

COMPARISON MICROSCOPE IDENTIFICATION OF A CHEESE BITEMARK: A CASE REPORT

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ABSTRACT

Police investigating the murder of a farmer recovered a piece of cheese containing bite-marks. The local dental practitioner used white plaster to make casts of the bitemarks in the cheese and also of the teeth of three suspects. The cheese specimen was retained by the police and seven months later the case was referred to the Forensic Odontology Unit at the University of Pretoria where a silicone rubber cast of the bitemarks in the cheese was made. A lack of concordant features present in a conventional pattern-associated comparison was overcome with the aid of a Leica DMC comparison microscope. Individual features observed under 6.3x magnification aided in the positive identification of the suspect, who when confronted with the evidence, admitted guilt at his first court appearance. (*J Forensic Odontostomatol* 2002;20;13-6)

Keywords: Bitemarks, cheese, DMC comparison microscope

INTRODUCTION AND CASE REPORT

On 16 November 1999 a farmer was robbed and shot dead in the Richmond area of Kwa-Zulu Natal, South Africa. A piece of cheese containing bitemarks was found at the crime scene and the local dental practitioner who was consulted took an impression of the cheese bite and made casts in white plaster. Three suspects were arrested shortly afterwards and the same dental practitioner was then requested to make dental study models of the suspects. Using alginate impression material for the impressions, casts were once again poured in white plaster and the exhibits were transferred to the Silverton Forensic Science Laboratory in Pretoria.

On the 7 June 2000, three sets of study casts marked A, B and C, a piece of bitten cheese, and a plaster cast of the bitemarks was brought to the Faculty of Dentistry, University of Pretoria for forensic analysis. Upon receipt, the white plaster cast of the cheese surface was found to be porous and insufficiently detailed for satisfactory observation. It was therefore decided to re-make the cast of the cheese surface in silicone rubber* (Fig.1). This yielded a



Fig.1: A silicone cast of the cheese made 7 months after the crime. The defect on the 11 is clearly visible

good quality replica considering the seven month age of the cheese specimen. Fortunately it had been stored in a sealed plastic container and kept in a refrigerator at approximately 4^o C.

The cheese bite was classified as a type 3¹ in which the teeth bite right through or almost through the bitten material. However, a limited number of concordant features in a pattern-associated comparison of the silicone impression and the models of the suspects forced us to consider alternative methods of observation. Microscopic analysis² as well as scanning electron microscopy³ were considered. The

* Light body President, Polyvinyl siloxane, Coltene Co, Switzerland

Ballistic Unit of the Silverton Forensic Science Laboratory offered their DMC (Das Mikroskop Comparison) comparison microscope* to assist in the analysis.

METHOD

A two-stage approach was used to examine and compare the bitemarks in the cheese with the study models of the three suspects. A pattern-associated comparison⁴ in which the tooth features and their relationships were analyzed acted as an initial screening tool. Suspects A and C were excluded as the result of obvious mismatches and suspect B was considered to be a possible match.

In the second stage the models of the possible suspect were analyzed under the comparison microscope and a defect situated centrally on the incisal edge of tooth 11 was the area focussed on (Fig. 2). The two images visible on the microscope could be brought into juxtaposition and a direct comparison of the tooth (11) and the silicone cast of the cheese bite was made. An oblique light source was used to illuminate both casts and highlight the defect.

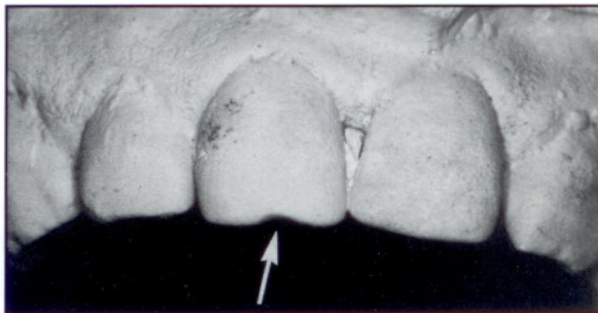


Fig.2: A defect situated centrally on the incisal edge of the 11 is clearly visible

RESULTS

The forensic team was satisfied that the bitemark was of human origin. During stage one it was further clear that the models belonging to suspects A and D did not match the silicone cast of the cheese but that there was a possible match with suspect B.

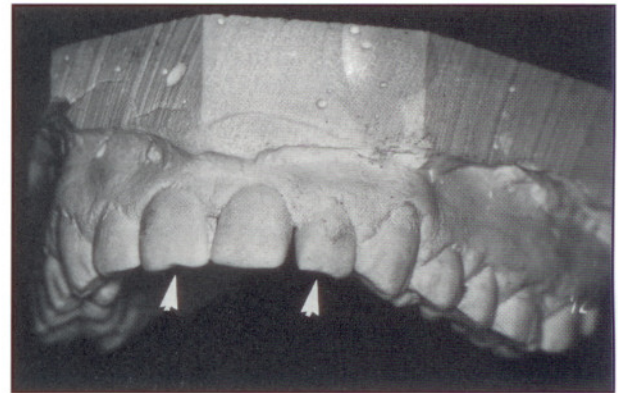


Fig.3: The maxillary model of suspect B showing the defect on the incisal edge of the 11 and the concave incisal edge of the 22

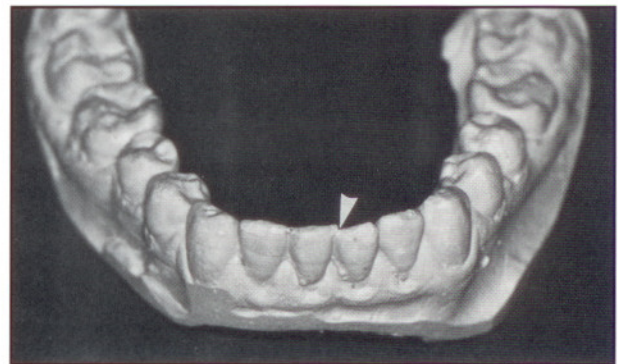


Fig.4: The lower model of suspect B, showing the 31 labially placed in relation to the 41. This was also evident on the silicone cast.

The following concordant features were observed in the pattern-associated comparison between the silicone cast and the model of suspect B (Figs. 3 and 4):

1. Centrally positioned defect on incisal edge of 11.
2. The defect on the 11 extended towards the lingual surface of the tooth.
3. The incisal edge of the 22 was concave.
4. The 31 was labially placed in relation to the 41.

Stage two was a microscopic comparison showing the following concordant features (Fig. 5):

1. The slope of the mesial edge of the defect formed an acute angle with the incisal edge.
2. The distal edge of the defect was shorter than the mesial edge, and formed an obtuse angle with the mesial edge.
3. The corner between the distal edge of the defect and the incisal edge of the tooth was rounded and bulbous.

* Leica, Mirosystems Wetzlar GmbH, Germany

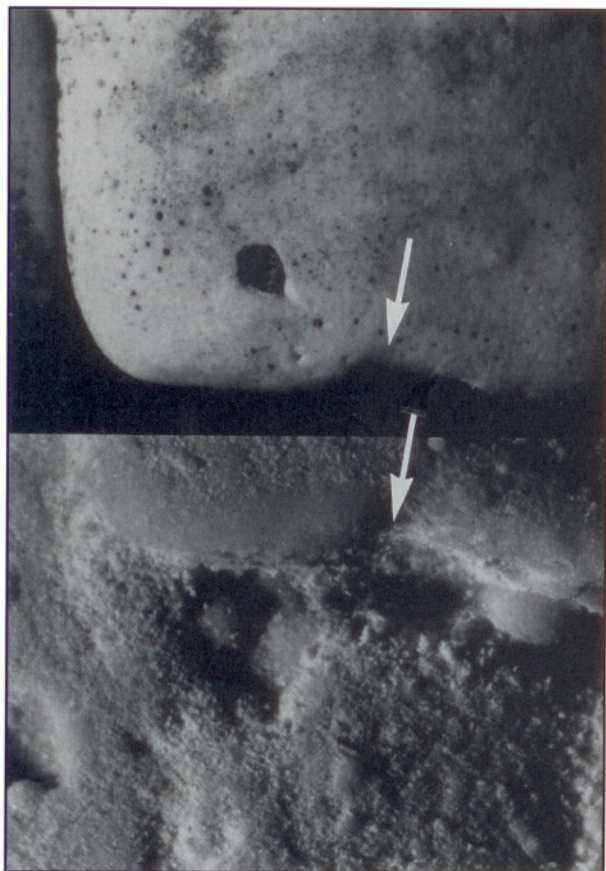


Fig.5: The two incisal edges (tooth 11) as seen under the DMC comparison microscope. The two images are brought into juxtaposition and each point of concordance can be observed

4. The incisal edge between the defect and the distal corner was slightly concave.
5. The defect was continuous with the lingual aspect of the tooth.
6. The mesial slope of the defect had characteristic mammilar protrusions (Fig 6).

It was concluded that in the presence of multiple concordant features suspect B was the probable perpetrator of the crime. The results of the above analysis were submitted to the Pietermaritzburg High Court and when confronted with the evidence at the first court hearing the suspect admitted guilt.

DISCUSSION

A bitemark can be defined as the registration of tooth cutting edges on a substance caused by jaw closure, and a tooth mark the print or impression registered on a substance by one or more teeth.⁵ Each human dentition is unique, and will leave unique prints in



Fig.6: The mesial slope of the defect shows the mammilar protrusions

the objects bitten.⁶ Bitemarks can be inflicted by humans or animals and can be found on skin or inanimate objects.⁷ A variety of bitten foodstuffs have been associated with crime scenes, such as cheese,⁸ cake,⁹ chocolate,² a bread sandwich¹⁰ and apples.¹¹

In spite of the initial blunder of making the cast from the impression of the cheese in white plaster, the time it took before the cheese was examined, and a lack of sufficient dental features in the cheese bite, a satisfactory comparison was nevertheless possible. The use of a pattern-association technique allowed the authors to utilize a cheese specimen even though it had been kept by the police for seven months. Obvious shrinkage and a degree of distortion had taken place. Fungal growth, was also observed on the cheese. Any attempt at measurement would have failed to stand up to cross-examination in court. Cheese should always be kept in a sealed plastic container or sealed plastic bags and stored in a refrigerator at 4°C¹². Refrigerators should be periodically checked as current may fail or mechanical faults can cause temperature changes.

Unique imperfections only seen under magnification were observed, compared and analyzed with the aid of a comparison microscope at a magnification of 6.3 X, which is well suited to studying bitemarks. The images can be moved independently allowing

the examiner to position the specific features as required and the images can be photographed during all stages of the examination. Lens inserts containing metric scales can be used and the light source can be positioned at different angles to pick up details not seen under direct lighting.

Dental features observed with the naked eye were used to screen possible matches from obvious mismatches. Bite mark identification relies heavily on the three dimensional structure of each tooth, its relationship to the surrounding teeth as well as the relationship of the maxilla to the mandible. Individual characteristics, clearly visible under magnification increase the number of concordant features present in the comparison.

CONCLUSION

The DMC comparison microscope can be used to complement a pattern-associated analysis of bitemarks and by including individual characteristics only seen under magnification, the number of concordant features in the comparison can be increased. It should be borne in mind that the number of concordant features necessary to satisfy the judicial requirements will vary from country to country.¹³

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