



F16 Hydraulic Forces as a Cause of Human Bite Mark Injury Patterns

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The goal of this presentation is to explain the causes of bite mark injury patterns in humans. Some of the bite mark injury patterns can be readily associated with teeth of the perpetrator. Marks found inside the identified teeth marks that were formerly erroneously called "suck marks"

can now be explained by compressive or tensile forces. It is not as much a function of the magnitude of these forces but their asymmetry. Coefficients of friction and Newton's Laws of Motion are necessary to explain the origin of these marks. Examples in diving and aerospace and medical physiology will be presented to give cogent and simple examples of the above hypothesis for the attendees.

The understanding the origin of the bite marks is important so the scientific community can now understand why a three dimensional event can be plotted very accurately in two dimensions as in bite mark analysis.

Bite mark pattern analysis is still a valuable tool in forensic science because DNA samples may not be available. When DNA can't be used, as in the case involving zygotic twins, BPA has been used to successfully identify or rule out the perpetrator.

This presentation's objective is to explain the observed injury patterns in human bite marks in terms of engineering principles such as compressive and tensile loads. It is not the absolute value of these pressures or forces, but asymmetrical hydraulic derivatives, or unbalanced fluid forces or pressures that cause the injury. These forces or pressures will be focused on two tissues: the skin and blood vessels.

This presentation will relate bite mark injury pattern analysis (BIPA) which is in the realm of Odontology specifically, to the forensic and scientific community in general, in terms that can be readily understood, which will provide a better appreciation of the BIPA in the prosecution or exoneration of suspect. Bite mark injury pattern analysis is most important where DNA evidence is absent or where the suspects are "identical twins." In order to understand how bite mark injury patterns evolve, several factors must be understood. First is the form and function of the teeth as they relate to a particular species. Secondly, the dynamic process of the bite must be staged so that the forces can be individually analyzed according to pressure/forces applied. The anatomy of the tissue must be considered. In addition general knowledge of physiology that is known in underwater diving and aerospace medicine also shows us that the human body can sustain large symmetrical forces, but not asymmetrical forces.

There are two major ways in which teeth function. One is puncture and the other is maceration. Human's teeth function mainly by maceration and tearing. Carnivore's teeth function mainly by puncturing and tearing. Herbivores macerate their food.

Among odontologists, certain aspects of the bite mark injury patterns caused disagreements. One such disagreement was whether the buccal surfaces of the teeth also appeared with the lingual surfaces in a bite mark injury pattern. Understanding the species specific form and function, and also staging the bite attack in with respect to the forces involved on the skin clears up that issue. Also marks that appeared inside the oval form the perpetrators dentition on the victim can now be understood in terms of asymmetrical hydraulic pressure/forces.

The bite mark attack can be divided in three stages, the first where sliding of the teeth over the skin happens, causing one type of mark, the second where the teeth have purchase over the skin and the relative motion of the skin and teeth stops. The third stage is where equilibrium is reached when the reactive force or pressure of the victim's tissue equals the applied force or pressure of the attacker jaw muscles. It is the final stage where the injuries to the skin and underlying vasculature occur resulting in a bite mark injury pattern.

BIPA will be briefly discussed. Now by understanding how the assailant's teeth cause symmetrical and asymmetrical hydraulic pressure/forces on the victim's skin, a one to one relationship to the bite mark pattern and the perpetrators teeth will become scientifically apparent.

Inferences on the magnitude of forces on the body can be estimated by the known pressure of a "G" suit on a pilot in a 10G dive. Injuries have been reported on pilots sustaining these G's that resemble strangulation victims. Untrained divers sustain injuries routinely, to lungs and ears because equalization of pressures wasn't attained. Ergo asymmetrical vis-à-vis symmetrical forces or pressures.

Asymmetry, Bite Mark, Hydraulic