should an accident occur by using the most effective measures to reduce the chance of serious injury."

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About the author:

Judith DeLany, LMT is a professional speaker regarding soft tissue injuries and an author/editor for Elsevier Publishing. Information given in this handout is part of the research from her second textbook on muscular injuries. She is a concerned parent and, due to her extensive background in treating muscular injuries, urges all