

## How Long Should Children Ride Facing the Back of the Car?

Both the American Academy of Pediatrics and National Highway Traffic Safety Administration recommend keeping children facing the rear of vehicles as long as possible. This is based on three sources of data: the national database on crashworthiness which indicates death and injury rates for children under 12 months and 12-23 months; biomechanical results of crash testing; and the very low death and injury rates of children in Sweden where rear facing travel for children up to ages 4 to 5 years is a long-standing practice.

Today, there are numerous convertible safety seats which are designed for rear-facing travel for children up to 35-50 lbs. Even the majority of rear-facing-only seats are certified to 30-35 lbs. However, be sure that there is at least an inch of plastic shell above the child's head as well. This reduces the chance that, as the safety seat rotates forward and down, the child's head is not fully contained and instead is protected from contact with other parts of the vehicle.

If a child is riding in a rear-facing-only seat (the type that usually has a handle and detachable base), it usually will be replaced with a rear-facing convertible seat before the child reaches the maximum weight specified (22-40 pounds), often because the top of the head is within an inch of the top edge of the seat. In fact, testing by Consumers Union indicates that children should move to a rear-facing convertible seat at about one year of age. Most children outgrow the typical rear-facing-only seat before they are two years old, but they are not ready for a forward-facing seat. New convertible seats available today allow children to remain rear facing until they weigh 30-50 pounds, depending on the model.

Young children have heavy heads and fragile necks. In a crash, an infant's soft spinal column can stretch, leading to spinal cord damage if he is riding facing forward. The baby could die or be paralyzed permanently. This is true even for babies who have strong neck muscles and good head control. The neck bones are flexible, and the ligaments are loose to allow for growth.

If the child is facing forward in a frontal crash, which is the most common and most severe type, the body is held back by the straps — but the head is not. The head is thrust forward, stretching the neck and the easily injured spinal cord. Older children in forward-facing safety seats or safety belts may end up with temporary neck injuries or fractures that will heal. But a young child's neck bones actually separate during a crash, which can allow the spinal cord to be ripped apart. Picture what happens if someone yanks an electrical plug out of a socket by the cord, causing the wires to break.

In contrast, when a child rides facing rearward, the whole body — head, neck, and torso — is cradled by the back of the safety seat in a frontal crash. Riding in a rear-facing safety seat also protects the child better in other types of crashes, particularly side impacts, which are extremely dangerous, if not quite so common.

Children in Sweden ride rear facing until they are three to five years old, lowering traffic death and injury rates substantially. Although not all safety seats sold in the U.S. are designed to be used rear facing as long as those in Sweden, safety experts recommend that children ride rear facing as long as possible, *at least* until they are two years old.

### **Why is it important to follow the manufacturer's instructions regarding the angle of a rear-facing seat?**

In a crash, a rear-facing car seat decelerates the child's body by spreading the crash forces over the seatback surfaces (like a baseball mitt does when catching a ball), rather than concentrating the forces through the harness to hard points (shoulder and pelvis) of the skeletal structure as forward-facing restraints do.

Infants have a larger head-mass to body-mass ratio than do older children, and, at the same time, do not have fully developed skeletal and neck structures. As newborns, they cannot yet support their own head if in a too upright position during normal travel.

In a crash, the seatback in almost all rear-facing car seats rotates downward, in the direction of the crash. The more horizontal the angle pre-crash, the more horizontal the seatback is at peak G's. If too horizontal, too much force is put on their shoulders and neck by that big ol' noggin trying to keep going while their body is being held back by the harness. Those higher forces, concentrated on the neck and shoulders, is what we were trying to avoid in the first place.

In FMVSS 213, NHTSA established a limit on maximum seatback rotation, during a crash-test, of 70 degrees from vertical for just this reason. Manufacturers set their acceptable seatback angles based on design and testing of their products at various weights in very severe crash conditions and have to advise that some vehicle seating locations are not acceptable installation locations.

So, rear-facing restraint design is mostly a balancing act between appropriate pre-crash positioning for comfort and protecting the airway (especially for a newborn) and in-crash dynamics requiring enough uprightness to accomplish proper restraint and deceleration.

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