F59 High-Speed Videography of Simulated Human Bites on the Skin of Living Humans

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After attending this presentation, attendees will have a better understanding of the response of living human skin to bites with simulated human teeth.

This presentation impacts the forensic science community by facilitating the examination of the behavior of living human skin during biting and the study of the features and characteristics seen in living human skin after the creation of a bitemark.

Human bitemarks have been studied in various media including living and cadaverous human and non-human tissues. There is disagreement among investigators whether human skin can record marks made by teeth with sufficient accuracy to reliably allow identification of biters. Bitemark evidence has consequently been subjected to increased scrutiny. To date, no study has demonstrated in detail the dynamic mechanism involved during the creation of a bitemark.

This study utilizes high-speed videography to document the action of appropriately articulated models of human teeth as they bite living human skin. The resulting videos allow study of the reactions of different subjects' skin during and immediately after controlled simulations of human bites. Serial still images demonstrate longer-term skin reactions and the nature and resolution of the patterns created by the human teeth models.

Although properly designed and performed studies using the skin of human cadavers are potentially illustrative, there are significant differences between the skin of living humans and cadavers. Disparities also exist between the skin of living humans and the skin of other living animals.

Consistent with Institutional Review Board (IRB) requirements for research performed on living human subjects, extreme care was given to the manner of recruitment and the treatment of subjects during the research. All consenting volunteers were over the age of 18. Care was given to ensure autonomy. Recruitment of volunteers was without pressure and/or coercion. Subjects were given full disclosure of all procedures and adverse effects of pain and bruising. All subjects signed a thorough informed consent including the ability to withdraw at any time without prejudice. No vulnerable populations were approached or used in any part of this project.

For this pilot study, ten volunteers were subjected to the simulated human bites using dental models of the upper and lower teeth of a single individual. The models were created using an epoxy resin (Primotec® Primopoly), a material that is close in hardness to human enamel. A force calibration device (Reid® Bite Reader) was used to measure the maximum-effort biting force of the single individual and to record the maxillary-mandibular biting relationship during biting. The models were mounted in that same maxillary-mandibular relationship with the anterior teeth in a slightly protrusive, end-to-end anterior relationship onto a mechanical biting apparatus that includes a modified Hanau adjustable articulator (Reynolds Controlled Bite Force Generator). The mechanical apparatus was calibrated using the Reid Bite Reader to produce the same biting force as the single individual's recorded earlier. The bite recipient subjects were blindfolded to inhibit anticipation. Each subject's right arm was placed into the biting apparatus and the biting sequence was initiated. Three digital video cameras were placed so as to record the bite event from different angles. The biting sequence was digitally recorded and, after biting, the subject's arm retained in the same position for ten minutes. After the initial ten minute period, single still images were taken every five minutes for a period of one hour. Additional still images of the areas bitten were recorded each day until the patterns were no longer visible.

The video data recorded at 60 frames per second are viewable in slow motion or normal speed allowing visualization and study of the living tissue response to trauma. The still images document the post-infliction responses of the skin of the ten subjects. These data may be used by forensic odontologists and others to augment the current understanding of the response of living human skin to injuries caused by teeth.

Bitemarks, Human Skin, High-Speed Videography

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