Bite marks

DR Sowmya GV
3rd year Lecture
IDS

- *Forensic is derived from the Latin word forum, which means public square in an ancient Rome city used for judicial & other business*

- *Forensic odontology is defined as "a branch of dentistry which deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of dental findings in the interest of the dentist".*

  -Keiser-Nielsen

  (1970)

Definition

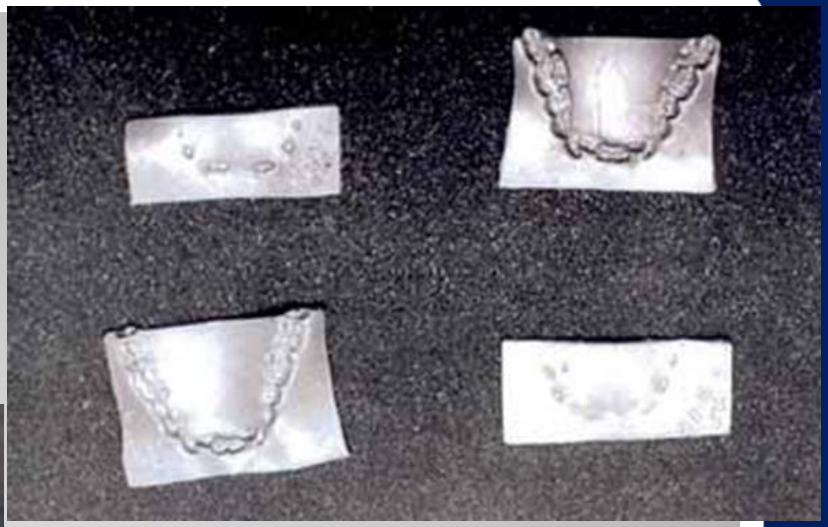
- *By Mac Donald) - 'a mark caused by the teeth either alone or in combination with other mouth parts.' Bite marks may be caused by humans or animals; they may be on the tissue, food items or other objects.*

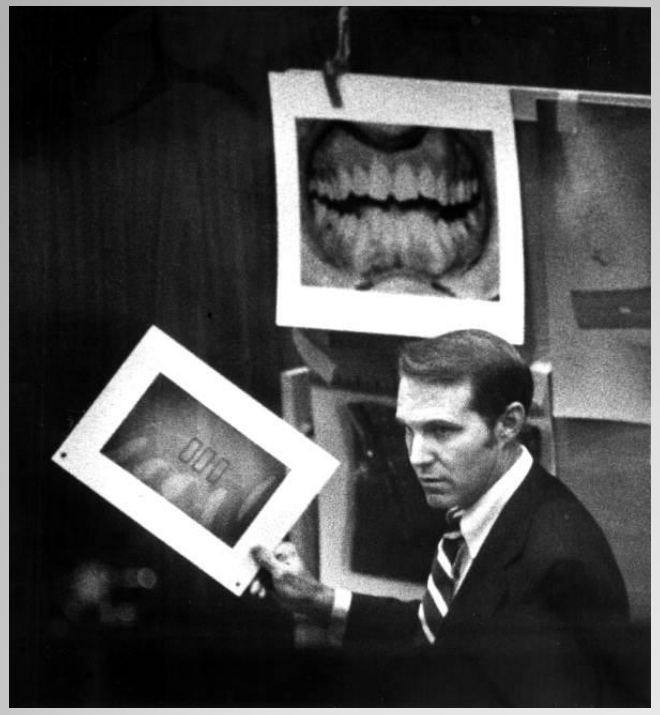
- Ted Bundy, was an American serial killer who murdered numerous young women between 1974 and 1978.
- He confessed to 30 murders, however the total amount of victims remains unknown.
- He would bludgeon his victims, then strangle them to death.
- **He was engaged in rape and necrophilia.**

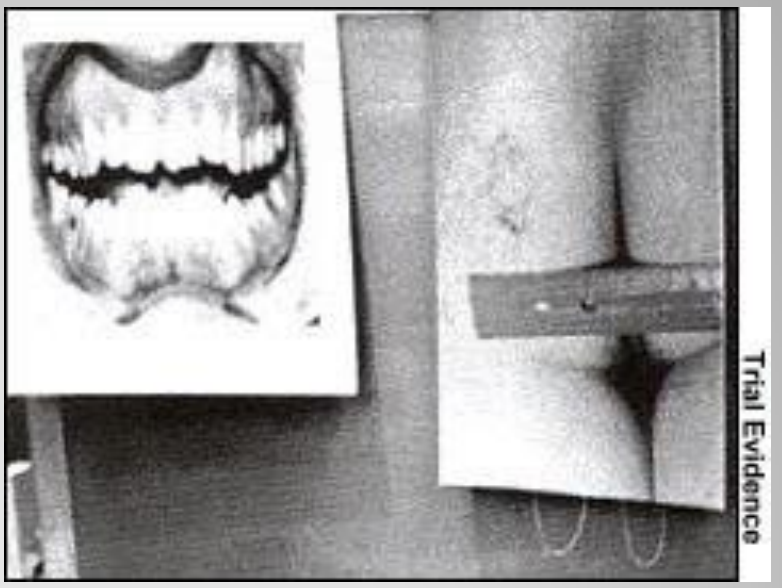
State of Florida v. Ted Bundy


AP/CORBIS


Levy
Bowman






Trial Evidence

IMPORTANCE OF BITE MARK

1. *Forensic dentist play important role in crime investigations and Bite marks is an important aspect of Forensic Odontology which contribute justice in the court of law.*

2. *One of the interesting challenges in forensic dentistry is the recognition, recovery and analysis of bite mark.*

3.Bite marks in forensic dentistry plays a major role in identification of those individuals, who cannot be identified visually or by other means.

4.Bite mark injuries can be caused by both human and animal,among this animal bite injuries are more common.

5. *Animal bite marks may be observed post mortem when the body has not been discovered quickly.*

6. *Since it can be confused with anti-mortem trauma or human bite, so it is necessary for a forensic dentist to identify correctly human or non human (animal)bite marks to save a innocent person.*

7. *So it is very necessary for a forensic dentist to have a knowledge of animal bite mark and its anatomy to differentiate it from human bite mark.*

8."Teeth are tools and a tooth mark is like a tool mark"

9.Bite mark varies from person to person from species to species.

10.Even though two identical twins are similar in every aspect but they are not dentally identical.

Difference between human and animal bite mark

- *Outline*
- *Shape of teeth*
- *Location*

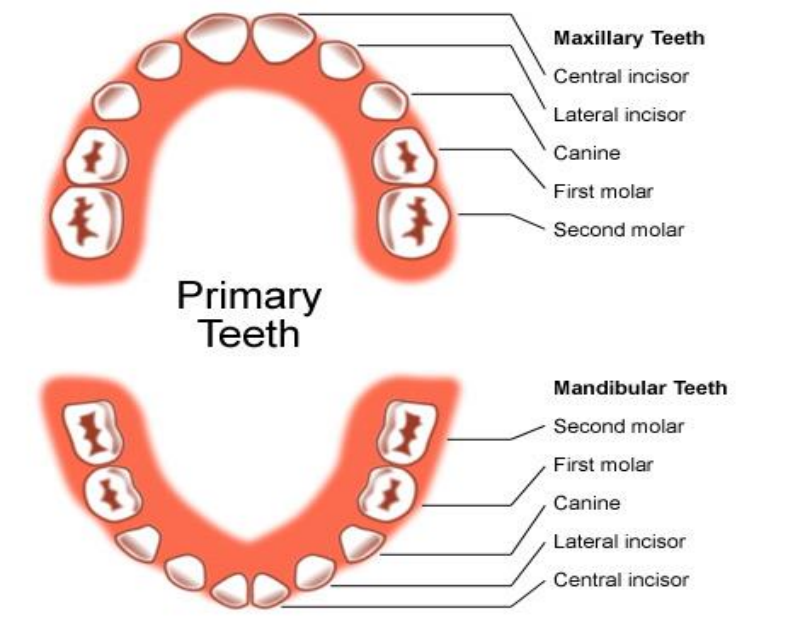
Teeth Basics

- *Approximately 32 teeth in adult mouth*
- *Four types of teeth:*
  - *Molars*
  - *Premolars*
  - *Canine*
  - *Incisors*
- *Teeth differ in:*
  - *Size*
  - *Shape*
  - *Root type*

Types of teeth.
Left to right: Incisor, Canine, Premolar, molar.

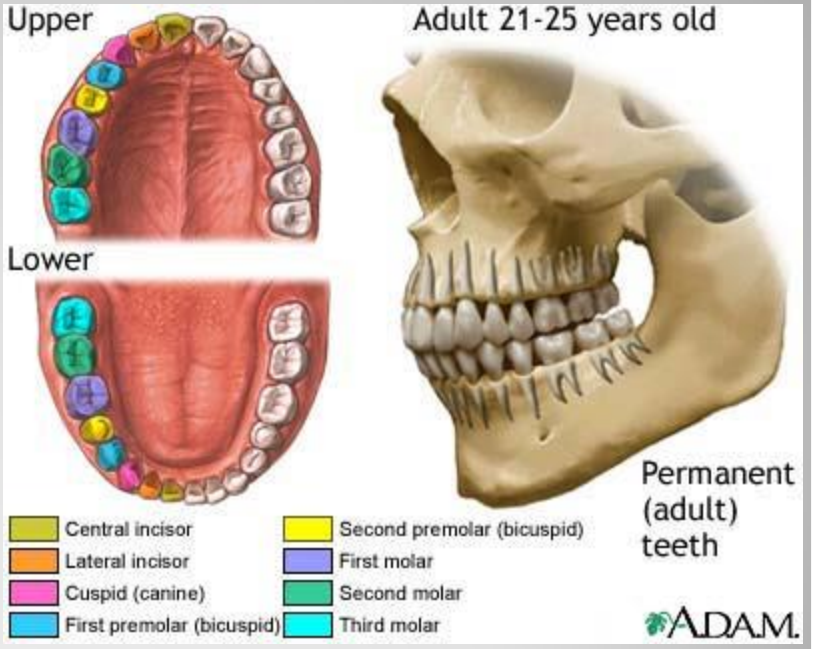
- Primary teeth sprout from milk buds and are temporary. Once they fall out, permanent teeth as seen on the other side appear.

Childhood



- Permanent adult teeth come in when primary teeth fall out; they are permanent because they establish roots inside the gums. Third molar come in around the mid teenage years.

Adulthood

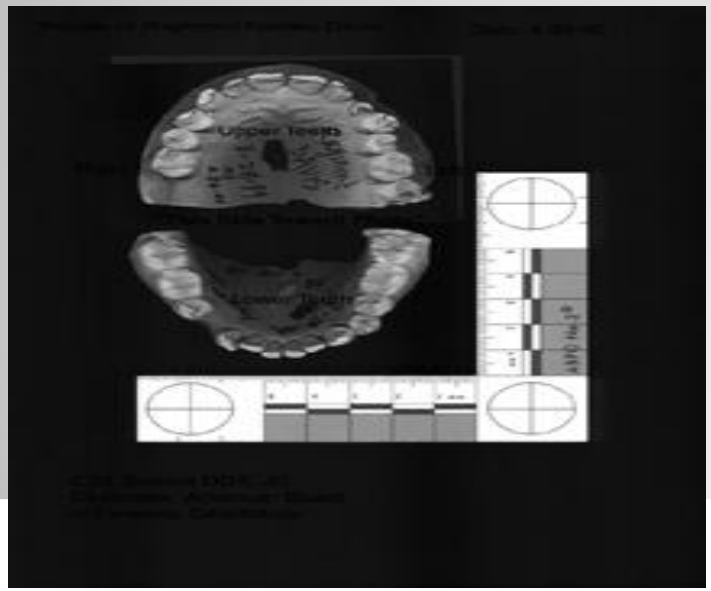


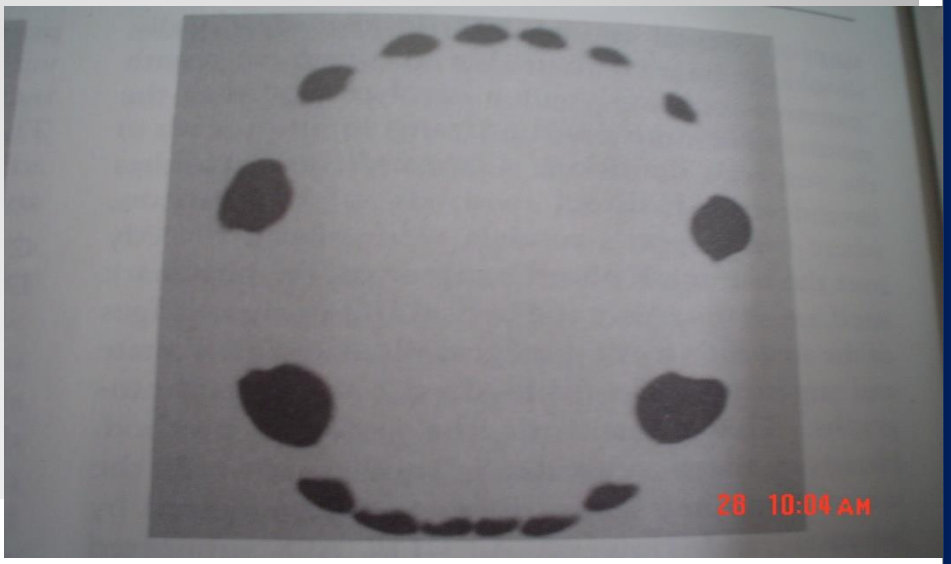
Teeth through the years

COMPARISION OF HUMAN AND NON HUMAN BITE MARK

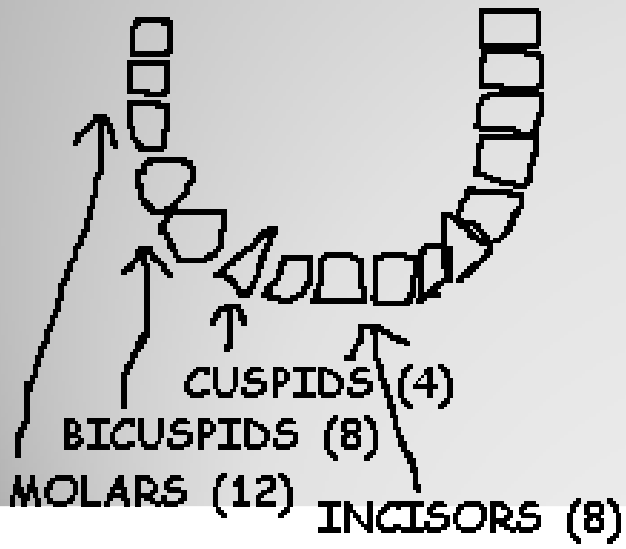
1.*Human Bite mark consist of two "U"shaped arches which are separated at their bases by an open space.*

1.*Bite mark of animal is narrower in anterior aspect and is "v" shaped and elongated in posterior aspect.*





2.*Human bite mark have broad central and narrow lateral incisor which are blunt.*



2 *Animal bite mark have broad lateral incisor and narrow central incisor with sharper & deeper canine.*

3.Human bitemark present on abdomen, nipple, thigh, back & shoulder.

3.Animal bite mark present on exposed skin surfaces.

Types of Bites

- A **CLEAR** impression means that there was **SIGNIFICANT** pressure;
- **obvious** bite signifies **medium** pressure
- **NOTICEABLE** impression means that the biter used **VIOLENT** pressure to bite down.

Classification

- *1. Cameron & Sim's classification*

  Based on type of :agents

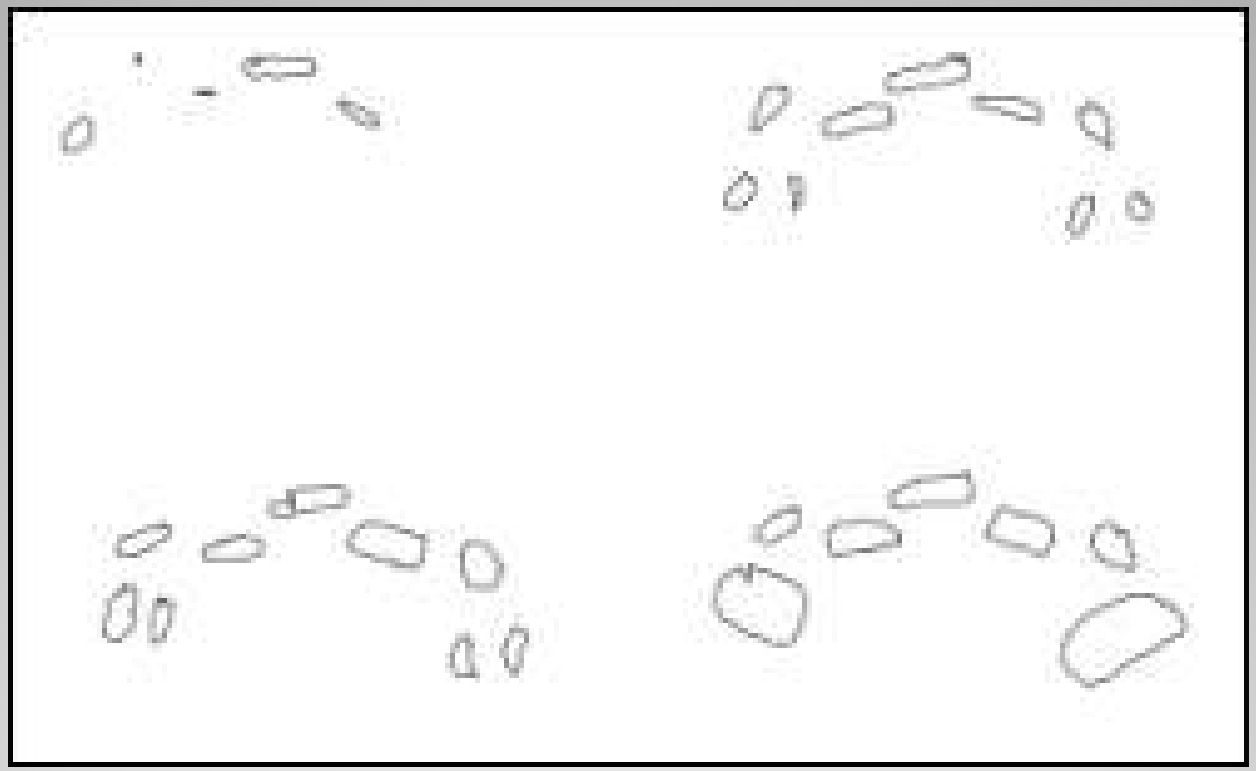
  :materials

- *2. Mac Donald's classification*
  - *Tooth pressure marks*
  - *Tongue pressure marks*
  - *Tooth scrape marks*

- Tooth pressure marks-tissue-direct application of pressure by teeth. Eg- incisal/occlusal surfaces
- Tongue pressure marks- sufficient amount of tissue in mouth-presses against rigid areas- lingual surface of teeth & palatal rugae

-marks left on skin- Suckling

- Tooth scrape marks- scraping of teeth across bitten material. caused by ant teeth, scratches & superficial abrasion



Outlines of the same set of teeth. The different perimeter shapes depend on how far the teeth are pressed into the test substrate.

- *3. Webster's classification - Causing fracture of food stuff*
  - *Type I- on limited depth of tooth penetration. eg- hard chocolate*
  - *Type II-considerable tooth penetration. eg- apple & other firm fruits*
  - *Type III-complete tooth penetration. eg cheese*

1. *Non-criminal – eg. lovebites*
2. *Criminal –*
   - *Offensive – upon the victim by assailant*
   - *Defensive – upon assailant by victim*

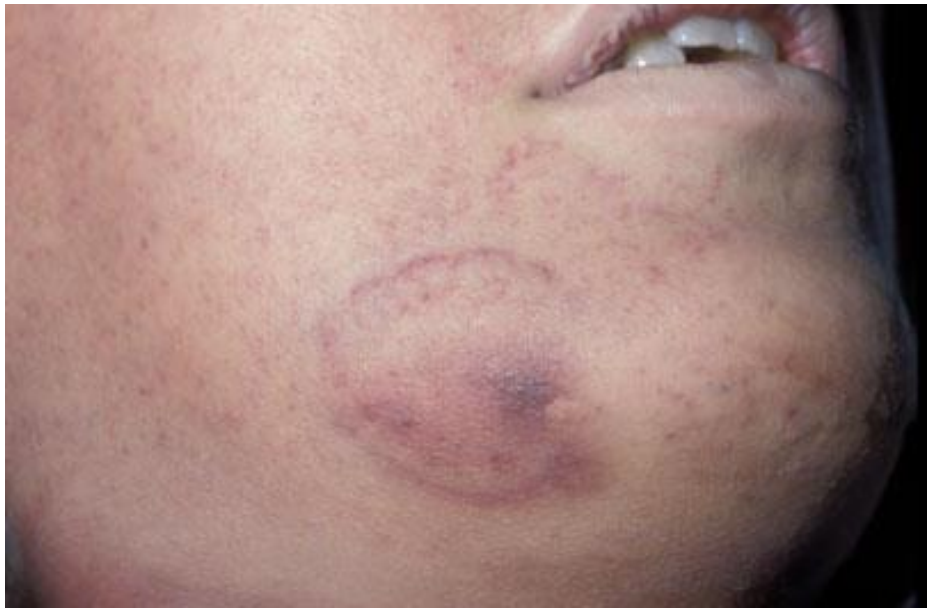
Based on manner of causation

1. *Sadistic / Sexual bite*
2. *Aggressive bite*
3. *Most aggressive bite – involves ears, nose etc.*

Clinical classification- by Guftafson 1996

- *Haemorrhage –small bleeding spot.*
- *Abrasion –undamaging mark on skin by pressure.*
- *Contusion-ruptured blood vessel.*
- *Laceration -punctured or torn skin.*
- *Incision -neat puncture of skin.*
- *Avulsion –removal of skin*
- *Artifact –bitten pieces of body*

By degrees of Impression by Shashikala et al in 2003

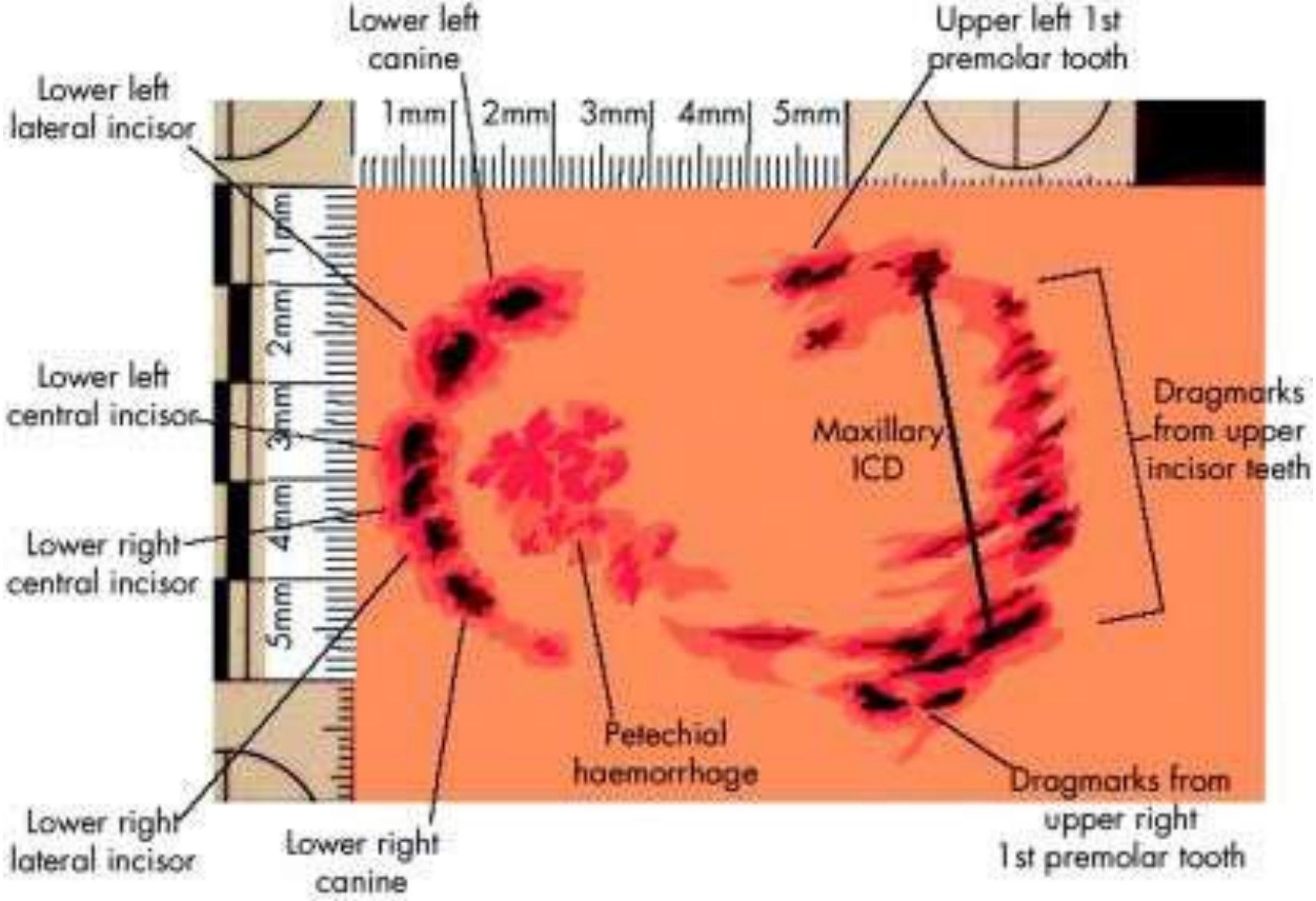


1. *Sexually oriented bites*
2. *Child abuse cases*
3. *Self inflicted bite marks – eg. Mentally retarted and psychological pts. Usually seen on forearm.*

Other classification

Characteristics of bite marks

- *Gross- elliptical or circular*
- *Appearance -U shaped with space between & central area of bruising seen within marks due to pressure from teeth.*
- *Class- differentiate between centrals, laterals , canine, premolars, molars.*
- *Individual- missing, fractured teeth, malformations.*


Lower left canine
Upper left 1st premolar tooth
Lower left lateral incisor
1mm
2mm
3mm
4mm
5mm
Lower left central incisor
Lower right central incisor
Maxillary ICD
Dragmarks from upper incisor teeth
Petechial haemorrhage
Dragmarks from upper right 1st premolar tooth
Lower right lateral incisor
Lower right canine

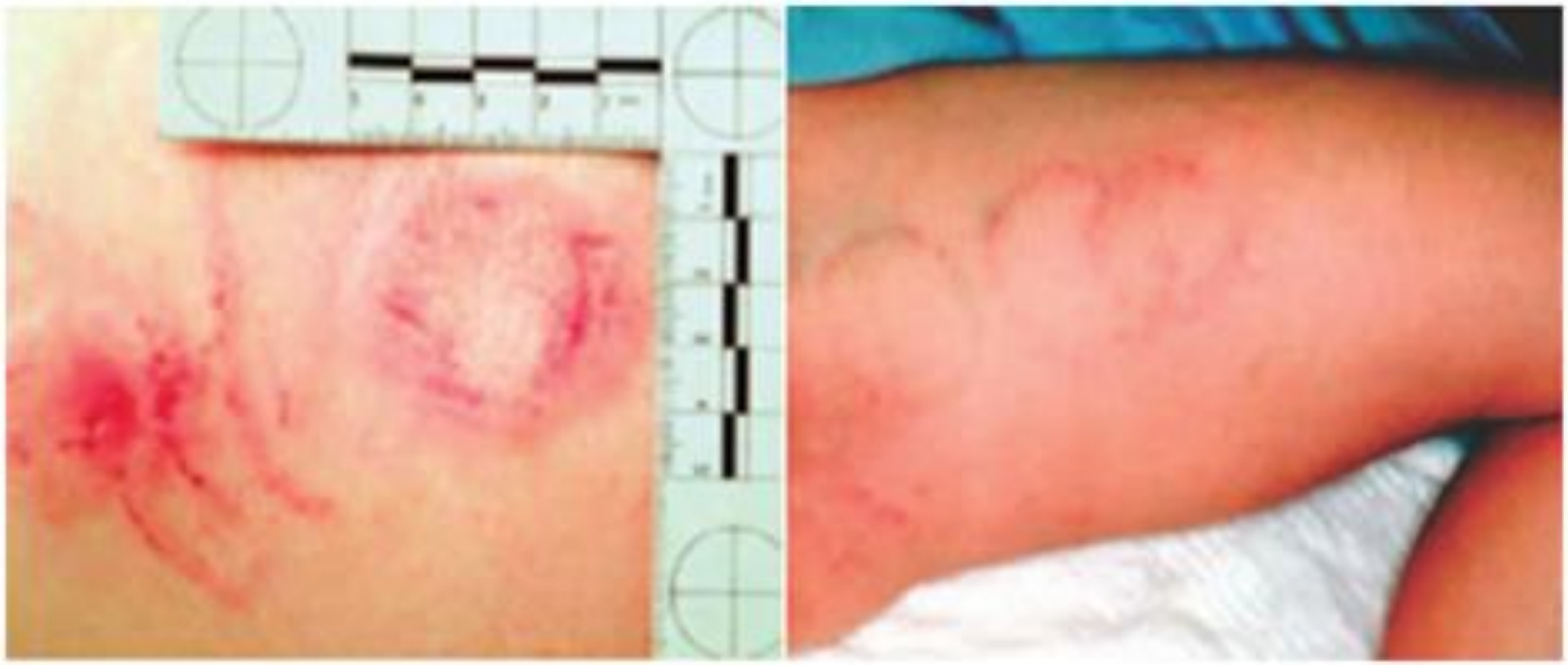


Fig. 1& 2 : Bite-mark consisted of an elliptical pattern of marks from individual teeth around a perimeter of abrasions and contusions

1. *Site variation*
2. *Curvature of the surface*
3. *Dragging during biting process*
4. *Structure and vascularity of the tissue*
5. *Time dependent changes*
6. *Medications*

Factors affecting Bitemarks

- *Type of tissue*
- *Age*
- *Sex*
- *Medical status*
- *Time*
- *Location on the body*
- *Clothing*
- *Distortion - primary & secondary*

Others

1. *Description of bitemarks*
2. *Collection of evidence from the victim*
3. *Collection of evidence from the victim*
4. *Bite marks comparison*

Steps to deal with Bitemarks

- *Demographic details – dental charting*
- *Location, skin*
- *Shape*
- *Color & size*
- *Type*

1. Description

- *Photography*
- *Collection of saliva swab*

2. Data collection of victim

Evidence collection from bite site

Photographic documentation of bite- Camera at 90° (perpendicular) to the injury

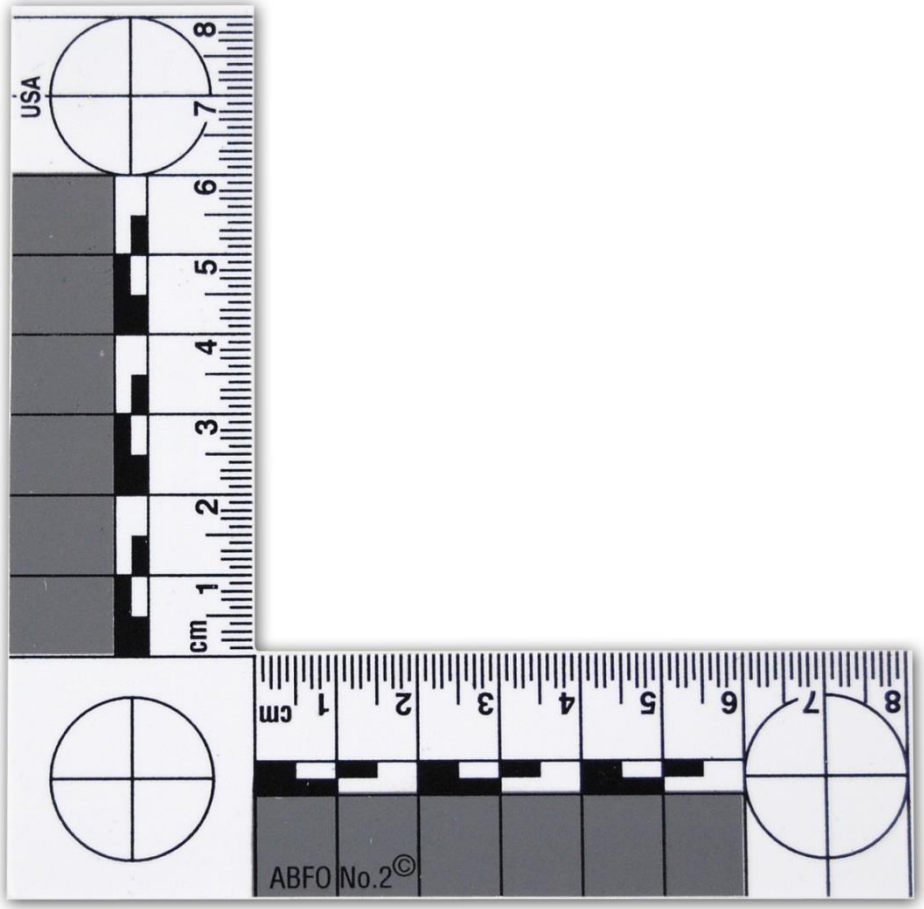
site-conventional photography.

-color print & black & white photographs.

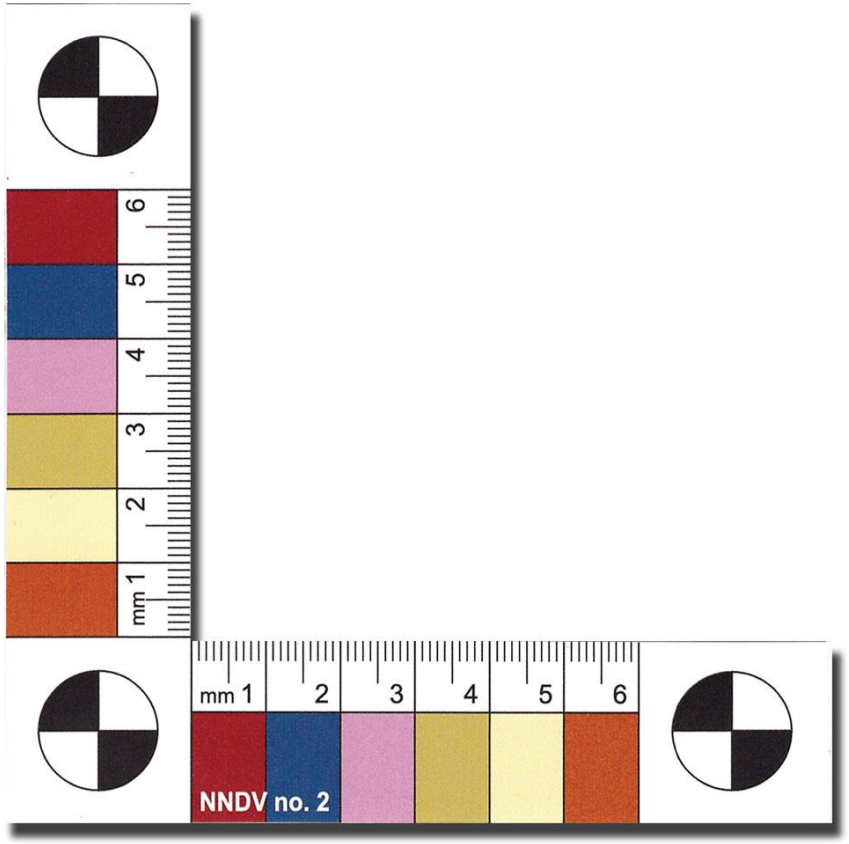
-video or digital imaging.

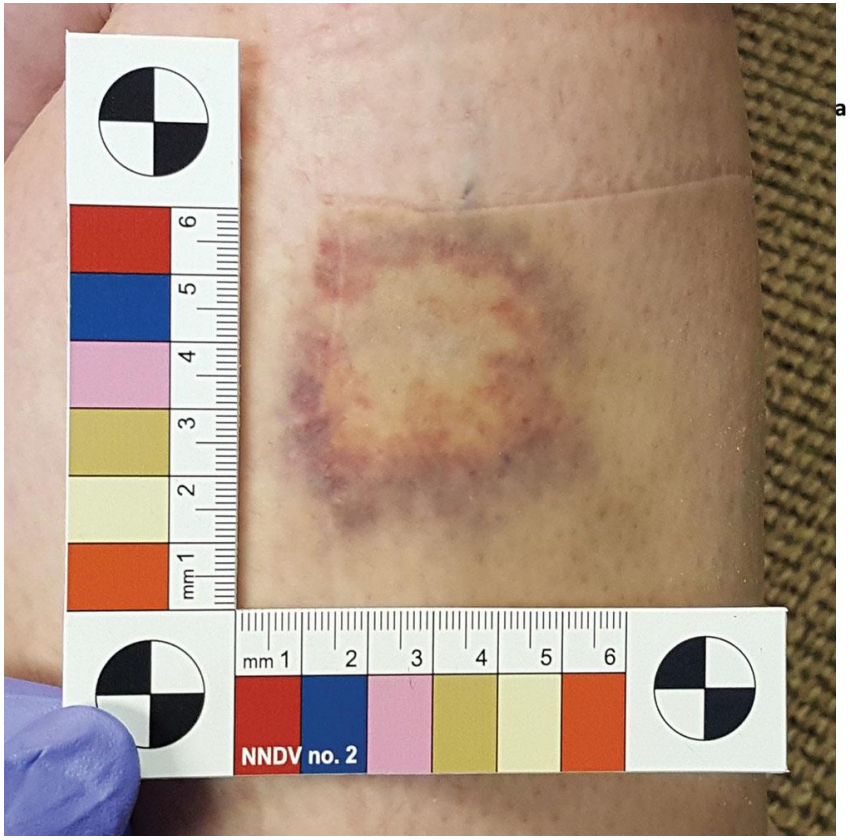
lighting- light source perpendicular to bite site

- light source parallel to bite site

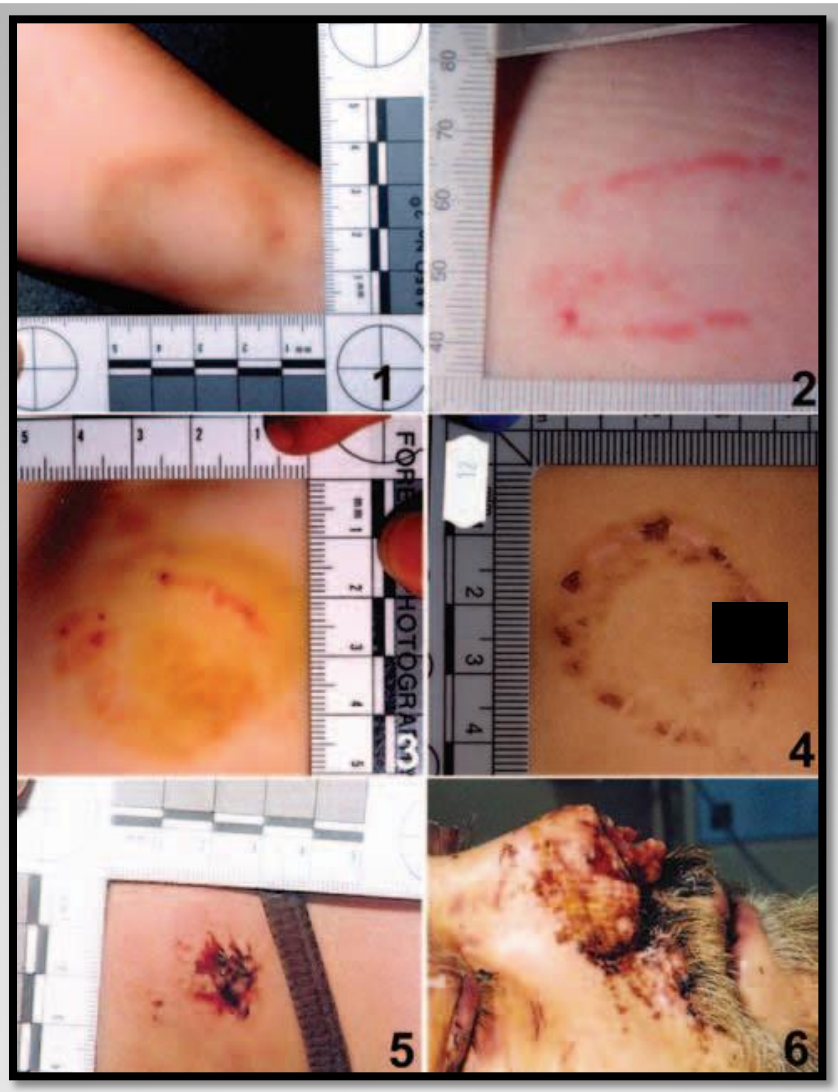


ABFO no.2 scale



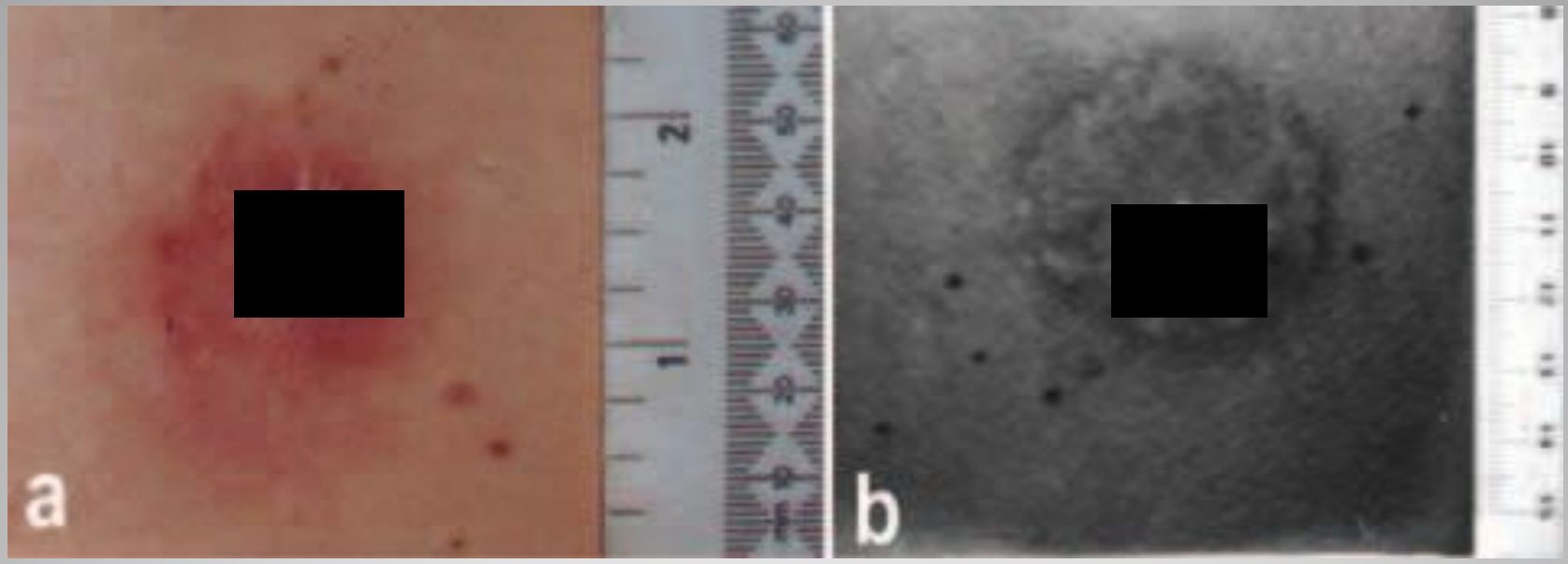


NNDV colorimetric scale



To do....

Not to do....



Example of UV photography on a bitemark some 8 weeks after assault: (a) injury photographed at presentation, living victim reports being bitten some two months earlier; (b) under UV conditions unique features of the dentition can be visualized.

Bitemark on non-human substrate, perishable items. Bites such as this should be carefully photographed, swabbed and then an impression should be taken to allow a 'docking' analysis to be conducted

Saliva swab

- Genotypic identification of oral streptococci
- one year later and found that their genotypes-same

a. Kit- including two swabs (for skin only, buccal suspect swabs require only one), gloves, card drying rack, evidence stickers, sealable plastic bag, documentation and evidence envelope
b. dried prior to placement in sealed evidence bag. Drying is a crucial stage and can take up to 30

- *Photography*
- *Bite mark analysis*

3. Examination of suspect

Impression of bite site

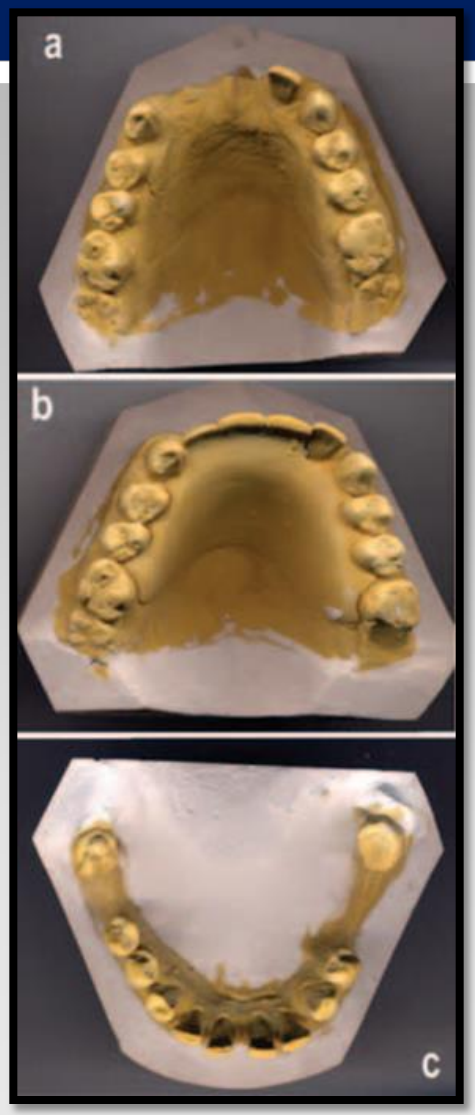
- ***Material of choice-*** ***poly vinyl siloxane.***

- ***Impression should be reinforced with dental stone or self cure acrylic or impression compound to prevent against dimensional change.***

Impression materials used in the collection of bitemark evidence: (a) impression materials including two grades (light and medium body) of poly–vinyl siloxanes and one of alginate; (b) stock impression trays such as these are appropriate for bitemark evidence collection.

- *Tissue specimen.*
- *Resection of tissue specimen should follow all other evidence collecting procedures.*

- *Tissue fixative.*
- *10% formalin commonly used.*

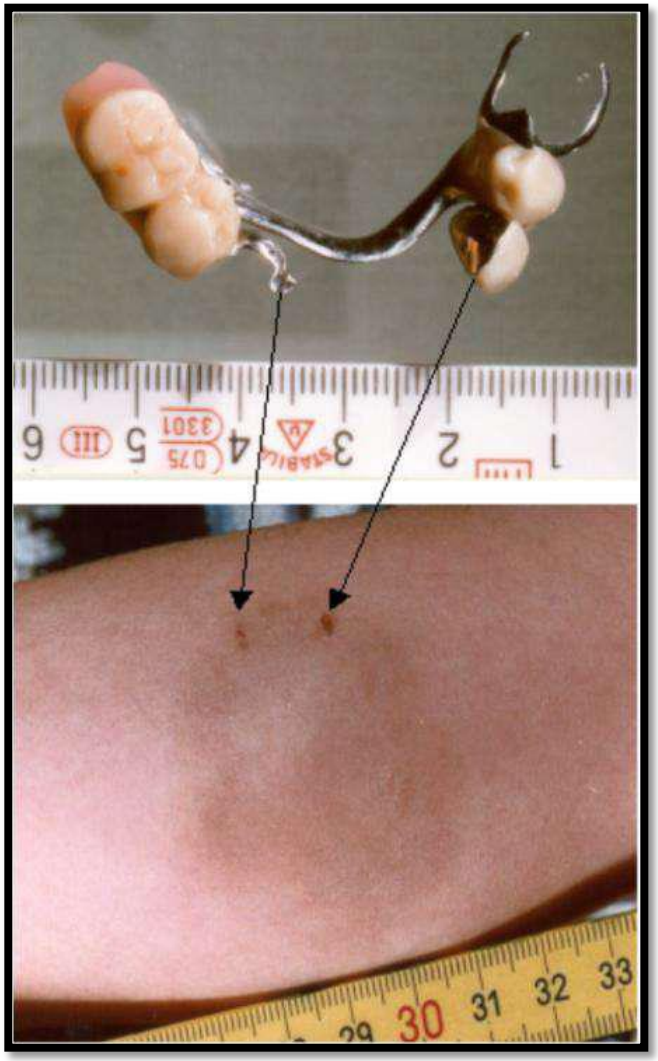


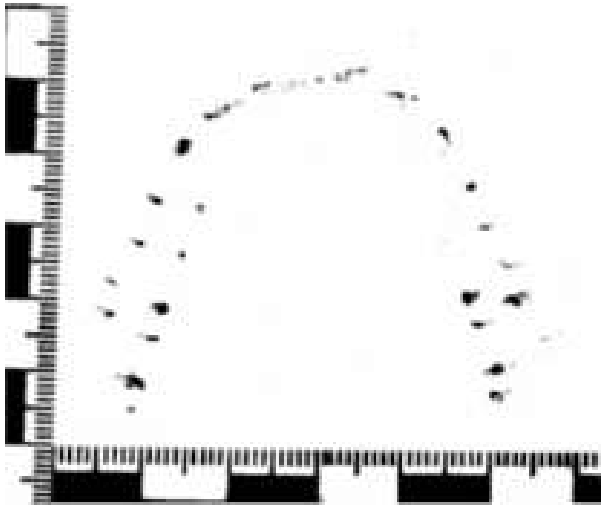
Example of stone casts produced from a bitemark suspect: (a) cast model of suspect's maxillary arch without dental prosthesis in place; (b) cast model of suspect's maxillary arch with partial denture in place; (c) cast model of suspect's mandibular arch.

Example of a wax bite obtained from a bitemark suspect

- *By class characteristics*
- *By individual characteristics*

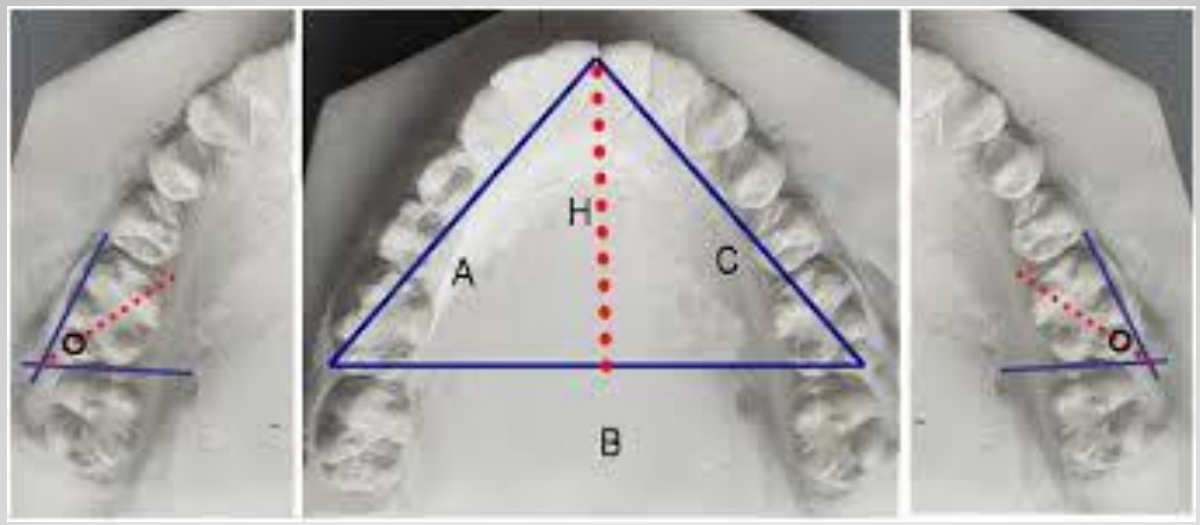
4. Comparison and identification of bitemarks



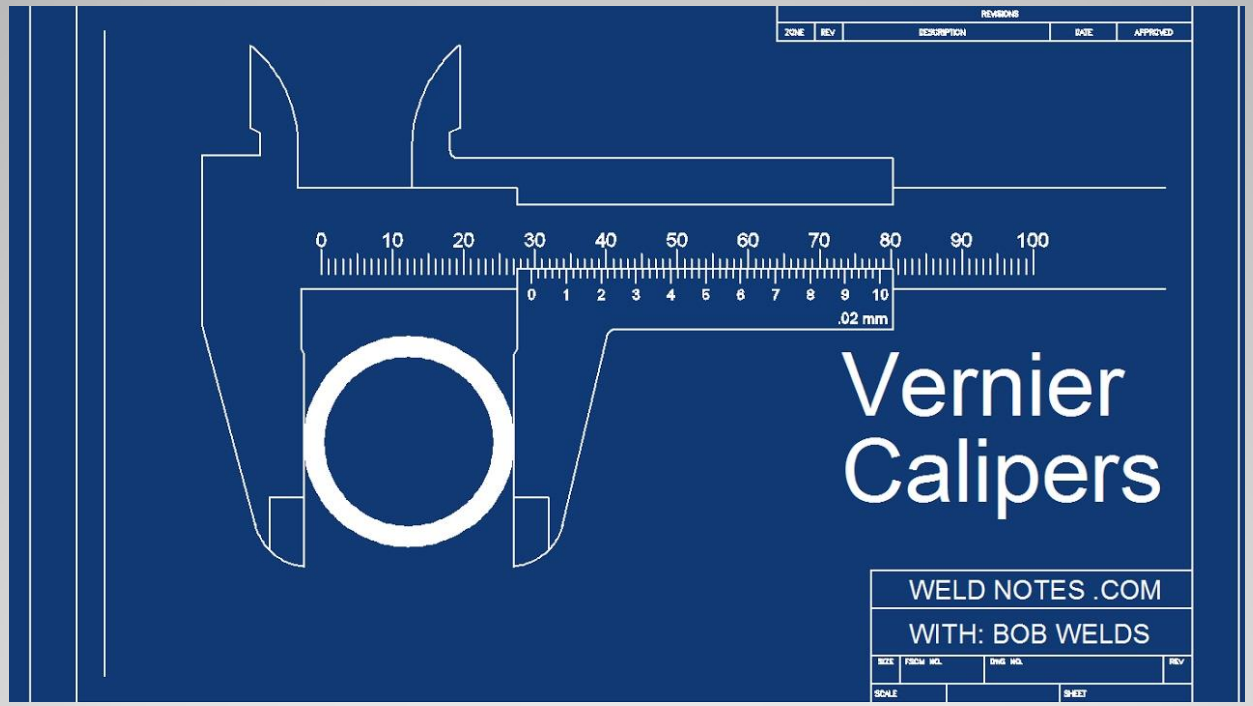


Analysis and comparison of bite marks evidence

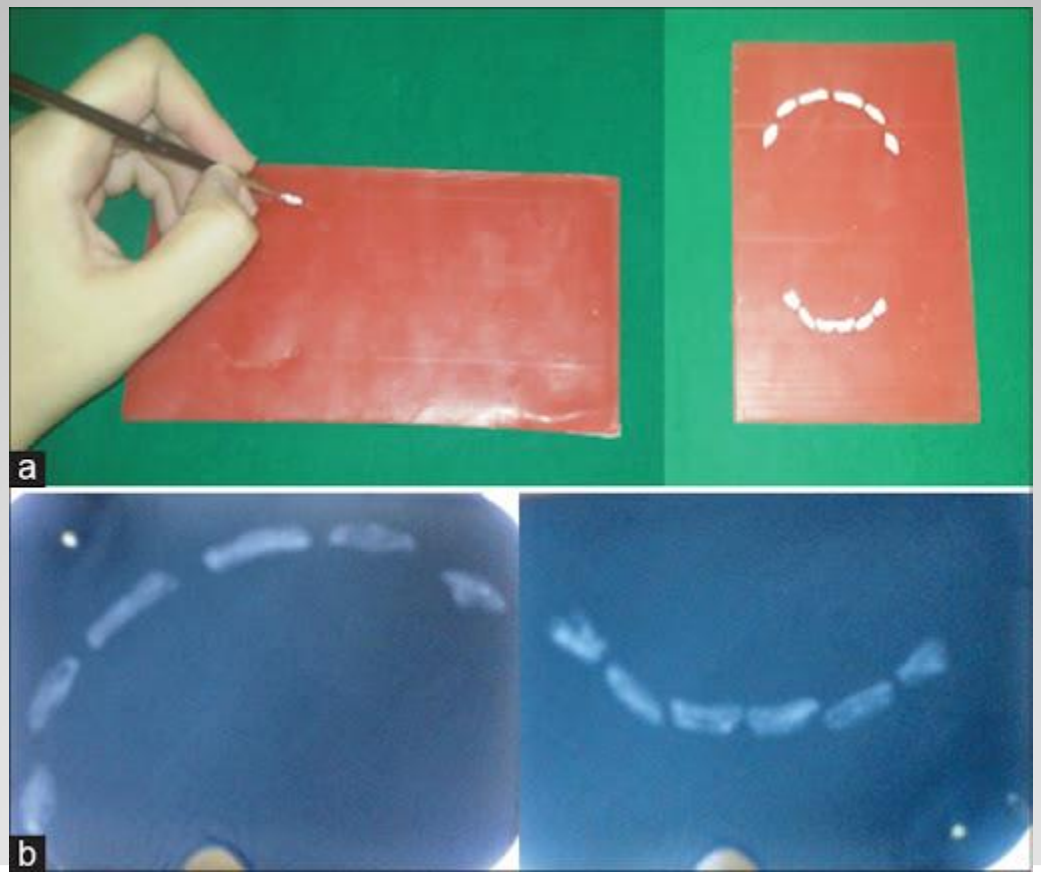
- *Odontometric triangle method*



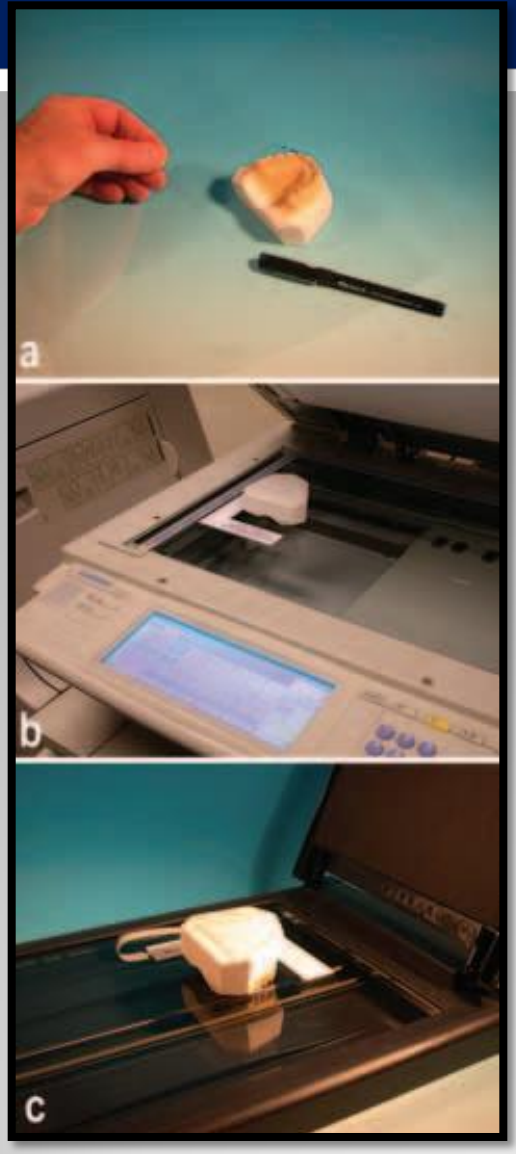
- *Metric analysis*

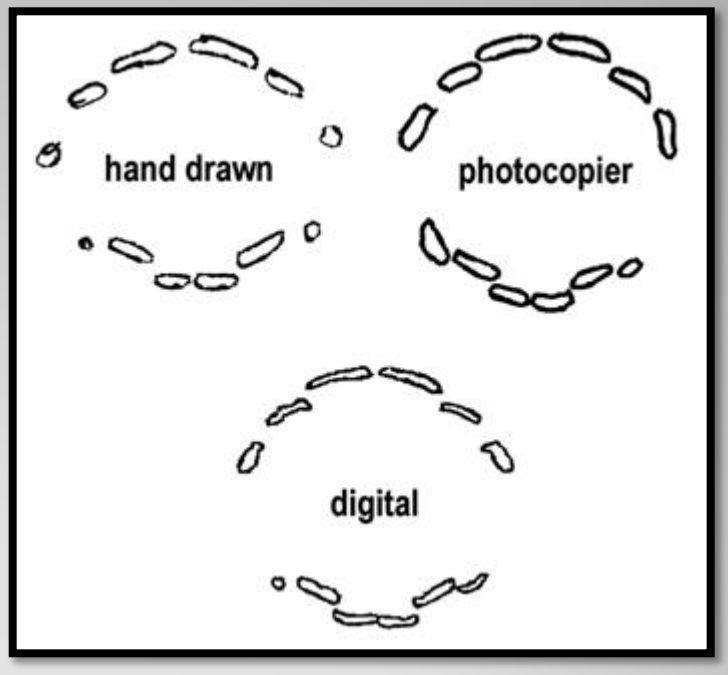


- *Pattern association by casts – direct & indirect method*
- *Radiographic wax method*

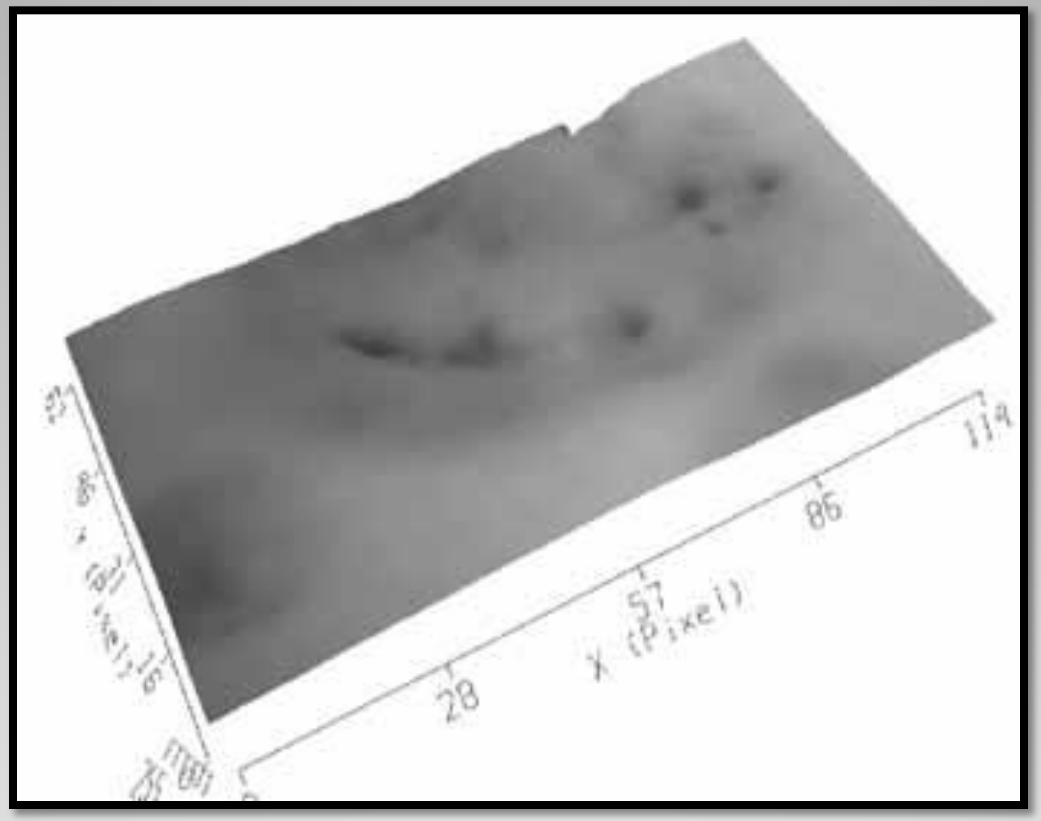


- *Overlays – manual method*
- *Powder method*
- *Computer based analysis*
- *Using 3D scans by Dental print*
- *SEM*

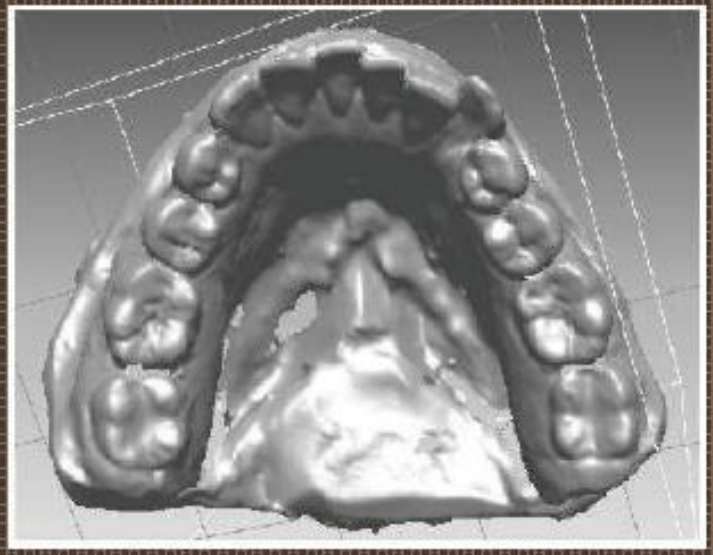




Overlay production methods and example of resultant overlay: (a) hand-drawn technique using acetate sheets and marker pen; (b) photocopier technique (note ABFO scale included to check scaling); (c) digitally scanning cast (note ABFO scale included to check scaling); (d) example of each type of overlay.

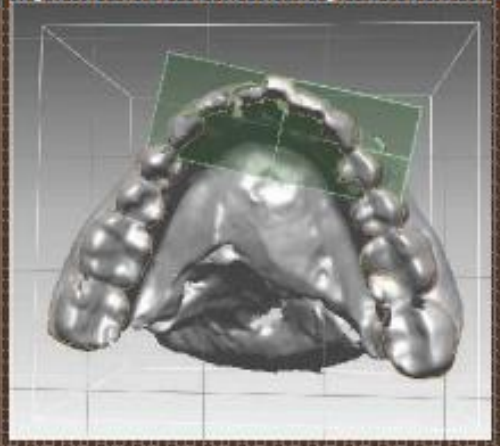


3D rendering of a bitemark from a standard image



A typical digitized dental model imported into Rapidform editing software

bite mark image generated by the dental casts.



Digitized 3D dental model with intersecting plane and captured tooth contour.

New method of analysing bite marks - Image Perception Technology

- *Artificially colour areas with equal intensity values*
- *2-D image as a pseudo-3-d surface object.*

Original photograph

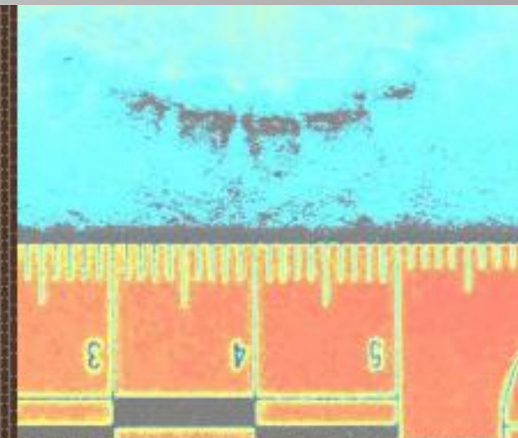
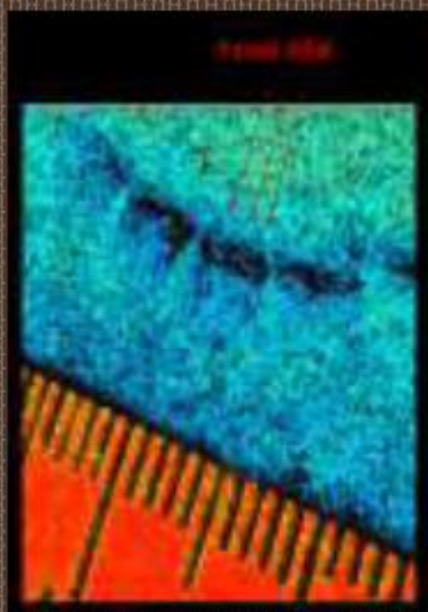
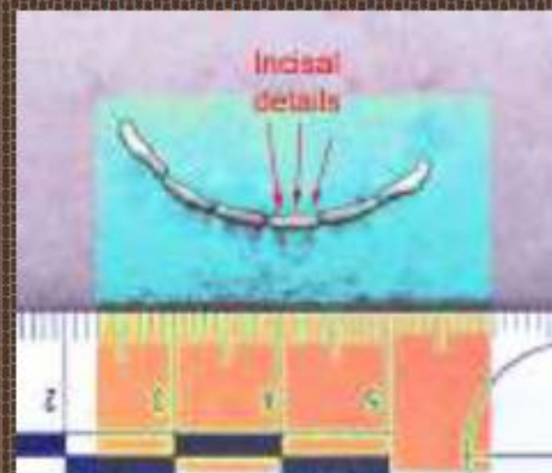


Image artificially coloured with image perception technology software



Pseudo 3-D image-visible bite mark detail



Corresponding incisal detail in bite mark photograph and [illegible] overlay

- *Wet swab rehydrates the salivary constituents, releasing more epithelial cells from the dried deposit.*
- *DNA typing of bacteria & its recovery / SEM analysis of bite wounds.*

BITEMARKS AND DNA

- Presence of nucleic acid-degrading enzymes (nucleases) → saliva can rapidly degrade DNA, (living victim) → skin temperature accelerate
- Sweet's double swab technique-rather than just relying upon pure 'salivary' DNA

Pretty IA, Sweet D. Anatomical location of bitemarks and associated findings in 101 cases from the United States. *J Forensic Sci 2000;* ***45(4): 812–814***

- Genotypic identification of oral streptococci
- one year later and found that their genotypes-same

a. Kit- including two swabs (for skin only, buccal suspect swabs require only one), gloves, card drying rack, evidence stickers, sealable plastic bag, documentation and evidence
envelope
b. dried prior to placement in sealed evidence bag. Drying is a crucial stage and can take up to 30

TECHNIQUES

- *DNA typing*
- *DNA probe*
- *RFLP analysis* (*restriction fragment length polymorphism)*
- *FISH- Fluorescence in situ hybribization*

LIMITATIONS

Reliable scientific tool or not

- *Movements of victim and accused*
- *Human skin – not a good recording medium*
  - *Healing power of human skin*
  - *Deformity and elasticity of human skin*
- *Numerous methods of fabrication*
- *Relies on manual fabrication*
- *Subjective element in fabrication*
- *Subjective element in comparison*
- *Distortion*
- *Loss of data, contamination*

- *Exclusion – The injury is not a bitemark.*
- *Possible bitemark – An injury showing a pattern that may or may not be caused by teeth, could be caused by other factors but biting cannot be ruled out.*
- *Probable bitemark – The pattern strongly suggests or supports origin from teeth but could conceivably be caused by something else.*
- *Definite bitemark – There is no reasonable doubt that teeth created the pattern.*

The American Board of Forensic Odontology provide a range of conclusions to describe whether or not an injury is a bitemark.