## A126 Is Puppe's Rule That Flawless? Two Peculiar Cases of Cranial Fractures Running Through Craniotomy Holes

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**Learning Overview:** After attending this presentation, attendees will be aware of peculiar exceptions to the Puppe's rule about cranial fractures in two cases where fractures exhibited an unexpected path.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by revealing that the Puppe's rule, which has never been refuted, may have a possible exception, which must be considered when skull fractures encounter previous craniotomy holes.

More than 100 years ago, the German forensic pathologist Puppe established a rule concerning the sequence in which multiple blunt force and injuries of the skull occurred. According to Puppe's rule, when dealing with intersecting fractures, it is possible to devise which injury was first produced as the undamaged skull allows fractures to develop normally while the fractures caused by the subsequent injury are stopped where other fracture lines are already present. This means that fractures from subsequent impacts are arrested at pre-existing fracture lines of the skull. Moreover, Puppe's rule was reliably applied even in cases of gunshot wounds to identify entries and exits. It was even demonstrated that gunshot holes and beveling were interrupted and delimited by pre-existing fracture lines. Moreover, fractures from exit gunshot wounds stop at the edge of the entry wound.

But what happens to a fractured skull when pre-existing holes are present? If bone around the hole's edge is largely remodeled, will this stop the fracture or will something different happen?

Two unusual cases are presented of subjects undergoing cranial fractures due to blunt force trauma (case 1) and gunshot (case 2): both previously underwent neurosurgical operations with the persistence of the holes produced by the craniotomy drill, with remodeled smooth bone around the edge.

Case 1 concerned a single gunshot to the skull of a male with a previous craniotomy hole in the right parietal region, with a large bone remodeling, dating back 15 years. Case 2 concerned blunt force fractures (a fall from standing) in a subject with several widely remodeled craniotomic holes, dating back 20 years earlier.

What was arguable, according to the information provided by the Puppe's rule, was that the fracture lines stopped at the edge of the craniotomy hole. However, what has been detected was different than what was expected. As a matter of fact, fracture lines continued exactly in the opposite direction, as though they were "skipping" the hole, following the same direction and the same axis and stopping a few centimeters over on the opposite side of the craniotomic hole.

This represents a very interesting "exception" to the rule of Puppe, probably determined by different forces of tension in the bone tissues due to bone remodeling, but which must be pointed out and is worth considering in similar cases. It is therefore arguable that remodeled bone behaves completely differently than fracture lines or coeval bone holes.

The Puppe's rule has never been refuted, but these cases are the closest to an exception ever seen in forensic anthropology.

**Cranial Fractures, Puppe's Rule, Craniotomy Holes**