Video of failed bike stunt lends insights into biomechanics of facial fracture

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A man attempting a bicycle stunt made a significant—if unintended—contribution to surgical science, as a video of his crash allowed researchers to analyze the "kinematic and dynamic parameters" of the accident and resulting facial fractures. The study appears in *The Journal of Craniofacial Surgery*.

Tom Jenkyn, PhD, of The University of Western Ontario and colleagues performed an in-depth video analysis to estimate the traumatic forces causing an actual facial fracture. The researchers write, "To our knowledge, such a video analysis of an actual recorded trauma has not previously been reported in the literature."

Bike Crash Video Lends Insights into Forces Causing Facial Fracture

The patient was treated by plastic surgeons after sustaining facial fractures in a bicycle accident. "Through serendipity," a digital video of the accident was recorded. With the patient's consent, Dr. Jenkyn and colleagues analyzed the video so as to estimate the traumatic forces causing the injuries.

The video shows the man attempting to perform a bicycle stunt by accelerating down a slight hill, across a plank, and onto a wooden dock. However, the front tire misses the plank, instead striking the edge of the dock. This causes the patient to fall forward, "rotating about the point of

contact of the front tire and the dock, with [his] face and body subsequently impacting the dock."

The researchers split the video into frames and analyzed it using an image editing program. They focused their analysis on seven frames showing the patient's fall and impact with the dock, making detailed calculations to estimate the velocity of impact, impact force, force impulse to fracture, and the angle of impact.

The accident happened fast: "The time to fully decelerate all segments was found to be about 300 ms," or one-third of a second. The velocity of the rider's head when it hit the dock was calculated at 6.25 meters per second, with a force of 1910 newtons—about 429 pounds.

Assessment of the patient's CT scans showed Le Fort types 2 and 3 fractures of the middle face—fracture types "indicative of high impact force trauma." The patient's head was extended and slightly rotated, hitting the dock his face hitting the hit the dock essentially nose first.

The opportunity to analyze the traumatic forces causing an actual facial fracture is of special interest, since this type of accident—"with the rider being vaulted over the handlebars at speed…with a circular arc of motion about the axis of the front tire"—is common in bicycle crashes. The authors note that similar mechanisms of injury could occur in other common situations, such as collisions with a car or stationary object.

Dr. Jenkyn and colleagues discuss their findings in context of the many previous studies that have estimated the forces causing traumatic injuries—all of which have been simulations or laboratory studies. Their estimates of the physics involved in the incident are consistent with experimental data on the forces necessary to cause midfacial fractures.

The researchers also emphasize that patient was not wearing a helmet at

the time of the crash. They conclude, "Our analysis can be considered further impetus for the promotion of helmet-wearing by all bicycle riders to avoid serious complications of accidents including facial bone fractures."

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