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Transillumination in Bite Mark Evidence

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ABSTRACT: Transillumination of bite mark evidence is a technique whereby the presence of subcutaneous hemorrhage can be visualized without having to section through the bite mark. This is a nondestructive technique. The presence of subcutaneous hemorrhage indicates that the bite mark was inflicted before death or perimortem. In addition, the technique proves invaluable in determining the orientation of the bite mark. This is particularly helpful when a bite mark is poorly defined, barely visible, or obscured by other superimposed bite marks or traumatic injury patterns. Observation of the subcutaneous hemorrhage by transillumination may provide an indication of the horizontal alignment of the aggressor's dentition since the force of occlusion used in delivery of the bite mark is a factor in the presence and intensity of the hemorrhage. Transillumination supports a conclusion that there may be two types of hemorrhagic patterns in bite mark evidence. Lastly, when transillumination is used in conjunction with visual aids, it can facilitate communication of bite mark evidence to other expert witnesses or to the jury in trial presentation or both.

KEYWORDS: odontology, bite marks, transillumination, pathology and biology, preservation of tissue

A simple and effective method has been described whereby bite mark evidence (or other traumatic injury patterns) may be preserved indefinitely in its original three-dimensional form [1,2]. In combination with the latter technique, it will be shown that transillumination can determine whether the bite mark is of antemortem, perimortem, or postmortem origin. This is of special benefit since transillumination is a nondestructive technique. Further, through the study of the subcutaneous hemorrhage by transillumination, additional information regarding the perpetrator's dentition may be derived. Moreover, it will be demonstrated that the cast of a perpetrator's dentition may be analyzed, applied to, and compared with the preserved specimen and the subcutaneous hemorrhage years later. The information derived through the technique would otherwise be unavailable by the standard methods of analyses [3-5].

Methods and Materials

Transillumination was developed and is meant to be used in conjunction with a technique described for preserving and fixing of skin in its original three-dimensional form [1,2].

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The following materials are used in transillumination:

- (1) a light box with a variable rheostat,
- (2) a 75-W "soft" light bulb,
- (3) black cardboard strips of various sizes, and
- (4) a photographic bench setup.

The three-dimensional excised specimen with its muscle tissue removed is mounted on top of a clear glass plate (Fig. 1). The glass plate rests on top of the light box. The light is transmitted through the specimen and its intensity is varied by means of a rheostat. The black pieces of cardboard form a mask and limit the light to the specimen area only.

Discussion

In transillumination, one looks *through* the epidermis, the dermis, the connective and adipose tissues. Evidence of subcutaneous hemorrhage may be observed when a bite mark has been inflicted antemortem or perimortem. Previously, one often had to section through the bite mark to see the hemorrhagic region, particularly if the bite mark was inflicted perimortem or if it was a "weak" bite mark. The absence of subcutaneous hemorrhage could mean that there was insufficient pressure inflicted by the perpetrator of the bite mark or that the bite mark was inflicted after death.

Orientation of the bite mark can be facilitated by transillumination. Since the retaining ring in which the specimen is collected [1,2] acts both as a three-dimensional stabilizer and as an identification marker (orientation of the bite mark to the victim's body), the subcutaneous hemorrhage pattern can readily differentiate the upper from the lower arch in most cases. This by extension orients the *head* of the suspect to the part bitten. The specific orientation of the perpetrator's *body* to that of the victim's cannot be deduced from this observation alone. This is particularly true in bite marks on limbs (Figs. 2 through 6).

Transillumination is useful for orientation of the bite mark particularly under the following trying conditions:

- (1) the bite mark is diffuse, poorly defined, or difficult to visualize with the naked eye (Figs. 3 and 7);
- (2) when there are multiple bite marks within the same area; and
- (3) when the bite mark is overlapped by other traumatic injury pattern.

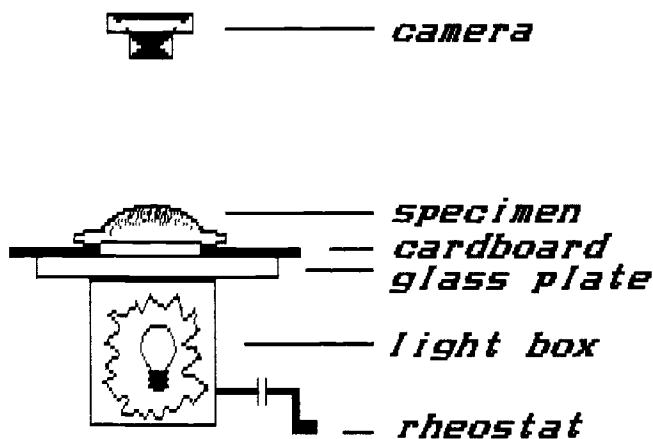


FIG. 1—Transillumination setup.

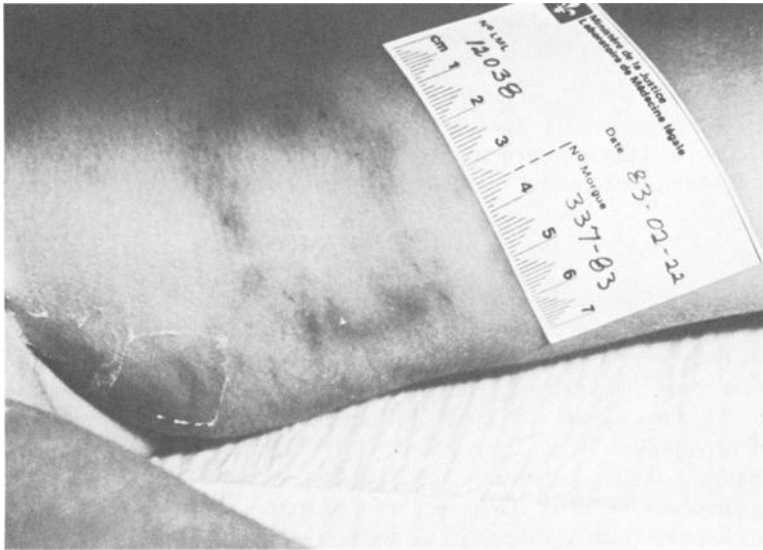


FIG. 2—*Photograph of a bite mark on the left thigh of a deceased 4-1/2-year-old battered child.*

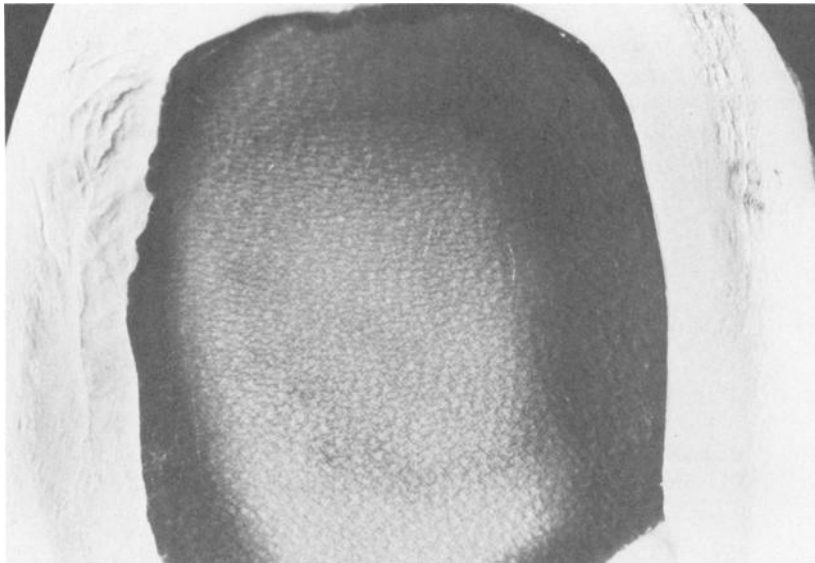


FIG. 3—*The same bite mark as in Fig. 2 after preservation and fixation using the Dorion technique [1,2].*



FIG. 4—*The same bite mark as in Figs. 2 and 3 as seen by transillumination.*

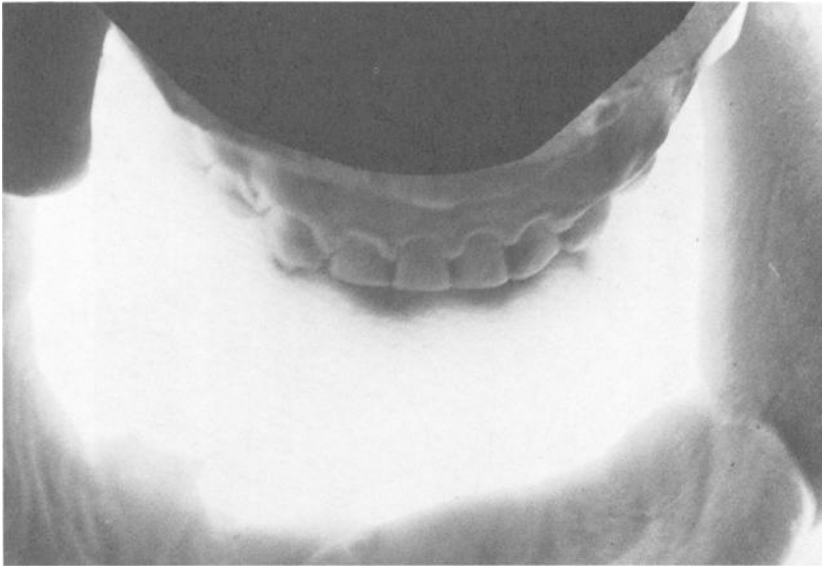


FIG. 5—*The same bite mark as in Fig. 4 illustrating the relationship between the hemorrhage to the perpetrator's lower teeth. Note that the second left bicuspid has a corresponding hemorrhage site while the first bicuspid does not.*

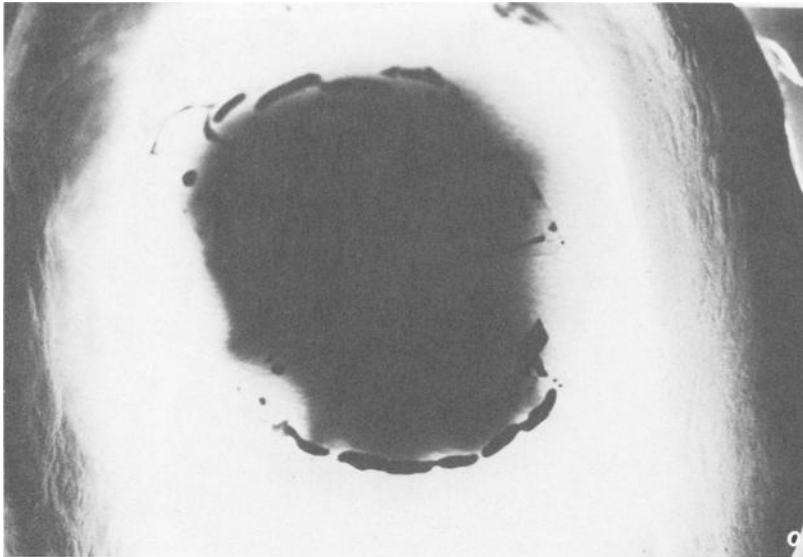


FIG. 6—The same bite mark as in Fig. 5 illustrating the relationship between the hemorrhage to an overlay of the perpetrator's teeth. Note the absence of hemorrhage corresponding to the area of the upper left canine and lower left first bicuspid despite the fact that the perpetrator had these teeth present in the mouth. See text for explanation.

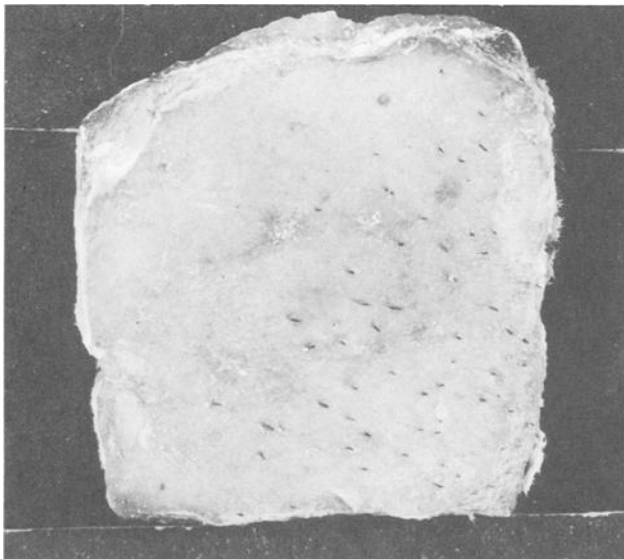


FIG. 7—Bite mark on a cheek of a homicide victim. The evidence is barely visible to the naked eye.

Transillumination may provide information which under normal circumstances would be considered easily identifiable. Such a case could include the observation of the presence of a tattoo on a badly decomposed body (Fig. 8).

Bite mark evidence is peculiar, yet specific in its characteristics. There would appear to be two types of hemorrhagic patterns.

The self-limiting pattern is attributable to the individual teeth causing the trauma. This would appear to be specific to bite mark evidence. The reasons for this phenomenon are yet unclear although the results have been recorded in vivo many months after healing is apparently complete. It has been photographed by means of ultraviolet photography [6].

The second, more generalized type of hemorrhagic pattern is associated with:

(1) a pinching action: between individual teeth in the same arch (passive form), and from applying pressure with opposing teeth in closure (active form) that is, the act of biting (Figs. 4 through 6 and 9) and

(2) a sucking action: this type is specific and may be observed as a separate hemorrhagic entity.

In transillumination one can also estimate via the hemorrhagic pattern the amount of force and the specificity of applied pressure by the dentition. By varying the intensity of the light transmitted through the specimen, one is able to detect areas with varying intensities of hemorrhage, establish their location in respect to the teeth marks, and thus deduce the rela-



FIG. 8—A tattoo lifted from a badly decomposed body as seen by transillumination.

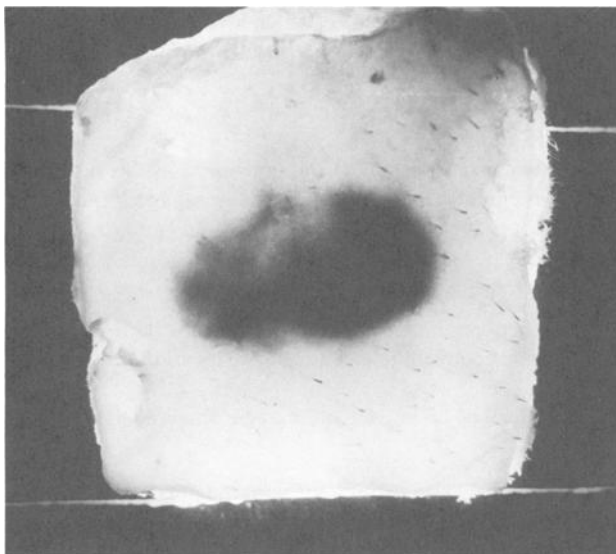


FIG. 9—Same bite mark as in Fig. 7 as seen by transillumination.

tive amounts of force used in its infliction (Figs. 2, 4, and 6). If one side of the bite mark in the same arch has more intense hemorrhaging, this could indicate that the aggressor's dentition applied greater pressure on that side of the mouth. Hemorrhaging caused by the dragging of the teeth is a separate entity.

Additionally, the hemorrhagic pattern may reflect the horizontal relationship of the perpetrator's teeth. Conversely, the absence of a hemorrhagic pattern corresponding to a specific tooth may indicate an uneven horizontal relationship of incisal edges as a result of:

- submergence of the tooth (Fig. 5);
- fracture of the tooth;
- misalignment of the tooth with the adjacent teeth in the arch (labiolingual versions [Fig. 6], noneruption, and so forth);
- absence of the tooth (extracted, congenitally missing, lost during the present or past trauma, and so forth); and
- combinations of features (Fig. 6).

It is important to keep in mind, therefore, that the absence of hemorrhage in a particular position in a bite mark does not necessarily imply the absence of a tooth in the perpetrator's dental arch. Conversely, a localized area of intense hemorrhaging can indicate the supereruption of a tooth.

Conclusion

The use of transillumination in conjunction with visual aids such as photography and video recording systems can facilitate communication of bite mark evidence to another forensic science expert or to a jury in a trial presentation or both. This is important as visual evidence is more easily understood and communicable than would be verbal testimony (Figs. 5 and 6).

As a final note, transillumination used in conjunction with the previously described techniques of lifting, preserving, and fixing of the skin can prove to be another effective tool in the analysis of bite mark evidence.

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