New Forensic Odontology Tools

By Dr. Gus Karazulas
Chief Forensic Odontologist
Connecticut State Police Forensic Science Lab
March 28, 2001

Overview

This paper describes advances in forensic odontology used to convict Alfred Swinton in the Carla Terry murder trial. New patented image processing software called Lucis was used to enhance patterns in a bitemark, assisting in conclusively proving a suspect's teeth as the cause of the injury. Photoshop image processing software was use to create a semi-transparent image of the castings of the suspect's teeth, replacing the older and less accurate method of tracing the biting edges of the teeth. Research on the healing process of bitemarks has been used successfully to place a suspect with the victim close to the time of the victim's strangulation.

Introduction

A human bitemark inflicted by an attacker on the skin of a victim may leave a definitive identifiable pattern that can be identified as being made by a certain set of teeth. If a suspect is apprehended his teeth are reproduced by taking impressions of the teeth and pouring plaster into the impression, thus producing a plaster model. The plaster models of his or her teeth are then put on a scanner and scanned to make a digital image. A tracing of the biting edges of the teeth is then made either using the computer or tracings from the printed image. This tracing is then superimposed on the bitemark photo, either manually or electronically using a scanned image of the bitemark, to determine if a match can be made.

Many times the photograph of the bitemark may be of poor quality or the bitemark's characteristics may have started to fade because of the healing process. Patented image processing software called Lucis now enables us to enhance these images to see the patterns more clearly so maybe a match can be made. Also, image-processing software such as Photoshop allows a semi-transparent image of the plaster model to be superimposed on the bitemark image instead of using a tracing of the biting edges of the

teeth. This removes any inaccuracies associated with creating the tracing and creates a clearer picture of the relative characteristics of the teeth and the bitemark.

A second challenge is the determination of when a bitemark was made. Research on the healing process of bitemarks could be useful in determining the time the bitemark was inflicted relative to the time of death in cases where death has occurred because of strangulation. As all healing processes cease upon death, the redness of the bitemark relative to the redness of bruises on the neck indicate the timing of the infliction of the bitemark relative to the murder.

Case Example: The Carla Terry Murder Trial

The body of Carla Terry, 28, was found January 13, 1991, on an abandoned road in Hartford Connecticut. When the paramedics found Terry they tried to revive her, took her to the hospital and cleaned her up, possibly destroying forensic evidence. There was no evidence connecting the suspect, Alfred Swinton, to the body except for bitemarks on the breast. The Medical examiner couldn't determine when the bitemarks were made, therefore the court refused to indict the suspect.

The District Attorney, Joan Alexander, brought the case, now cold, to me in June 1998. I am the Chief Forensic Odontologist for the Connecticut State Police Forensic Science Lab. I have worked with Dr, Henry Lee since 1975. From 1960 until 1970 I was an oral surgeon for the Connecticut State Prison System. I have examined 5,000 bitemarks in the last forty years. Based on my experience, it is not often that bitemarks that have sufficient matching characteristics to take into court. Approximately 150 of the 5,000 bitemarks I have examined would qualify as court evidence. I have only made approximately 10 court appearances concerning bitemark evidence, as I will not testify unless I am certain with reasonable medical certainty that there is a match. Reasonable medical certainty is the highest criteria. It means a high correlation between the tracings of the teeth and the bitemark, making it a certainty that no other human being could have made the mark.

The challenge in this case was to 1) match Swinton's teeth to the bitemarks and 2) show that the bitemarks on the victim had been made close to the time of her death. I utilized new, patented image-processing software called Lucis to make the features of the bitemark more easily visible. Lucis enhances image detail without adding or subtracting data. Lucis reveals image detail that could not be seen any other way, and Lucis reveals simultaneously in the bright and dark regions of an image. The Lucis-processed bitemark could now be matched to Swinton's teeth.

I bit myself in the arm severely enough to cause a red bitemark similar in color to the mark found on Terry approximately fifty times. Each time I noticed and recorded via a photographic record that the red color only lasted 10-15 minutes. Also, the redness of the bitemark on Terry's breast was similar in color to the redness of the marks on Terry's neck where she was strangled. Since both the marks on Terry's body were approximately the same color, they were inflicted the same time because healing does not occur after death. The court accepted my research and the match of the enhanced bitemark with Swinton's plaster models and Swinton was indicted in the fall of 1998.

Yet now I had to conclusively prove the rate at which bitemarks changed color. Over an approximate two-year period I performed approximately 100 bitemark tests on my arm and took photographs every minute to show how the bruise healed. I found that bitemarks heal very rapidly, with the extreme redness disappearing within 10-20 minutes. The bruise becomes much less distinct within sixty minutes and also disappears within 120 minutes. Therefore this method can be used to narrow the time at which a bitemark was inflicted relative to the death of the person bitten.

The plaster mold of Swinton's teeth taken in 1991 also had to admitted into evidence as Swinton's bite had changed from the removal of two teeth. This was complicated by the fact that forensic dentist who took the molds in 1991, Lester Luntz, died five years ago. Senior State's Attorney John Massameno argued that the State had photographs of the molds being made and a proven chain of custody of the molds. I also testified that, based on an examination of Swinton's teeth. the molds matched them. The molds were admitted as evidence.

The match of the bitemark with Swinton's teeth depended on the Lucis-enhanced images. Lucis was a new technology and the New Haven defense attorney Norman Pattis challenged the admissibility of Lucis-enhanced images. Massameno presented a successful argument that validation of evidence comes from qualified expert witnesses who do not necessarily know how the technology works. For example, an expert witness may use a copy machine to create a duplicate image and will testify that the copy is accurate. The expert witness does not have to know how the copier works. So Major Timothy Palmbach, Commanding Officer, Division of Scientific Services, who was also very experienced in using Lucis and had worked on the bitemark images, explained in laymen's terms how Lucis worked. He established that Lucis did not add anything to the image. Lucis shifts relative contrasts to make detail clearer. Lucis was the only image enhancement method used on the bitemark images.

Instead of using the usual technique of tracings of the teeth biting edges I used Photoshop to created a semi-transparent impression of the teeth models. This was placed electronically on top of the image of

the bitemark to clearly show the match. I identified 15 points of comparison, seven by the upper teeth and eight by the lower teeth. To the best of my knowledge, no one had reduced the opacity of the teeth model and superimposed them on a bitemark in a court case. This process is the new gold standard for forensic odontology, replacing the old method of hand tracing the incised edges of the teeth.

The combination of the Lucis-enhanced bitemark and the overlaid teeth marks was compelling evidence for the jury to convict. Swinton was convicted on March 22, 2001. He faces 60 years in prison at his sentencing scheduled for May 21. It is now believed that Swinton may be responsible for the deaths of 17 other women. A serial killer would still be at large if not for the efforts of Massameno, Palmbach, myself and all of the people that worked on this case.

My research on the healing process of bitemarks, the Lucis software and Photoshop are powerful tools that could be applied to other criminal investigations and open, unsolved, older cases provided that 1) the teeth molds of the subject exist and can be admitted as evidence, and 2) that there are images of the bruise marks that reveal teeth patterns when enhanced with Lucis.

Below are the original images of the bitemarks with the overlay of Swinton's teeth and the Lucis-enhanced images.

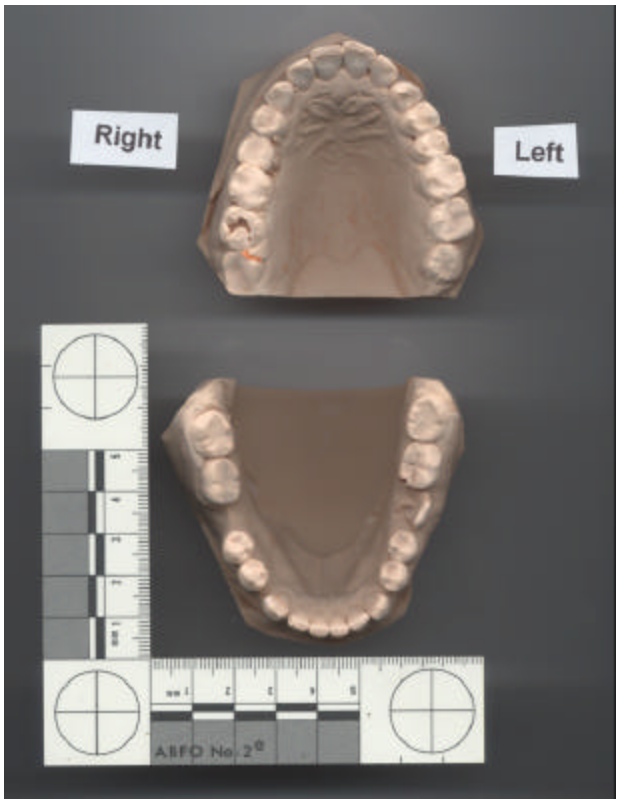

Figure 1. The plaster casting of Swinton's teeth.

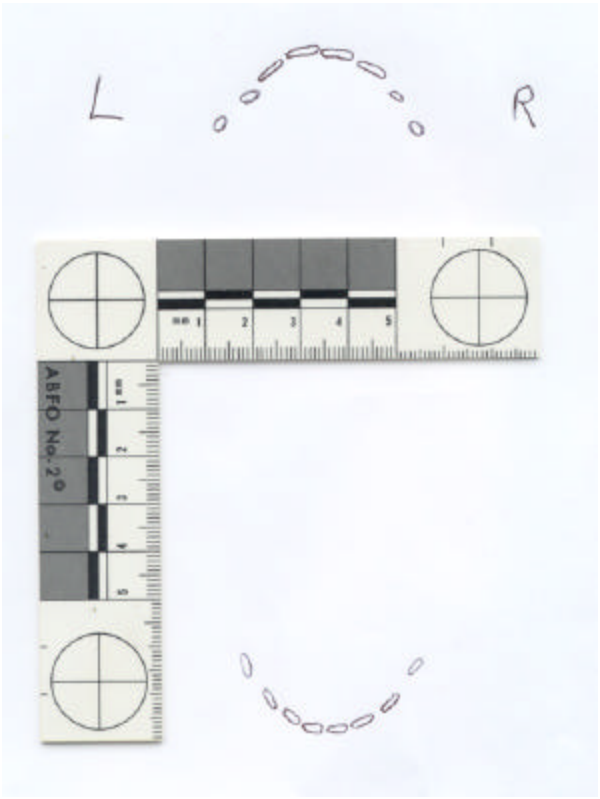

Figure 2. The tracing of the biting edges of Swinton's teeth.

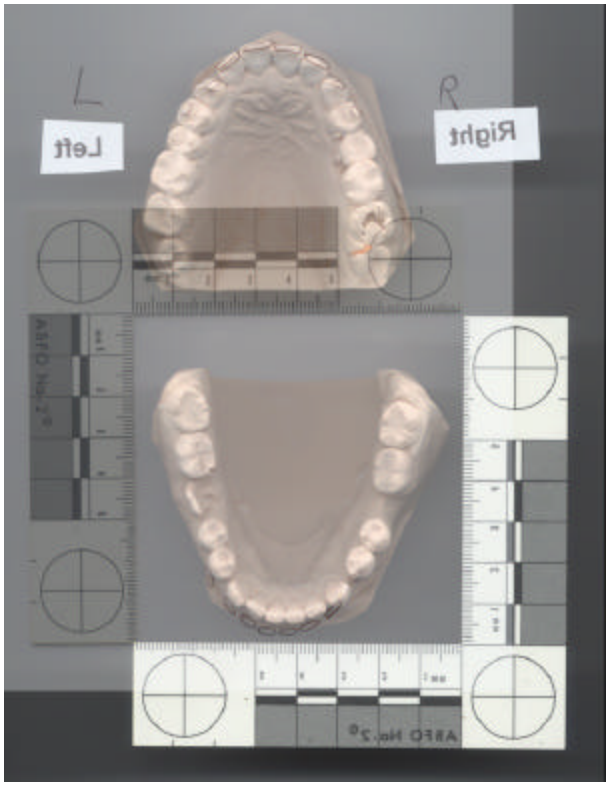

Figure 3 (left). The tracing of the biting edges of Swinton's teeth superimposed on the image of the casting.

Figure 4. The original image of the bitemark on the victim's breast.

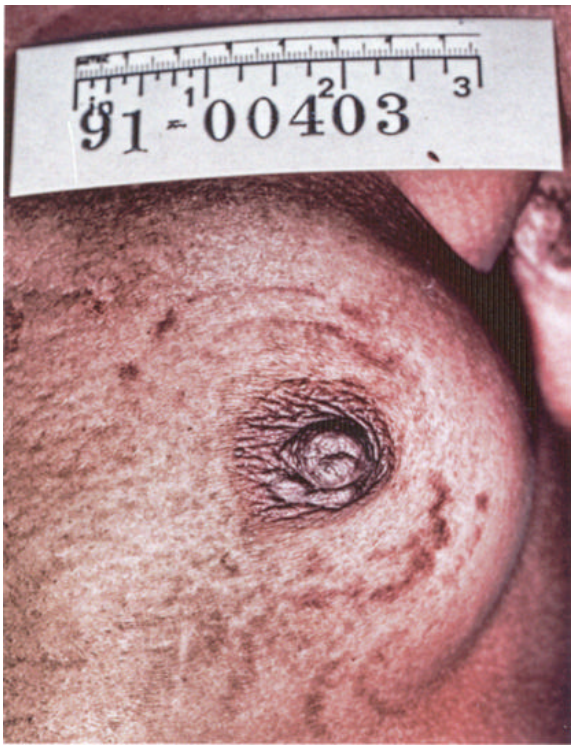

Figure 5. The Lucis-enhanced image of the bitemark reveals the patterns in the bruise more clearly.

Figure 6. A semi-transparent image of the mold of Swinton's upper teeth is superimposed upon the bitemark to demonstrate the match.

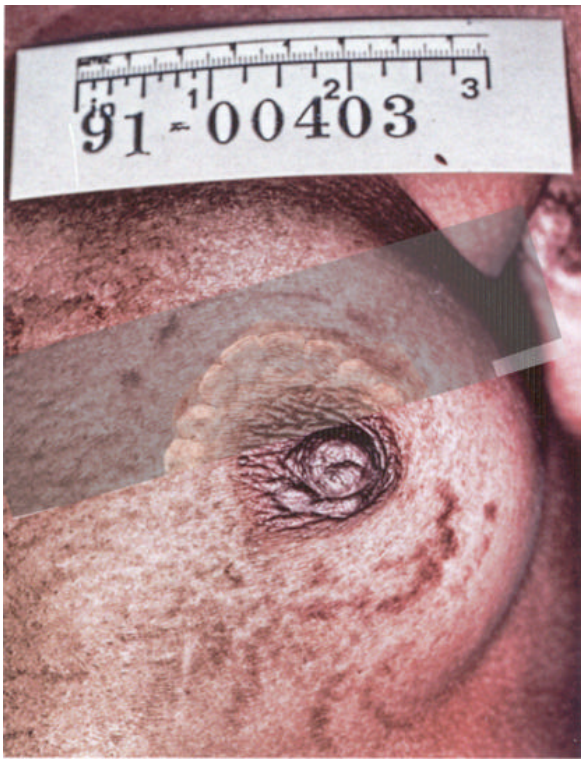

Figure 7. The semi-transparent upper teeth image is superimposed on the Lucis image. The matching characteristics are more clearly visible.

Figure 8 (left). The tracing of the cutting edges of Swinton's teeth is placed over the original image of the bitemark. This is the less effective, old method of matching teeth to a bitemark.

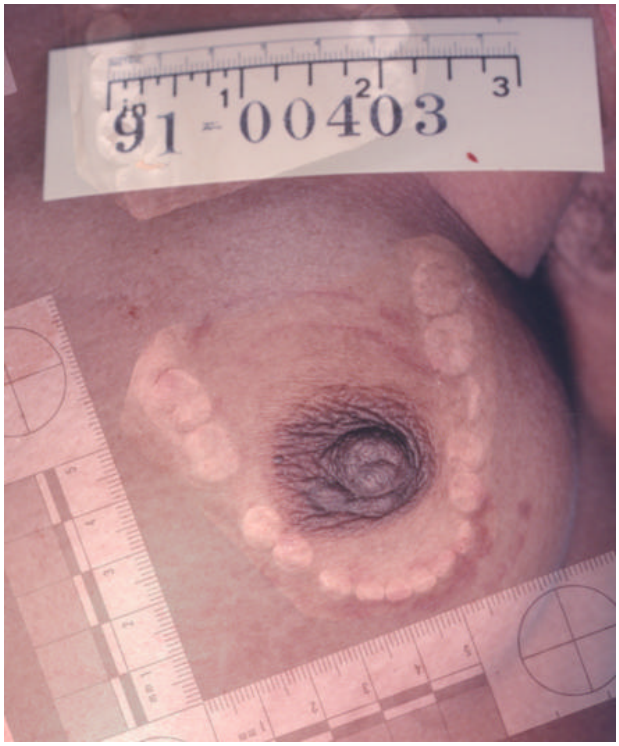

Figure 9. The semi-transparent image of Swinton's lower teeth has been superimposed on the original image to demonstrate matching characteristics.

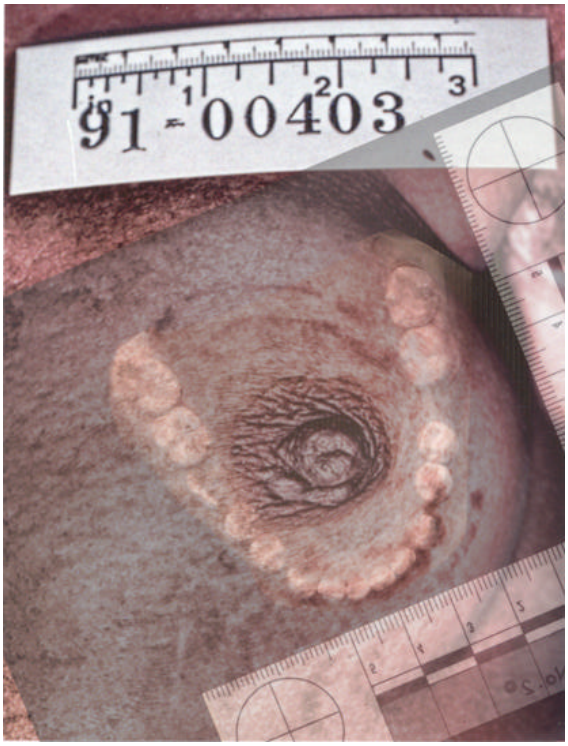

Figure 10. The semi-transparent image of Swinton's lower teeth has been superimposed on the Lucis-enhanced image to more clearly show the matching characteristics.