



### F60 A Follow-Up Study of Bitemark Characteristics in Live Human Subjects

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After attending this presentation, attendees will have a better understanding of the issues associated with performing bitemark research on live human subjects and the results of the latest attempt to gather research data.

This presentation will impact the forensic science community by reporting on the latest attempt to study the manifestation of bitemarks on live human subjects after altering the parameters of a preliminary study reported by Hermsen and Wilson.<sup>1</sup>

Following Institutional Review Board (IRB) recertification, 22 young, healthy subjects volunteered for the project. The purpose of this study was to determine if changing the orientation of the dentition from centric relation to an incisive (end-to-end) relationship and changing the amount of tissue included in the bite would alter the results of the original study. In the previously reported study, the teeth had been mounted and the bite administered in centric relation. In addition, the bite had included the entire thickness of the forearm, from anterior to posterior (anatomical position). In this study, the incisors were aligned end-to-end and a smaller volume of tissue was engaged. As in the previous study, the bite was delivered by a device whose design was provided by Drs. Mary and Peter Bush and constructed by Dr. Eric Wilson. The device was fitted with a set of denture teeth provided by the prosthetics laboratory at Creighton University School of Dentistry and outfitted with a pressure sensor that could measure the amount of pressure being exerted by the bite. For this study, modification of the holes in the metal base to which the mandibular denture was attached allowed for the anterior/posterior reorientation of the teeth.

The intent was to deliver as much pressure as possible for five to six seconds, up to a maximum pressure determined in the previous study of 146 pounds for females and 235 pounds for males. The volunteers were all instructed to vocalize their desire to stop at any time during the procedure. There was also an observer who could abort the process at any time if it appeared that the volunteer was in distress or there appeared to be the possibility of skin tissue damage. Photographs were taken immediately following the bite and again at 24 hours.

In some respects, the results were similar to the previous study. As reported previously, there was significant variation in the manifestation of the mark at 24 hours and the females in the study tended to mark at lower pressures than the males. The time required for the skin indentations to disappear to the naked eye also stayed consistent, ranging from 20 minutes to over an hour. However, there were a number of significant differences between the studies. In the current study, none of the volunteers were able to withstand pressures approaching those in the previous study. The marks lasting 24 hours were obtained at significantly lower pressures with petechial hemorrhage and central ecchymosis a commonly observed feature. Among the volunteers was one of the volunteers from the previous study. Consistent with the results of the new group of volunteers, he marked at significantly lower pressure than in the study reported in 2012.

This study demonstrated one of the major issues in performing bitemark research on live humans: pain. About one-third of the volunteers exercised their option of stopping the bite prematurely due to discomfort. The other two-thirds were stopped by the observer as a precaution when it appeared the volunteer was in distress or there was the possibility of skin laceration or abrasion. When questioned, the participant who had volunteered for the previous study admitted that he experienced significantly more discomfort even though the pressure exerted on his arm was significantly less than had been recorded previously. He described the previous study as producing pressure on his arm, like placing his arm in a vice, as opposed to the current study in which he felt the pressure but also, and more painfully, a pinching sensation. The end-to-end orientation of the teeth and the smaller tissue volume involved in the bite generated significant pinching of the tissue which is thought to account for the increased discomfort. The central ecchymosis often observed in bitemarks and more frequently observed in the current study than in the prior study, is also likely the result of the severe pinching of the tissue causing disruption of the underlying capillary beds. Despite the concerns of the observer at the time of the bite, none of the volunteers suffered abrasion of the tissue evident after 24 hours nor did any exhibit laceration of the tissue up to pressures as high as 135 pounds.

#### Reference:

1. Hermsen KP, Wilson E. A study of bitemark characteristics in live human subjects. Proceedings of the American Academy of Forensic Sciences; 2012. Atlanta, GA.



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**Bitemark, Human, Live**