C12 Was That Fender Dent Really Caused by a Closed Fist Punch?

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After attending this presentation, participants will learn how engineering fundamentals can be applied with inexpensive test apparatus to quantify biodynamic phenomena in a felony case. Intuition may yield a similar conclusion, but would not ordinarily be admissible as evidence.

This presentation will impact the forensic science community by demonstrating an application of engineering fundamentals and inexpensive test fixtures to quantify dynamic phenomena and supplement intuition in a case with felony charges.

Background: Defendant was giving his teen aged daughter a ride to school in his Hummer. He was angered by the driving behavior of a male student in a imported luxury sports sedan in the school parking lot. He stopped the student, exited his large luxury SUV, walked over to the sedan shouting obscenities, and opened the driver's door. He attempted unsuccessfully to pull the student out of the sedan, because the seat belt was fastened. Defendant struck the left front of the sedan with his bare hand making a loud noise. De- fendant claims he slapped the car with an open hand on a down-stroke on the outer edge of the hood. The student claims the blow was a closed fist horizontal punch to the top of the left fender. The defendant had no hand injuries.

After the altercation, a sharp dent was noted in the top corner of the fender above the left front wheel. Repair cost estimates obtained by the pros- ecutor were over $750, while a 3rd estimate made obtained by the defense attorney was $490. Minnesota law states that all the assault actions in this incident are misdemeanors unless property damages exceed $500, in which case it may be classed as a felony.

At the request of the defense attorney, the author inspected the sedan noting the location and dimensions of the fender dent in question. The dent was located along the stamped crease near the top of the fender which is a structurally strong part of the fender. The possibility of the cause being an open hand slap on a down-stroke was ruled out by the shape and location of the dent. The possibility of the cause being a closed fist horizontal punch was contrary to the intuition of the author and of several engineer colleagues. Intuition, at least in the engineering sciences, is usually not a sufficient basis for an expert opinion to be admissible.

The defense attorney retained an investigator who located and purchased a similar model sedan with no front end damages. The exemplar was made available for limited destructive testing of the front fenders.

An inexpensive pendulum fixture for delivering impact blows which could be quantified in terms of kinetic energy at impact was designed and constructed. Lumber and hardware were purchased from local retail stores. The pendulum pivot is a loose bolt connection to an overhead wood frame with adjustment features that is supported by the ceiling joists in the author's garage. The impacting surface is pine wood cut in a shape that approximates a closed fist. A physical therapy ankle weight consisting of a partitioned vinyl bag filled with fine grain sand utilizing a Velcro® strap was attached to the wood pendulum arm. The weights were measured with a spring scale and the center of mass was determined by a simple balance test.

Pivot fiction loss characteristics were determined by measuring amplitudes of pendulum cycles.

To determine data for punching energy of adult males, volunteers known to be stronger than the general population punched the ankle weight from the bottom pendulum position and the author measured the height to which the pendulum swung. These data were used to select release heights for impact tests of the pendulum against the exemplar fenders. Results showed that impact energies of 1.5 times the maximum demonstrated by the volunteers caused dents which were less severe in the exemplar than the dent in the subject sedan. The dent from a maximum energy single impact was similar to the dent from the same energy 3rd impact in a sequence of increasing energy impacts. Results confirmed that a closed fist punch was *not* a probable cause of the subject dent.

Pendulum Impact Tests, Engineering Fundamentals, Biodynamic Applications

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