

BITEMARKS IN CHOCOLATE: A CASE REPORT

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ABSTRACT

Police investigating a theft from a chocolate factory recovered three pieces of chocolate with irregular fractured surfaces displaying a pattern of marks made by human teeth. A highly accuracy dental impression material was used to prepare casts of these marks which were examined and photomicrographed, confirming that they had in fact been produced by human teeth.

Casts and photomicrographs of the suspect's teeth were made in order to record the fine details of the casts of the dentition. Unique characteristics evident on these casts included a small notch on the incisal edge of the upper right lateral incisor, wear facets on the incisal edges of the upper central incisors and on the lower right lateral incisor and a space of approximately 1.5mm between the upper left central incisor and lateral incisor which was rotated about 20 degrees distally.

Both direct and photomicrographic comparisons between the casts of the chocolates and of the suspect's dentition revealed correspondence between their unique characteristics. (*J Forensic Odontostomatol* 2000; 18:10-4)

Keywords: Foodstuffs, photomicrographs, dental characteristics, wear facets.

INTRODUCTION

In February 1996 a forced entry and burglary occurred at the confectionary manufacturing and retail premises of Haigh's Pty Ltd. in Adelaide, Australia. Entry had been obtained through the roof and a safe which was present had been overturned and a hole made in the back. An axe and jemmy bar were found nearby and a quantity of cash was missing from the safe, as well as some chocolates from a nearby display area; a number of partially eaten chocolates were recovered from the floor. During the preceding weeks there had been a number of forced entries to other properties with similar characteristics which had resulted in an accumulation of evidence. Following the break-in at the chocolate factory the police arrested a suspect who was charged and subsequently detained under the Summary Offences Act at Yatala Labour Prison. In March 1996 three pieces of partially eaten confectionary were delivered to the Forensic Odontology Unit, University of Adelaide. Three days later, at the

request of the Police under Section 81, subsection 4 of the Summary Offences Act, impressions of the suspect's dentition were obtained using GC Examix.*

METHOD

Examination of the Chocolate

Each of the 3 pieces of chocolate was incomplete at one end and displayed irregular fractured surfaces which were consistent with marks made by a human bite (Figs. 1-4). The portion of chocolate honey nougat measured approximately 27.0 mm at the maximum width and 29.0mm at the maximum length. The portion of chocolate frog measured 40.0mm at the maximum width and 55.0mm at the maximum length whilst the bar of plain chocolate measured 40.0mm at the maximum width and 77.0mm at the maximum length.

*GC Examix™ GC Corporation 76-1 Hasunuma-Cho-Itabashi-Ku, Tokyo Japan

Under microscopic examination the depressions visible in the surface of the chocolate could be identified as human tooth marks. The chocolate honey nougat had marks in both the upper and lower surfaces while the remaining two chocolate pieces displayed details in one surface only.

Casts of the marks in the chocolate surfaces were made from GC Examix impressions known to give highly accurate and stable results and were then examined and photographed microscopically (Figs. 6-7).

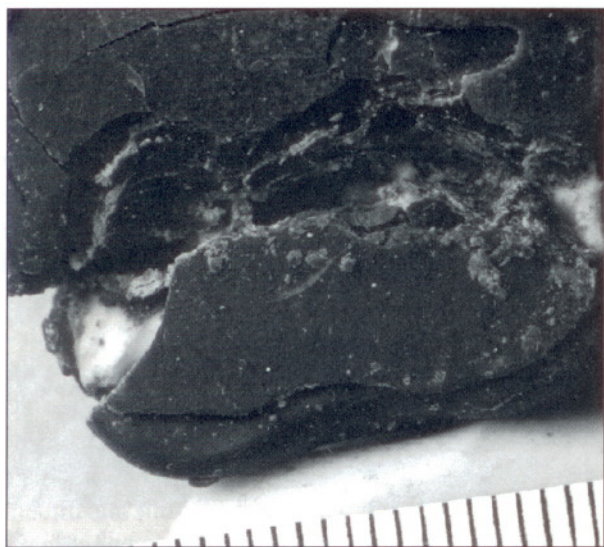


Fig.1: Portion of chocolate honey nougat, lower surface.

Examination of the Suspect's Dentition

The incisal edge configurations of the suspect's anterior teeth were examined microscopically on the stone casts and recorded as photomicrographs with several features being evident:

1. There was a space of approximately 1.5mm between the upper left central and lateral incisors with a rotation of the lateral incisor of around 20 degrees distally (Fig. 5).
2. The upper right lateral incisor demonstrated a small characteristic notch (Fig. 6a).
3. The upper right central incisor displayed occlusal wear facets (Fig. 7a).
4. The lower right lateral incisor also demonstrated wear facets (Fig. 8a).



Fig.2: Portion of chocolate honey nougat, upper surface.

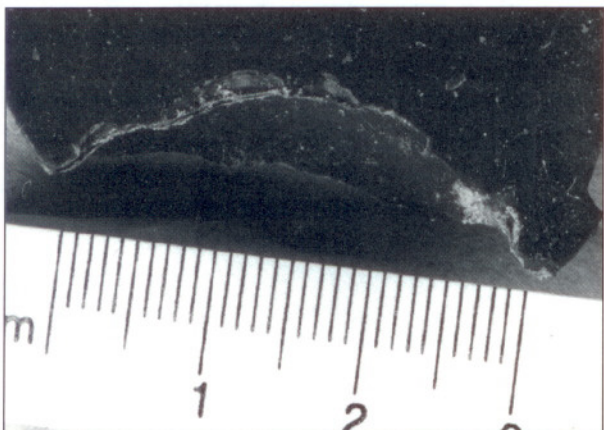


Fig.3: Portion of chocolate frog.

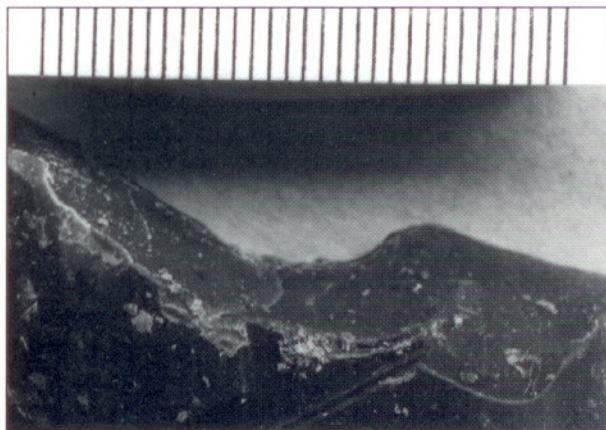


Fig.4: Portion of dark chocolate bar.

Comparisons between the casts of the bitemarks in chocolate and the suspect's dentition were performed by direct alignment and also by comparison of details visible on both series of photomicrographs. The features which were visible on the anterior teeth of the suspect were also apparent as features on the casts of the indentations retained in the chocolates (Figs. 6-8).

Fig. 6a displays the incisal edge of the upper right lateral incisor of the stone casts embedded in boxing wax. The labial margin is exposed adjacent to the



Fig. 5: Cast of suspect's upper anterior teeth

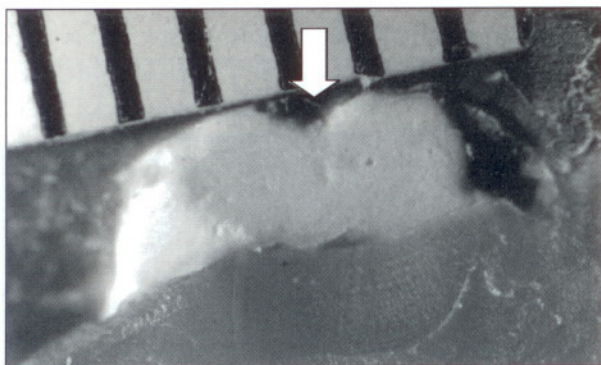


Fig. 6a: Photomicrograph of cast of suspect's upper right lateral incisor, a notch is visible in the middle third of the labial margin (arrowed).

millimetre scale, a notch is visible in the mid-portion of the labial margin. Fig. 6b displays the positive cast replication in GC Examix of one of the indentations retained in the upper surface of the chocolate honey nougat adjacent to a scale. This distinct outline delineates the same shape and general dimensions as those visible in Fig. 6a, including the labial notch. Fig. 7a shows the cast of the incisal edge of the suspect's upper right central incisor embedded in boxing wax with the labial margin exposed adjacent to the millimetre scale. Fig. 7b shows a GC Examix cast of the indentation in the

upper surface of chocolate honey nougat which was adjacent to the cast shown in Fig 6b. This second indentation in the upper surface of the chocolate honey nougat displays the same shape and dimensions as those visible in Fig 7a. In particular the labial and lingual margins in Figure 7a have similarities to the margins visible in Fig. 7b. Fig. 8a demonstrates a cast of the suspect's lower right lateral incisor with the labial margin of the incisal edge adjacent to the scale. Distinctive wear facets are visible on the incisal edge. Fig. 8b depicts the GC Examix cast of the indentation in the lower surface of the honey chocolate nougat. The general outline and dimensions of the incisal edge seen in Fig. 8a are reproduced exactly.

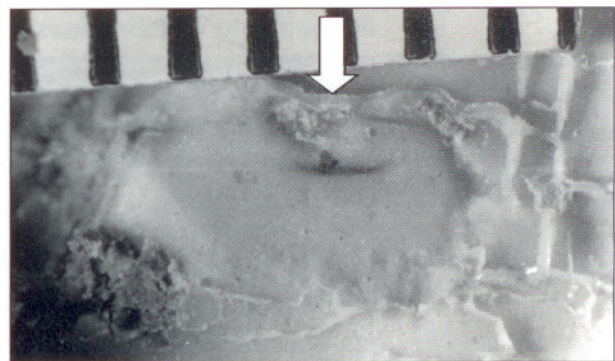


Fig. 6b: Photomicrograph of cast of one of the indentations retained in the upper surface of chocolate nougat. The outline visible is analogous with the outline of the upper right lateral incisor (arrowed).

DISCUSSION

The degree to which dental characteristics are retained in bitemarks in foodstuffs varies greatly and obviously depends on the nature of the foodstuff involved. Evidence of bitemarks has been recovered from types of food ranging from soft cakes¹ to cheese². Webster³ classified the results of such bitemarks according to the foodstuff as follows:

- Type 1 fractures with limited tooth penetration (chocolate).
- Type 2 fractures with extensive pressure applied by the teeth (apples).
- Type 3 fractures with complete or near complete penetration through the food substance (cheese).

Webster³ noted that bitemarks in chocolate lead to a fracture of the material with a limited depth of tooth penetration recording possibly the most prominent incisal edges and some of the labial aspects of the upper and lower anterior teeth. This effect was visible with the marks retained in both the chocolate frog and the chocolate bar. The third type of bitemark described by Webster³ included those where the teeth bite through or almost through a material such as cheese. The latter has provided valuable evidence previously as reported in 1906¹ and by McCullough and Layton.^{4,5} The effect of a type 3 bitemark was visible in the case of the chocolate honey nougat bar. The material below the chocolate was of a different physical nature to the chocolate on the surface and was not fractured at the region of the bite. An amount

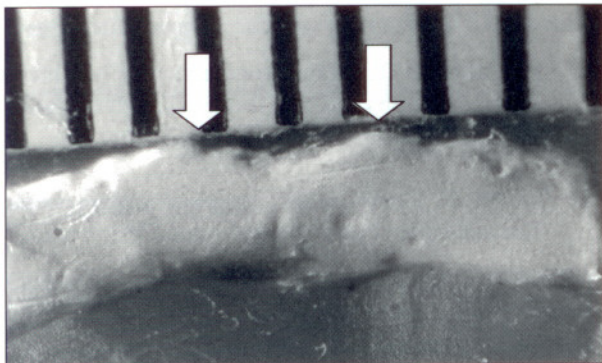


Fig.7a: Photomicrograph of cast of suspect's upper right central incisor. The outline of the incisal edge and surface is distinctive in shape (arrowed).

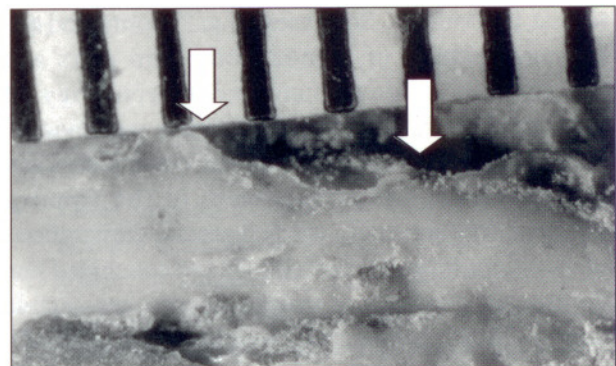


Fig.7b: Photomicrograph of cast of another indentation retained in the upper surface of the chocolate honey nougat. A similar outline to that in Fig.7a is visible (arrowed).

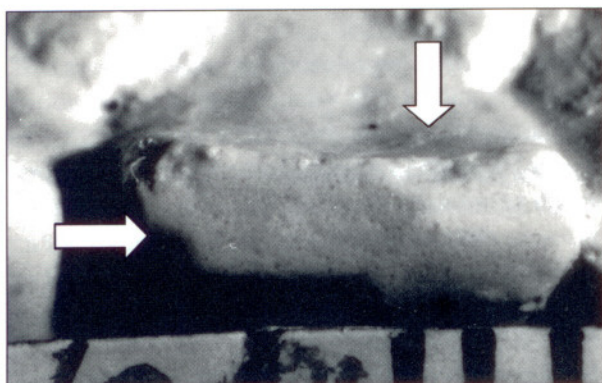


Fig.8a: Photomicrograph of cast of suspect's lower right lateral incisor. Distinctive wear facets are visible (arrowed).

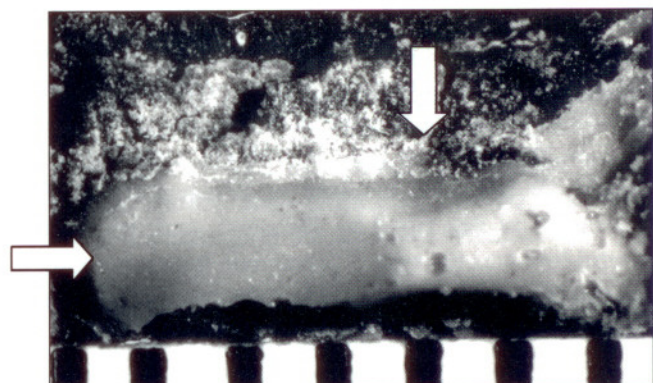


Fig.8b: Photomicrograph of cast of indentation retained in lower surface of the chocolate honey nougat. There is correspondence between the shape of this cast and the wear facets visible in Fig.8a (arrowed).

of chocolate had been lost from the surface and from the edge of the bar, however in the area of the bitemark the nougat had retained marks which indicated that a tooth scraping action had occurred up to an area seen as a 'stopping point' (as described by Webster³) which displayed an outline of the incisal edges. These details which were visible on the upper and lower surface of the honey nougat bar corresponded with details of the upper and lower anterior teeth of the suspect's dentition.

The ability to make meaningful interpretations of bitemark evidence relies heavily on both the nature of the material involved and the reproduction of unique characteristics displayed in the dentition of the perpetrator. The validity of bitemark evidence requires that each individual dentition has a combination of features relating to the size, shape, occlusion and arrangement of teeth which is unique to that individual. Sognaes *et al.*⁶ compared the bitemark pattern of monozygotic twin pairs and despite similar developmental morphology of individual teeth, significant variation was evident between twins in each pair with respect to individual tooth position and arrangement in the anterior segment. Rawson *et al.*⁷ studied precise registrations of dentitions from 397 individuals and concluded that the human dentition is unique beyond reasonable doubt. These findings add weight to the generally accepted belief that dental characteristics are both distinct and unique to each individual and the possibility of mistaking an individual's bitemark for another is extremely slight.

In the case reported here the clearest evidence providing correspondence between the suspect's dentition and the bitemarks was found in the bar of chocolate honey nougat. There were additional details provided by the marks in the chocolate frog and the chocolate bar but the different nature of the foodstuffs involved resulted in different types of bitemarks as described by Webster³ and the most useful bite was the type 3 (chocolate honey nougat) where the teeth could provide a deeper indentation and therefore more comprehensive marks.

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