Bite Mark Recognition and Interpretation

D. G. MACDONALD
Department of Oral Medicine and Pathology
Glasgow Dental Hospital and School, 211 Renfrew Street, Glasgow G2 3JZ

A classification of bite marks is presented which is based upon consideration of the mechanical factors involved in their causation. The possible value of this suggested classification in the interpretation of bite marks is indicated and an approach to bite mark interpretation is proposed.

Introduction
Identification of suspects from bite marks has been undertaken in this country for nearly 70 years. Despite this, cases involving this type of identification are relatively rare and a statement made in 1966 by Gustafson, that few authorities have seen more than a handful of cases, remains true today. The available published case reports indicate that the techniques of investigation of bite marks are often highly individual to particular experts. This must be confusing, both to other forensic dental experts and to those involved with the Court presentation of dental evidence.

As any field of study becomes established, it requires the development of specific nomenclature and systems of classification. Cameron and Sims (1974) presented a classification of bite marks, but this was concerned mainly with the agents, either human or animal, causing the bites and the materials bitten. No adequate classification of bites, considering the types of injuries produced and the mechanisms of their production, has been published. It is the purpose of this paper to suggest such a classification and to describe a possible approach to the interpretation of alleged bite marks.

Bite Marks—Basic Considerations
It is important to decide initially what constitutes a bite mark, or in other words, to attempt to define the term bite mark. The dictionary definition of the verb to bite is to tear or seize with the teeth. In a forensic sense the term is used rather more broadly and it is suggested that a suitable definition of a bite mark is "a mark caused by the teeth either alone or in combination with other mouth parts". This definition merely implies that the marks were made by the teeth. It does not require that the material in which the mark was registered was either seized or torn by the teeth and indeed the force causing the teeth to leave a mark need not have been derived from the individual whose teeth caused the mark.

The materials bitten may be considered in three categories—foodstuffs, such as apples or biscuits, may be bitten and discarded and if left at the scene of a crime can be of evidential value. Alternatively, bite marks can be in flesh. A third miscellaneous category of materials bitten would include such instances as the unusual case recorded by Pederson and Keiser-Nielson (1961) in which marks were left in the surface of a wooden cabinet.

Aetiologic Classification of Bite Marks
Study of the literature on bite marks would suggest that these are almost exclusively relatively simple impressions or marks, due to mechanical pressure from the biting edges or surfaces of the teeth. Such a view is far from the truth. Bite marks are frequently highly complex and it is pertinent to examine them from an aetiologic view and to enquire how the changes observed in the bitten material have actually been produced. The proposed classification of bite marks will be illustrated by marks in human flesh, but it is equally applicable to marks in other materials.
Fig. 1. Bite mark on breast showing tooth pressure marks of the lower anterior teeth (L) and tongue pressure marks of the upper anterior teeth (U). The marks in the centre of the bite (R) are tongue pressure marks from the palatal rugae.

Fig. 2. Bite mark on abdomen showing tooth pressure and tongue pressure marks and a penetrating tooth pressure mark caused by a sharp pointed lower right canine (arrow).

Fig. 3. Complex bite mark injury, probably showing three partially superimposed bites. Tooth pressure marks are present and a large penetrating tooth scrape mark (S) has been caused by the lower right anterior teeth.
Tooth Pressure. Marks may be caused by the direct application of pressure by the teeth upon tissue. In general, these marks are caused by the incisal edges of anterior teeth or the occlusal surfaces of posterior teeth. The exact nature of the marks produced probably depends upon several factors: the force applied, the duration of the application and the degree of movement between tissue and teeth during the application of the force. The best definition in tooth pressure marks is seen with anterior teeth in slowly applied marks where considerable pressure is used. In such marks the incisor teeth leave pale areas representative of the main part of the incisal edge and a zone of bruising at the margins of the incisal edge due to damage to blood vessels at the area of maximum stretching adjacent to the relatively fixed tissue in contact with the incisal edge (Fig. 1). Such marks can give a clear indication of irregularities of size, shape or position of individual teeth and are the most valuable and easily interpreted marks for identification purposes.

Tongue Pressure Marks. When the material bitten can be taken into the mouth adequately and is sufficiently malleable it may be pressed by the tongue against the teeth or other rigid areas of the mouth, such as the palatal rugae, and this can leave distinctive marks. In bites in flesh this mechanism has been referred to as suckling as it involves a combination of sucking and tongue thrusting.

Marks produced by tongue pressure are usually of the palatal surfaces of the upper anterior teeth, but marks of the lingual surface of lower incisors may also be found. In Figure 1 a series of arches is seen which represents the outline of the palatal surfaces of the upper incisor teeth. These marks are due to bruising caused by stretching of unsupported tissues across the gaps between teeth or at the cervical margins while the main mass of the tissue is relatively fixed against the tooth surface or the gingiva. The marks in the centre of the bite in Figure 1 are caused by a similar mechanism in which tissue is stretched across the grooves between the palatal rugae.

Tooth Scraper Marks. Marks may be caused by the teeth scraping across the bitten material. Such marks usually involve the anterior teeth and may present as scratches or as areas of superficial abrasion. If such marks present as scratches, then they may be indicative of peculiarities in the incisal edges and this is of value in identification. Marks presenting as superficial abrasions are of much less value for identification purposes.

Fig. 4. Alleged bite mark on finger. Despite a clear history this can only be identified as a possible bite mark.
Further Considerations and Interpretation

Bite marks may be penetrating or non-penetrating in the sense of whether or not the teeth penetrate through the epidermis. Whether or not such penetration occurs is probably a function of several factors such as the sharpness of the biting part of the tooth, the force applied, the rate of application of the force and the amount of movement between the teeth and the tissue bitten.

Consideration of the elements of a bite mark can give an indication of the probable circumstances in which the bite was made. Bite marks in flesh can be considered as forming a spectrum from amorous bites to aggressive bites. This spectrum can be seen in the three bites illustrated in Figures 1, 2 and 3, which are all from the body of the same murder victim. Figure 1 shows a mark from the left breast and is a non-penetrating mark with prominent tongue pressure marks and also tooth pressure marks. This is a type of bite mark seen in sexual cases where the bite is applied slowly and deliberately. Despite the fact that the designation amorous has been applied to this type of mark, it probably represents a painful injury. The bite on the abdomen, depicted in Figure 2, although showing some features of an amorous mark, shows more evidence of tooth pressure marks and in addition, evidence of penetration of the skin is seen where a sharp pointed lower canine has punctured the epidermis. On the right breast of the same body were the marks shown in Figure 3. These form a confused mass of tooth pressure marks and tooth scrape marks with a large area of abrasion or penetration. The tissue damage seen is probably the result of three partially superimposed bite marks and is a decidedly aggressive injury. Marks of this type are much less useful for identification purposes than are the amorous type of mark illustrated previously.

Interpretation—Reports on Bite Marks

The investigation of a bite mark by a forensic dental expert will usually be followed by a report to the Procurator Fiscal or Coroner. There is considerable variation in the way in which individual experts approach the study of bite mark cases, but it is important that the approach be systematic and logical. The following outline is suggested as a scientifically and legally acceptable procedure for interpretation of alleged bite marks.

It is critical that the first question the expert asks himself is “can I identify this mark as a bite mark?” It is all too easy to leap ahead and compare the teeth of a suspect with an alleged bite mark before deciding upon the actual nature of the mark in question. Marks should be placed in one of three categories; these being definite bite marks, possible bite marks and marks which show features which specifically preclude them from being caused by the teeth at all.

Ideally, to make the decision that a mark is a definite bite mark it is desirable to see clear evidence of the marks of several teeth in which the particular teeth involved can be distinguished. This is not always found. All features of a mark must be considered. In some cases tooth pressure marks alone may not allow a decision that a mark is a definite bite mark, but taken in combination with tongue pressure marks such a lesion may be diagnosed as a definite bite mark. The much publicised Biggar murder case (Harvey et al, 1968) presented a mark of exactly this nature.

On occasions marks are encountered where the victim gives a clear history of having been bitten, but where inspection of the mark alone does not allow of the conclusion that it is a definite bite mark. The mark shown in Figure 4 is of such a case, and in this instance, despite a clear history, the mark could only be identified as a possible bite mark.

The next decision to be made is whether or not it is likely that a suspect could be identified from a particular bite mark. This again is a decision which should be made principally from examination of the mark before any study of a suspect’s dentition. Factors which would influence a decision about possible identification are the clarity and number of elements in a mark and the degree of distortion seen in the tissues. It is possible that a mark may show insufficient detail to allow
of a positive identification but still show sufficient evidence of the perpetrator's dentition to allow elimination of suspects.

Conclusions
Human bite marks may be highly complex injuries and the teeth, either alone or in combination with other mouth parts, may damage bitten material in a number of ways. In order to assist with the recognition and interpretation of possible bite marks, it is important to have an appropriate way of describing them. This paper has presented a suggested classification of bite marks from an aetiologic viewpoint and has illustrated how use of this classification may assist in interpretation of the circumstances related to the bite.

The further stages of bite marks investigations will involve the dental expert in a number of decisions about the nature of a mark and possible suspect identification or elimination. A method of approach to this area of study is presented and it is suggested that it is of critical importance that a full and detailed study of alleged bite marks is completed before any attempt is made at comparison with the dentition of the suspect.

Acknowledgement
The photographs of Figures 1, 2 and 3 are the work of Mr Hugh Hood, Greenock, to whom grateful acknowledgement is extended.

References