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How Does Your 4-Passenger Car or Minivan Stack (Crack) Up?

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Recognizing that current Federal Motor Vehicle Safety Standards (FMVSS) are no guarantee that the cars we drive are safe at speeds outside the boundaries of these requirements, both the National Highway Traffic Safety Administration (NHTSA) and the Insurance Institute for Highway Safety (IIHS) have adopted slightly more rigorous testing standards. The current FMVSS require manufacturers to crash their cars into fixed barriers at speeds of up to 30 mph. Anthropomorphic test dummies riding inside are used to measure the effects of the crash via visual analysis of high speed film recorded during the crash and the data recorded from the dummies' on-board array of accelerometers. While many of us in the automotive safety/clinical/public health fields have been critical of some of the methodologies and/or standards used in this analysis, such as the Head Injury Criterion (HIC) used as an allowance for head inertial loading, this paper will look only at some of the recent IIHS crash tests.

As physicians who regularly manage the effects of motor vehicle trauma, we have a duty to our patients to pass along important information regarding the effectiveness and importance of new (and old) safety systems, their proper use, and perhaps also to provide input on issues of crashworthiness when our patients are considering the purchase of a new family car, van or sport utility vehicle. This article will provide you with some guidance and perhaps the raw material for a patient newsletter or front office handout.

The Test

Most head-on collisions in the real world are offset, i.e., bumper contact is incomplete. Vehicles that can ordinarily withstand a full contact barrier test (FMVSS) with acceptable intrusion of brake pedal, foot rest, toepan, and dashboard may perform poorly when the force is concentrated over only 40-50% of the bumper. Most often, this occurs on the driver's side. These intrusions result in a variety of lower extremity, chest, facial and brain injuries.

In consideration of this reality, the IIHS tests vehicles in 40 mph offset crashes, and these are the results I shall report here. However, note that in NHTSA's voluntary New Car Assessment Program (NCAP), in which stars are awarded based on crashworthiness (more stars indicating better performance), the crash test speed is only 35 mph.

The evaluations of IIHS are based on a combination of factors: structural/safety cage; restraints and dummy kinematics; injury measures to the head/neck, chest, and lower extremities; head restraint design; and bumper performance. The latter is important only in terms of the expense of replacing/repairing bumpers in 5 mph crashes: no estimation of injury is made for (or even expected in) these low speed crashes -- an indication of the continuing level of ignorance of the magnitude of this problem. However, the head restraint geometry test does address the problem to a degree.

There are four levels of performance: "good"; "acceptable"; "marginal"; and "poor", with each category mentioned above getting an individual rating. Based on all ratings taken together an overall rating is then assigned. I will report only the overall ratings.

Results: Midsize 4-door Cars

In order of test performance from best to worst, here is how the field stacks (cracks) up. These cars were all given an overall "good" rating and declared "best picks" by IIHS: the Ford Taurus and Mercury Sable (1996-98 models); the Chevrolet Lumina (1995-98 models); the Volkswagen Passat (1998 model) (note: a big improvement for VW, because, in earlier tests, the 1995 Passat was given a "poor" overall rating); the Volvo 850/S70 (1995-98 models); and the Toyota Camry (1997-98 models). Only the Volvo's head restraint was rated as "good."

An overall rating of "acceptable" was awarded to the following cars: the Pontiac Grand Prix (1997-98 models); the Nissan Maxima (1997-98 models); the Subaru Legacy (1995-98 models); the Honda Accord (1998 model); the Toyota Avalon (1998 model); and the Mazda Millenia (1995-98 models).

The Saab 900 was the sole member of the "marginal" class.

In the dubious achievement category, winners of the "poor" overall rating included: the Ford Contour and Mercury Mystique (1995-98 models); the Hyundai Sonata (1995-98 models); the Mitsubishi Galant (1994-98 models); the Chevrolet Cavalier and Pontiac Sunfire (1995-98 models); and the Chrysler Cirrus, Dodge Stratus, and Plymouth Breeze (1995-98 models).

Passenger Vans

Two minivans received "good" overall ratings and were considered "best picks": the Toyota Sienna (1998 model) and the Ford Windstar (1995-98 models). With a slightly better head restraint design, I would give the "best pick" to the Toyota.

No ratings of "acceptable" were assigned. In the "marginal" category were the Mazda MPV (1996-98 models); the Dodge Grand Caravan, Chrysler Town & Country, and Plymouth Voyager (1996-98 models); the Honda Odyssey and Isuzu Oasis (1995-98 models); and the Nissan Quest and Mercury Villager (1996-98 models).

Bringing up the rear, with "poor" overall ratings, were the Chevrolet Astro and GMC Safari (1996-98 models); the Pontiac Trans Sport, Oldsmobile Silhouette, and Chevrolet Venture (1997-98 models); the Ford Aerostar (1992-97 models); and the Toyota Previa (1994-97 models).

Final Note

I would be remiss if I failed to remind readers that, when it comes to safety and occupant protection, there is no substitute for mass: in a given collision between two vehicles, the bigger of the two will generally afford much more protection and survivability; occupants of vehicles that are 50% smaller than the vehicle they collide with will be from 3-5 times more likely to be killed than the occupants of the larger vehicle. Thus, for example, even though the Toyota Sienna minivan was rated "good" and a "best pick" by IIHS, she would be no match in a frontal offset slugout with my full-sized, 1-ton rated, 1997 Ford Club Wagon (which is also equipped with air bags and pyrotechnic restraint retractors).

Remember that the offset crashes of NHTSA and IIHS pit the test vehicles only with fixed barriers -- not other vehicles. This is roughly the equivalent of crashing into another vehicle of the same mass. Thus, the results can be deceptive: just because a car or minivan achieves high ratings (or many stars, in the case of the NCAP) in barrier test crashes, it does not imply that it is always a safe car within a field of larger vehicles.

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