Myth vs. Reality

Myth #1
“The theme park industry has increased speed and forces on roller coasters to beyond those experienced by astronauts.”

Astronauts on the space shuttle travel at speeds approaching 18,000 miles an hour and receive g-forces for many minutes at a time. The fastest coaster on earth reaches speeds of about 100 miles per hour and riders experience g-forces for only a few seconds.

Reality: Over the last forty years, there has been NO INCREASE in the accelerations produced in roller coasters as determined from data supplied by Six Flags. Maximum speed data for 167 roller coasters and acceleration data for 110 roller coasters were compared with the year of initial installation. While top speeds have increased, maximum accelerations have remained essentially unchanged.


Reality: The common assertion that g-forces have increased secondary to increases in ride height and speed is abjectly false. Ride heights and speeds can increase without changing the g-forces and, in fact, that appears to be the case.


Myth #2
“Government statistics show that theme park injuries are on the rise.”

Despite reports to the contrary, there has been no increase in the rate of injuries at fixed site amusement parks.

Reality: Exponent analysis of CPSC Neiss data from 1997-2001 indicate that the risk of injury associated with fixed site amusement parks did not change during that time. Risk of injury associated with fixed site amusement park attractions has dropped in each of the last two years.


Reality: While the CPSC data is probably useful for well distributed and clearly identified product categories (e.g. toasters), it is not designed for determining incidence rates for these exceedingly rare and difficult-to-identify events. For the types of neurological injuries described in association with fixed theme park rides, the panel felt that the NEISS data is not relevant. More strongly, the panel felt that using the CPSC data to describe neurological injuries that it does not systematically capture in its statistical sample is misleading.

Reality: In 2002 it is estimated that there will be 320-350 million visits to fixed site (fixed site describes parks that are permanently situated at one physical location) theme parks in the United States. As the number of rides delivered per year at these parks is more than three billion and the number of injuries reported is low, the absolute risk that any individual will suffer a neurological injury while riding a fixed site theme park ride is extremely low.


Reality: CPSC amusement ride injury data is characterized by an extremely high level of sampling imprecision, with statistical margins of error that are much higher than for almost all other major product categories reported on its NEISS database; for example, a 57 percent margin of error for 1997 and a 54 percent margin of error in 1999.

Source: The International Association of Amusement Parks and Attractions (IAAPA).
**Myth #3**

"G-forces on roller coasters are causing brain injuries."

Neither the Exponent nor American Association of Neurological Surgeons studies can identify a mechanism for non-traumatic brain injury related to roller coasters.

**Reality:** The annual rate of spontaneous, non-traumatic, non-impact cerebrovascular injuries (e.g. vertebral artery dissections, carotid artery dissection, sub-arachnoid hemorrhages) that have occurred at amusement parks is far below the rates that one would expect at fixed theme parks based on attendance and average rates for the general population. The scientific literature reports that the rate of spontaneous, non-traumatic, non-impact, cerebrovascular injuries for the population of the United States is approximately 25,000 injuries per year.

*Source: Exponent, “Investigation of Amusement Park and Roller Coaster Injury Likelihood and Severity.”*

**Reality:** The panel made two summary observations regarding the g-forces data. First, the g-force literature does not show an association between increasing g-forces and the neurological injuries under review. Second, g-forces do not appear to be increasing on fixed theme park rides.

**Reality:** Although much has been stated in the popular press and even one published medical article regarding g-forces and neurological injuries, many of those statements are actually inconsistent with the evidence. There is a large body of experimental research on multiple subjects regarding the effects of acceleration on the human body. None of these studies mention a case of neurological injuries that are being reported to occur on fixed theme park rides.


**Reality:** Even for a conservative worst-case scenario, we found that the highest estimated peak head accelerations induced by roller coasters were far below conventional levels that are predicted for head injuries. Accordingly, our findings do not support the contention that current roller coaster rides produce high enough forces to mechanically deform and injure the brain.

*Source: “Roller Coasters, G Forces, and Brain Trauma: On the Wrong Track.”

---

**Myth #4**

"There is science to support the premise that g-forces cause brain injuries."

The studies could find NO relevant medical research that could support the idea that g-forces on roller coasters could cause non-traumatic brain injuries.

**Reality:** There is a large body of experimental research on multiple subjects regarding the effects of acceleration on the human body. None of these studies mention a case of neurological injuries that are being reported to occur on fixed theme park rides.

**Reality:** As one panelist summarized, “review of the substantial literature on human anomaly centrifuge data reveals no physiological evidence supporting the notion that subdural hematomas [or other neurological injuries] are associated with increased g-forces.”

**Reality:** A second case series, which appeared in the journal *Annals of Emergency Medicine*, was also reviewed by the panel. The panel strongly disagreed with some of its key conclusions. First, use of CPSC data to make general statements related to brain injuries is not recommended given the fact that the neurological injuries under review are absent from the NEISS data that forms the statistical sample of the CPSC report. In other words, the NEISS data appears not to be capturing these brain injuries and therefore should not be used to make inferences or conclusions about such injuries. Second, there is no evidence that has been reported to indicate that g-forces and durations sufficient to cause G-LOC are associated with subdural hematomas or arterial dissections. From aeronautical data using centrifuge studies, the most severe injury of pilots experiencing g-loads of 10-15 G for much longer duration is neck sprains.