

By Tara T. Amenson

Accident reconstructionists need to evaluate correct installation and use, proper fit and restraint, and vehicle compatibility when analyzing injury outcomes.

Understanding the Challenges of Child Car Seat Use, Fit, and Compatibility

Considering the myriad of crash modes occurring in the real world, child car seat design engineers are continuously working to improve the safety of children, just as vehicle manufacturers are striving to improve safety to a variety

of occupants, including children. Due to design constraints at both levels, there are times when even the best designs are not optimally compatible with one another. Coupled with this is the risk associated with improper use of the car seats. According to Safe Kids Worldwide, correctly using child car seats can reduce the risk of death by as much as 71 percent. The National Highway Traffic Safety Administration (NHTSA) reported of the children 14 years and younger, an average of three were killed and 642 injured every day in the United States as a result of motor vehicle crashes during 2012. Child injuries and fatalities from motor vehicle crashes can be mitigated through proper use, fit, and vehicle compatibility. For this reason, during an accident investigation, these features must be evaluated and assessed in order to evaluate a car seat's design and perform-

ance forensically relative to the specific accident outcome.

Research by NHTSA and Safe Kids Worldwide has shown the proper type of seat depends on the child's age, height, weight, and type of vehicle in which they frequently travel. To mitigate child injuries during a crash, the child seat must fit the child correctly, be secured properly in the vehicle, and the child must be properly restrained. Safe Kids recently reported 73 percent of car seats are not used or installed correctly. If a parent has any questions or concerns about proper use or vehicle compatibility, certified child passenger safety technicians (CPST) are able to help at car seat inspection events hosted by Safe Kids. These events are held throughout the year, across the country, at local police and fire stations, children's hospitals, and Departments of Public Health.



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To address the increasing challenges parents are having with child seat use and vehicle compatibility, the NHTSA developed an Ease of Use rating program. The rating program is based on individual assessments of four categories, including the evaluation of label content and clarity, evaluation of the installation instructions for the car seat, ease of using features to

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secure the child correctly in the restraint and the vehicle installation features. The Ease of Use program assigns one to five stars for each category. Five stars correlates to excellent features in a particular category. Consumers who frequently install their child's car seat in multiple vehicles would want a five star rating in the vehicle installation feature category, whereas parents who rarely remove their child's car seat from their vehicle may find a lower rating of one to two stars acceptable. Unfortunately, the Ease of Use ratings do not address vehicle compatibility, but many child seat retailers will allow consumers to install the seat in their vehicle before purchasing.

Passenger vehicles made on or after September 1, 2002, are equipped with a LATCH (Lower Anchors and Tethers for Children) system that was developed to make it easier to install child car seats. Installing a car seat with seatbelts or LATCH will provide the same level of protection to the child; the most important factor is to be sure the child seat is correctly installed in the vehicle, regardless of which installation method is used. It is recommended that only one system be used at a time, LATCH or seat

belt, because there is no evidence to suggest the use of both attachment systems provides additional protection. The LATCH system consists of two clips or hooks that attach to the lower anchors located in the back seat where the seat back and seat cushions meet. The top tether anchor is commonly located behind the seat and can be used when installing the car seat with the LATCH system or seat belt. When to use the top tether is a common source of confusion for parents. The top tether improves the safety of all forward-facing child car seats whether they are installed using the lower anchors or seat belt.

Child car seat vehicle compatibility, proper use, and fit continue to be obstacles many parents struggle to overcome. There are no clear guidelines describing which car seat designs are best suited for a particular vehicle, and positioning multiple child car seats in the rear seat brings additional challenges. Depending on the crash scenario, the middle seating position in the rear seat is considered the safest. However, this seating position is frequently narrow or uneven making it difficult to install a child car seat properly. Additionally, many vehicles do not provide LATCH anchors in the middle seating position, but parents can use the seat belt as an alternative installation approach if the child seat manufacturer and the vehicle manufacturer manuals give permission to do so.

During a car crash, many factors contribute to an increased risk of injury for children. Proper use, fit, and vehicle compatibility must be considered when analyzing injury outcomes of child occupants post-crash. It is important to note that even after the appropriate child seat is selected for the child's age, height, and weight, it must be properly installed in the vehicle and the child must be properly restrained in the child car seat for it to mitigate injuries during a crash effectively. Having a trained and certified child seat technician inspect the car seat and teach the caregiver how to install the car seat properly in the vehicle can correct many misuse errors and mistakes. No single child car seat is the best for every vehicle or every child. The optimal child car seat system is one that is used correctly every time, fits the child so he or she is properly restrained, and is compatible with the vehicle in which the child

is travelling. Accident reconstructionists need to evaluate all of these factors when analyzing injury outcomes. 