

## Loss of the Ear Cartilage from a Human Bite

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**Abstract:** The term of bite marks is defined as the trauma caused on the skin from the contact of the teeth with or without the contribution of the soft oral tissues (lips, tongue) and which depicts the form of particular oral structures. The use of bite mark evidence in criminal or abuse cases has been widely accepted by law enforcement agencies and courts for many years. Several historical data reveals the significance of the proper recognition and identification of bite marks since the 17th century. With the evolution of Forensic Odontology, a plethora of new tools and equipment can be used to positively identify an assailant through a bite mark on the victim's tissues. The current case report aims to present a victim's ear loss due to a human bite during a fight and with this occasion to refer to the up-to-date standard elements of human bite marks regarding the concurrent categorization, the frequencies of incidences according to anatomical area, sex and type of crime.

**Key words:** Facial bite mark, auricular bite, human bite mark categorization, frequencies, historical, Greece

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### INTRODUCTION

The term bite mark is used other loosely to describe a mark caused by the teeth alone or the teeth in combination with other mouth parts (Whittaker and MacDonald, 1989; Herschaft *et al.*, 2006). Bite marks can be found in flesh, foodstuffs and less frequently in a variety of other materials. The bite mark in flesh with which the forensic dentist is likely to be concerned are most frequently found on the body of the victim.

However, attack victims may attempt to defend themselves by biting their assailant. A bite mark may also be self-inflicted either deliberately or involuntarily for example by a hand being pressed against the victim's mouth to stifle a cry. Bite marks may be made in a variety of ways. They can result from direct pressure from the teeth, from tissue being pressed against the teeth by the tongue or teeth scraping over tissue. These types of wounds can occur singly or in combination.

Bite marks are therefore often complex injuries and their recognition and interpretation depend upon an understanding of the mechanisms involved. Bite mark analysis presupposes that there is a biting event that causes an injury of a tissue and that the effects can be carefully recorded for comparison to the teeth causing the disruption (Vale, 1996; Pretty and Sweet, 2000; Dorion,

2005; Herschaft *et al.*, 2006). From the inception of the scientific study of bite marks it has been assumed that teeth are unique and the comparison of an injury to a specific tooth could be considered similar to tool mark or ballistic analysis.

### HISTORICAL TRENDS

The first bite mark case in the United States was the famous Salem Witch Trials in 1692. Rev Burroughs who convicted and hanged used to bite his victims. During the trial his bite marks and of other people were compared to the victim's marks. The judges readily accepted the bite marks as evidence. The first known publication of a scientific paper discussing a human bite is indicated to have been a case report by Dr. Skrzeckes in 1874 concerning a bite infection. Probably, the most famous incident where human bite mark evidence led to a conviction was the case of the notorious serial killer, Ted Bundy.

Nobody really knows how many people Bundy killed between 1973 and 1978 but he was finally tied to the murder of Lisa Levy who he attacked in the Chi Omega Sorority house of Tallahassee's Florida State University through bites that he inflicted on her body. Forensic bite mark analysis revealed Bundy's highly irregular teeth left the impressions (Lotter, 2008). Another case concerns

Edmund Burke Police arrested Burke in 1998 for the murder of a 75 years old woman in Walpole, Mass. The woman was strangled, beaten and stabbed and there was a bite mark on her left breast. The probable cause for Burke's arrest was the findings of forensic odontologist Dr. Cowell Levine who was a prosecution witness in Prade's case. The killer later was identified by matching the DNA derived from the bite mark to a DNA profile to a variety of factors.

Skin is not a good medium for dental impressions it is liable to have a number of irregularities present before the imprint that could cause distortion. Also, bite marks can be altered through stretching, movement or a changing environment during and after the actual bite. Furthermore, the level of distortion tends to increase after the bite mark was made (Pretty and Sweet, 2001a). Bite mark analysis is also controversial because dental profiles are subject to change. The loss of teeth or the alteration of arch configuration through a variety of procedures is common in human populations (Dorion, 2005). Finally, the methodology behind analyzing bite mark is extremely variable because it depends upon the preference of the specific odontologist.

### CASE REPORT

In this case a bite mark injury is reported. This case report refers to an elder man who arrived in the Oral and Maxillofacial Surgery Clinic of the Aristotle University of Thessaloniki in 1997. The clinical examination revealed significant loss of the cartilage of the right auricle (Fig. 1) resulting in impaired hearing. The ear loss was a result of a fight during that time the attacker wrenched the ear part from the defender with his teeth. There were no other significant signs of fight except for the ear loss and some bruises and abrasions in the facial area. In this incidence no metric photographing was made with the use of millimeter scale A.B.F.O. N° 2 that is imposed by the Forensic dentistry so that the evaluation of the natural size of the traumatic damages is possible neither the other



Fig. 1: Photographic record of the victim frontal aspect (Courtesy of Stefanopoulos and Tarantzopoulou)

guidelines that are applied in such cases (impression, saliva swabs, tissue samples from the victim and dental record, history, photography, impressions, study casts, DNA sample, intraoral and extraoral examination). The lack of these procedures led into the incompetence of methods of comparing exemplars to bite marks (Sweet, 1995; Sweet and LeRoy, 1996). The certain facial bite injury is class IIIB because it concerns a deep avulsive injury exposing auricular cartilage (Lackmann *et al.*, 1992). Accurate photography is crucial to forensic investigation as a means of documenting evidence. Photographs should be taken with and without a scale.

The forensic dentist or investigator must decide what information the injury may contain, the extent of the injury and how best to photographically record it. Preserving the detail of the injury with photographs may involve a combination of color and black and white visible light photographs as well as the use of the non visible ultraviolet and infrared photographs. The photographer should develop a standard technique which includes orientation photographs showing where the injury occurred on the body. This protocol should include close-up photographs for detail and photographs placing the lighting source (flash and light guide) at different angles in relation to the injury (Wright and Golden, 1997).

Bite mark injuries in the face should be treated as typical lacerations that is primary closure may be permissible if the injury involves only soft tissues is seen early and is adequately cleansed. Prophylactic antibiotics have not been shown to significantly decrease the risk of infection following human bites. They are only indicated for immunodeficient patients and badly infected facial wounds.

Facial bites wounds are associated with low infection rates approximately 6%. The final cosmetic result is the most significant factor involving surgical treatment of these wounds (Stefanopoulos and Tarantzopoulou, 2005; Callahan, 1980; Earley and Barsley, 1984). The general guidelines involving the management of a facial bite mark injuries involve the following steps. At first the injury is rinsed and the depth is carefully inspected, prior to suturing, in order to establish a possible damage of structures such as the facial nerve.

Also, in severe bites especially in children there is a significant possibility of bone fracture. The edges are refreshed and the injury's edges are sutured in layers. Finally, antibiotics and tetanus prophylaxis is prescribed, if it is necessary.

### CATEGORIZATION OF BITE MARKS-STATISTICS

Human bites tend to occur on the face with relative high frequency second only to that of human bites of the upper extremity. These injuries are also commonly

associated with aggressive behavior most often involving prominent locations of the face namely the ears, nose and lips (Donkor and Bankas, 1997). Bite marks can be categorized as following:

**Adult criminal assaults**

**Sexual nature:**

- Violent
- Voluntary
- Homosexual
- Heterosexual

**Non-sexual nature:**

- Quarrels-fights
- Defense against all kind of aggressive behavior
- Self-injury

**Child abuse**

**Repeated cases of assault:**

- Healed wounds
- Healing wounds
- Recent wounds

**Single assault:**

- New wounds only
- Adult assaulter
- Child assaulter

Bite marks can be found on both victims and assaulters. In mortal combat situations such as the violence associated with life and death struggles between assailants and victims the teeth are often used as a weapon. Indeed, using the teeth to inflict serious injury on an attacker may be the only available defensive method for a victim.

Alternatively, it is well known that assailants in sexual attacks including sexual homicide, rape and child sexual abuse often bite their victims as an expression of dominance, rage and animalistic behavior (Vale and Noguchi, 1983; American Board of Forensic Odontology (ABFO, 2000); Herschaft *et al.*, 2006).

The frequency of occurrence of bite injuries at specific locations varies with the type of crime and sex and age of the victim (Table 1). According to the American Society of Forensic Odontology (Herschaft *et al.*, 2006) the bite mark incidence by anatomical area and type of crime is as follows (Table 2). According to the literature (Pretty and Sweet, 2001b) the possibility of two persons having the exact same bite marks is 1-2.5 billion which indicates that it is practically

Table 1: Bite mark area according to type of crime and sex of assaulter/victim

	Sexual			
	Heterosexual		Homosexual	
Non-sexual	Victim female	Victim male	Victim female	Victim male
Head	Breast	Abdomen	No. case reported	Upper back
Limps	Thigh	Chest	-	Armpit
Chest	Neck	Arm	-	Shoulder
Breast	Shoulder	Genitalia	-	Penis
-	Arm	-	-	Scrotum
-	Hips	-	-	Chest
-	Pubic area	-	-	Arm
-	-	-	-	Posterior area

(Herschaft *et al.*, 2006)

Table 2: Incidence of bite marks according to anatomical area and type of crime (the incidence of bite marks in the ear is mentioned earlier)

Total incidence	Sexual crimes					
	%	Breast	%	Homicide	%	Child abuse
Arm	22.4	18.6	Arm	24.3	Arm	28.6
Legs	12.1	15.9	Legs	14.3	Legs	18.9
Breast	16.7	13.3	Breast	12.7	Back	8.5
Face	10.7	9.0	Face	10.6	Buttocks	7.3

impossible. This is due to the fact that they have class characteristics and individual characteristics. The first term refers to characteristics commonly found in all teeth (number, shape, size, etc.,) while the second to deviations from the general characteristics such as tooth rotations, displacements, fractures, missing teeth, germination, microdontia, supernumeral cusps etc (Rawson *et al.*, 1984).

Furthermore, other factors such as the extent of the trauma, the area and the characteristics of the skin bitten and the clothing and covering of the bitten surface affect the depiction of the special characteristics mentioned above (Dorion, 2005). Additionally to that there are certain variations of the representative bite mark including the following:

- Additional characteristics:
  - Central echymotic area
  - Linear abrasions, bruise, striations, scratch marks
  - Drag mark, lingual markings
  - Radial sunburst pattern
  - Double bite or bite within a bite
  - Characteristic patterns of clothes and objects
  - Peripheral echymosis
- Partial bite marks:
  - Indistinct-faded
  - Superimposed or multiple bites
  - Avulsive Bites (American Board of Forensic Odontology (ABFO, 2000) Dorion, 2005)

## DISCUSSION

In the United States, bite mark analysis has been judicially accepted since 1954 (*Doyle v. State*). The identification of the perpetrator has been instrumental in criminal investigations of homicide, sexual assault and child abuse cases (Pretty and Sweet, 2000). The majority of bite mark cases involve photographs of bite marks on skin and other substrates that are later compared with dental evidence obtained from suspects (Kraus, 1984). This comparative analysis primarily uses superimposition of these evidence samples. Therefore, the dimensional accuracy and sizing of both evidence images are of utmost importance.

It is fundamental to follow the acceptable forensic protocols for the photographic capture of crime scene evidence which demands a linear scale to be placed next to the evidence sample to make an accurate comparison (Hyzer and Krauss, 1988). This known dimensional reference allows the examiner to compare 1:1 pictures of the evidence materials using software programmes like Adobe photoshop.

The presence of photographic distortion is evidenced by the scale's incremental lines appearing nonparallel and not uniformly shaped (Bernstein, 1985). The overall incidence of bite marks in the ears is 2.7%. The percentage of ear bite wounds caused in sexual crimes is 1.6%, in homicides 2.6% and in child abuse is 4.3%. As far as the sex is concerned bite wounds in the ear occur on females at 2.4% of the total incidences of bite marks and on males at 2.1% (Herschaf *et al.*, 2006).

In these certain types of bite marks it is not possible to say exactly which tooth has caused each element of the bite.

The injuries are usually caused by assailants who tend to bite people and the most aggressive ones bite tissues until they are bitten off. Such bites can be very difficult to interpret because the tissue is usually removed by a combination of biting and tearing and it is seldom easy to relate individual parts of the mark to individual teeth.

The identification of the biter from the marks on the remaining part of the ear is unlikely. The possibility for a positive identification increases if the part of the ear which has been removed is found by the police, in cases of a fight like the present one. The satisfactory outcome in a positive recognition is usually achieved only when the exact mechanism by which the teeth of the accused had caused the bite is determined (Whittaker and MacDonald, 1989).

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