CHAPTER 1

INTRODUCTION

The Bite marks impressions are formed during the occlusion of teeth. Bite marks are the tool marks left by the actions of teeth and other oral structures during the biting of objects and people. Forensic odontology is the study of dental applications in legal proceedings. They are useful in the identification because the alignment of teeth is peculiar to the individual. Bites can occur on both the victim and the suspect; teeth are used as weapon by the aggressor and in self-defense by the victim. Bite Marks are commonly found on a suspect when a victim attempts to him/herself. Bite marks may be found virtually on any part of the human body, common sites being the face, neck, arm, hand, finger, shoulder, nose, ear, breast, legs, buttocks, waist, and female genitals. In cases of sexual assault, face, lips, breasts, shoulder, neck, thigh, genitals and testicles are mostly involved. Bite mark impression can be left on skin, chewing gum, pencils, pens and may also be found on musical instruments, cigarettes, cigar, food material like cheese, fruit, potato, and chocolate etc. These are encountered in a number of crimes especially in homicides, quarrels, abduction, child abuse cases, sexual assaults, during sports events and sometimes intentionally inflicted to falsely frame someone. While bite marks on the body are intentionally caused, those found on food articles are usually unnoticeably left by the offenders at the scene of crime.[17]

Figure 1: Bitemark

Classification of Bite Marks Bite marks can be broadly classified as non-human (animal bite marks) and those inflicted by humans. Based on the manner of causation, the bite marks can be non-criminal (such as love bites) as well as criminal which can further be classified into offensive (upon victim by assailant) and defensive (upon assailant by victim) bite mark. There are seven types of bite marks:

- 'Haemorrhage' (a small bleeding spot),
- 'Abrasion' (undamaging mark on skin),
- 'Contusion' (ruptured blood vessels, bruise),
- 'Laceration' (near puncture of skin),
- 'Incision' (neat punctured or torn skin),
- 'Avulsion' (removal of skin),
- 'Artefact' (bitten off piece of body).

These further can be classified into four degrees of impressions; 'Clearly defined' that results from the application of significant pressure, 'Obviously defined' which is the effect of first-degree pressure, 'Quite noticeable' due to violent pressure and 'Lacerated' when the skin is violently torn from the body.

A. Cameron and SIMS Classification**:** is based on the type of agent producing the bite mark and material exhibiting it.

1. Agents:

a) Human

b) Animal

2. Materials:

a) Skin, body tissue

b) Food stuff

c) Other materials

B. Mac Donald's Classification is

a) Tooth Pressure Marks: Marks produced on tissues as a result of direct application of pressure by teeth. These are generally produced by the incisal or occlusal surfaces of teeth.

b) Tongue Pressure Marks: When sufficient amount of tissue is taken into mouth, the tongue presses it against rigid areas.

c) Tooth Scrape Marks: These are caused due to scraping of teeth across the bitten material. They are usually caused by anterior teeth and present as scratches or superficial abrasions. [2]

C. According to Degree of Impression:

a) Clearly Defined - significant pressure

b) Obviously Defined - first degree pressure

c) Quite Noticeable - violent pressure, Haemorrhage, abrasion, contusion, laceration, avulsion or artefact. [18]

The crime type, age and sex of the subject affect anatomical location of a bite injury. Biting is seen in crimes like homicide, rape, sexual assault, robbery and child abuse.

The study also revealed that females are four times more likely to be bitten than males, and the bites are concentrated on the breasts, arms, and legs. In case of female children bite marks are seen on the face, legs, and arms. Males are most frequently bitten on the arms, back, and hands. Also, more than one bite-mark in a different anatomical location from the first can be found in a victim.

Factors Affecting Bite Marks in Skin are

1. The size and shape of bite-mark is affected by its location on the body, because certain areas of the body bend distorting the surface area of the skin due to high viscoelasticity.

2. Some marks are made through clothing. Hence clothing is considered a potential source of bite mark impressions and biological evidence from transferred saliva.

3. Loose skin/subcutaneous fat lead to a poor bite mark. Whereas areas of fibrous tissue or high muscle content bruise less easily and demonstrate good bite mark. Infants, elderly and females tend to bruise more easily.

There is a method called Gustafson's method, this is done as follows. After 21 years, age is estimated by teeth from physiologic age changes in each of dental tissues. 1- Attrition. 2- Periodontitis: Regression of the gums and periodontal tissues occurs in old age, gradually exposing necks and roots. 3-Secondary dentin: It develops from walls within the pulp cavity and diminishes

its size. 4-Cementam apposition, especially near end of root occurs continuously throughout life, and forms incremental lines. 5- Root resorption starts at apex and extends upwards. 6 - Transparency of root is seen after 30 years. The canals in dentin are filled by mineral and dentin becomes transparent. It is the most reliable of all criteria. Error is said to be +/- 4 to 7 years.

The bite mark mechanism is bite mark occurs mainly due to pressure of teeth on skin. It is accompanied by mandibular closure and suction of skin (as a negative pressure). Upper jaw is usually stationery and holds and stretches the skin and lower jaw is moveable and gives the most biting force.A human bite mark is an elliptical or circular injury with specific characteristics of the teeth. If there is a single "C" shaped mark, then only one jaw (lower jaw) was involved. The diameter of injury ranges from 25-40 mm. Bruising within the marks is caused by pressure from the teeth as they compress the tissue inward.

The physical characteristics are the amount and degree of detail recorded in the bitten surface varies from case to case. First it is important to determine which teeth made the marks. The term 'characteristic', is a distinguishing feature, trait, or pattern within the mark. It is of two types, class characteristic & individual characteristic.

Class characteristic is a feature, pattern, or trait which reflects a given group and is not related to a particular individual. The biting surfaces of teeth are related to their function like incising, tearing or grinding. Front teeth are the primary biting teeth in bite marks.

The two upper central incisors are wide, lateral incisors are narrower and cuspids are cone shaped. The two lower centrals and two laterals are uniform in width and lower cuspids are cone shaped. The upper jaw is wider than the lower jaw. The characteristics of individual teeth are

- Incisor: Rectangular shaped mark, sometimes with perforations at the incisal angle areas
- Canines: Triangular markings with apex towards labial and base towards lingual
- Premolars: Single or dual triangle with bases of triangles facing each other or coming together as diamond shaped
- Molars: Rarely leave bite marks, usually quadrilateral markings.

An individual characteristic is a feature, pattern, or trait that represents a variation from the expected finding in a given group, like a rotated, damaged, or broken tooth that differentiates two different dentitions and is helpful in determining the dentition that caused the bite injury or mark. Cases with class characteristics are used to confirm the events of a crime & those with individual characteristics can identify an individual source. Thus, depending on the characteristics, it is possible to use terms like "unique", "possible bite mark", "definite bite mark", "positive match", "consistent with" and "probable biter". For a positive identification to be made there must be marks left by four or five approximate teeth. Bite mark evidence, as mostly analyzed by Forensic Odontologists, is one of the most common forms of dental-related evidence that is presented into a medico-legal setting. Bite Mark evidence are usually seen in cases involving sexual assault, murder, and child abuse and can be a major factor in leading to a conviction. Human Bite Marks as Forensic Evidence Human bite marks are most often found on the skin of victims, but they may be found on almost all parts of the human body. Females are most often bitten on the breasts and legs during sexual attacks, whereas bites on males are commonly seen on the arms and shoulder. In defensive circumstances, as when the arms are held up to ward off an attacker the arms and hands are often bitten. Bites can occur singly, but are often present at multiple sites or multiple bites at a single location. Bite marks are therefore complex injuries and their recognition and interpretation of forensic significance relies upon a thorough understanding of the mechanisms involved. Bite injuries can establish that a suspect was in violent contact with the victim.

Bites can also provide evidence that a suspect was present at a particular crime. A bite on an abused child can indicate that other injuries may not be accidental. In order to ensure that this type of evidence is retained, it is important for odontologists to inform investigators about the proper recognition and preservation of bite mark evidence. It is the role of forensic odontologists to confirm that a particular injury is indeed a bite mark, to collect the required evidence from both the victim and the suspect, and to analyse the bite in light of the collected evidence. . But as such the question about bite mark uniqueness remains unanswered till date. Many forensic dentists and lawyers have questioned this fact and demanded to know from testifying experts the relative frequency of dental features identified in bite marks. By examining the ability of forensic dentists to identify correctly biters from the bite marks, the issue of bite mark uniqueness can be answered. If it is quite clear that odontologists have a great deal of difficulty in correctly identifying bite marks, the question of uniqueness will become irrelevant. Accuracy of bite marks on human skin has been the most debated area in discussions of forensic significance. Skin is a poor registration material because it is highly variable in terms of anatomical location, underlying musculature, or

fat, curvature, and looseness or adherence to underlying tissues. Skin is highly visco-elastic, which allows stretching to occur during either the biting process or when evidence is collected. They concluded that the changes in bite mark appearance are likely to be greater as the injury grows older. Human Bite Marks as Physical Evidence Physical evidence can yield significant information about the nature and circumstances of a crime. The analysis regimen for bite marks is broadly split into two main components. First is the metric analysis that involves the measurement of specific traits and features, secondly, the comparison of the configuration and pattern of the bite injury to that of the suspect's teeth.Bite marks on human tissues can be observed in violent incidents such as sex-related crimes, child abuse cases, and offenses involving physical altercations, such as homicide. It can occur in instances where the attacker bites the victim or the victim bite the attacker as an act of defence, but it should be remembered that the bite victim could be the suspect in the cases. Male victims are most often bitten on the arms and shoulders, while female victims are most commonly bitten on the breasts, arms, and legs.

The biting surfaces of the individual groups of teeth are unique and related to the function. And also, it shows individual characteristics such as fractures, rotations, missing, or extra teeth. In addition, the width of the dental arches could be related to the age of the attacker.

The anatomical location, severity, and quality of the bite marks have significance in the identification of the individual. The information such as demographics (name, age, sex, date, etc.), location, size, shape, colour, type of injury, and swabs should be collected from the bite victim. In case of bites which are not visible to the naked eye, demonstration using ultraviolet light illumination technique can be performed. The collection of evidence from the bite suspect must have a proper consent, detailed history, photographs, and the details of extra- and intra-oral examination along with high-quality impressions of the upper and lower arches. The process of comparing bite marks includes analysis and measurement of size, shape, and position of the individual teeth. The fabrication of overlays is the most common comparison method used. The methods used to fabricate overlays are hand tracing from study casts, hand tracing from wax impressions, hand tracing from xerographic images, the radiopaque wax impression method, and the computer-based methods such as using the image perception software. In addition to all these methods, salivary DNA recovery and bacterial genotyping from the bite marks are the most recent ones and have become the backbone of forensic investigation. [19]

Features of a suspect's dentition useful in bite mark analysis are

- Shape of the dental arch (any rotations, abnormal positions, gaps or missing teeth)
- Number of teeth present in each jaw (odontogram)
- Presence of dentures/ sharp denture clasps
- Distortion of occlusive surfaces during biting (occlusal registration)
- Occlusal level of teeth within the jaw
- Broken/ fractured teeth (particularly incisal fractures that may be responsible for abrasions)
- Any prominent teeth
- Biting pattern at various angles including bite overhang

Forensic odontology is the application of dental science to legal investigations, primarily involving the identification of the offender by comparing dental records to a bite mark left on the victim or at the scene, or identification of human remains based on dental records.

Forensic odontologists are highly experienced, specially trained dentists who use their expertise to help identify unknown remains and trace bite marks to a specific individual.

Historical Review are

Father of odontology Oscar Amoedo y Valdes

Bite mark evidence has slowly gained acceptance as a Forensic tool. The earliest recorded bite mark case in the United States was Ohio vs. Robinson in 1870. Ansil Robinson was suspected of murdering his mistress, Mary Lunsford. His teeth matched to bite marks on the victim's arm, but Robinson was acquitted.

The most famous bite mark case was of Ted Bundy (raped and killed more than 30 women) who was convicted of rape and murder of Lisa Levy and Martha Bowman. He had left a bite mark on Lisa levy's buttock While investigation, the mark was photographed with a ruler kept alongside.

Bundy's teeth were photographed, the bite mark was matched against his teeth and he was convicted. This case also highlighted the importance of photographing the bite-mark with a ruler at the scene, as the bite-mark may degrade with time but the photograph may reveal

the original size and shape of mark which can be used for comparison with transparent overlay of victim's teeth in future. Many other rapists and serial killers have been convicted based on bite mark testimony over the years.

Some dental terminologies are:

- Arch: Term used to refer to an upper or lower denture
- Cementum: Hard connective tissue covering the tooth root.
- Decay: The lay term for carious lesions in a tooth; decomposition of tooth structure.
- Dentin: The part of the tooth that is beneath the enamel and cementum.
- Enamel: Hard calcified tissue covering dentin of the crown of tooth.
- Jaw: A common name for either the maxilla or the mandible.
- Maxilla: The upper jaw.
- Molar: Teeth posterior to the premolars (bicuspids) on either side of the jaw; grinding teeth, having large crowns and broad chewing surfaces.
- Occlusal: Pertaining to the biting surfaces of the premolar and molar teeth or contacting surfaces of opposing teeth or opposing occlusion rims.

Forensically speaking, the bite-mark evidence has two main applications of use; the first application is for the use in a medico legal setting, with the hope and confidence that a criminal can be identified and convicted for the crime. The second application is for the identification of deceased individuals, through the comparison of pre- and post- mortem dental records**.** Sex determination is one of the important use of bite-marks. So that we can identify that who committed the crime i.e. she/he**.**

Marks made on skin (from teeth) during punching are termed 'reverse bit marks. It is these wounds that carry a high risk of infection, and joint involvement, and must be thoroughly examined and irrigated prior to any definitive treatment.

Bite-marks can provide useful evidence in cases of assault (particularly in cases of Non Accidental Injury (NAI cases) – the evidence is of a comparative nature, and this section will outline the means by which this evidence can be collected and analysed.

Bite-marks may also provide a source of assailant DNA - assessment of these injuries must therefore take place after collection of biological trace evidence.

Bite marks are the unique patterns which is used for identification purpose. This means an investigator can tell a lot about the perpetrator or biter which can make the hurt for a suspect easier. The project addresses about the comparison and analysis of the juvenile Bite Mark patterns, determination of sex from Bite Marks in juveniles for identification purposes.

CHAPTER 2

LITERATURE REVIEW

Stella Martin de las Heras (2010) studied Bite marks possessing three-dimensional attributes to suspected biters using a proprietary three-dimensional comparison. The infliction of a bite is a four-dimensional space–time event that is ideally analysed with three-dimensional (3-D) technology. Comparison of 2-D images (photographs) of a bite mark with a 3-D replica of a suspect's dentition is challenging. The authors present a technique that produces 3-D images of indented marks and dentitions for comparisons. Study models and corresponding dental-wax bites were digitized by 3-D scanning, and comparison overlays were generated using Dental Print© software. The effectiveness of the method was analysed by determining the area under receiver operating characteristic (ROC) curve and the sensitivity, specificity and 95% confidence interval (CI) for each cut-off point. An area under the ROC curve of 0.953 (SE = 0.029; 95% CI = 0.893–0.985) and high sensitivity and specificity values were obtained for 104 comparisons made by an expert examiner, who correctly identified 92.3% of matching dentitions and 98.7% of non-matching dentitions. This technique can be considered a highly accurate method of bite mark analysis, although indentations must be present in the injury, limiting the cases that can be resolved. A comparative study of the same dentitions using 2-D bite mark photography confirmed the superiority of the new approach.

Kalyani Bhargava et.al (2021) reviewed Research Paper an Overview of Bite mark Analysis Bite Mark Analysis, Comparison and Evaluation: Bite marks are never considered accidental, although some injuries caused by teeth (for example a child accidentally strikes his/her parent in the mouth leaving tooth marks on the hand) may be. The American Board of Forensic Odontology provides a range of conclusions to describe whether or not an injury is a bite mark. These are: a) Exclusion – The injury is not a bite mark. b) Possible bite mark – 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. c) Probable bite mark – The pattern strongly suggests or supports origin from teeth but could conceivably be caused by something else. d) Definite bite mark – There is no reasonable doubt that teeth created the pattern. The first stage of analysis is to determine if the injury is a bite mark, and then to provide a statement on the forensic significance. While evaluating the bite mark firstly the

cause of the mark has to be determined, since bite marks may be caused by nonhumans or humans. 1. Size, shape and arrangement of teeth: Human incisor teeth produce rectangular marks whereas canine teeth produce triangular marks in the cross-section. Animal bites (dogs, cats) usually puncture the skin and the cross-sectional size of the tooth is small and circular. Number of incisor teeth and the distance between individual teeth may be greater with animal bites. 2. Size of Dental Arch: Width of adult arches from canine to canine is 2.5-4cm. Children arches are smaller than the adults whereas dogs and cats 'arches are smaller than children. 3. Evaluation of the bite mark photographs: Attempts should be made to thoroughly analyse the bite marks in vivo and in vitro rather than mere superimposition of marks in the photographs over the models. 4. Evaluation of the arches: Shape of the arch should be noted. Central lines of upper and lower arches should be established 5. Suction marks: The presence of suction marks in the centre of the arch marks is a sign of bite marks of human origin. But now it is considered that suction marks are caused due to injury to the blood vessels when compressed between the jaws of the biter. Characteristics in the mark: Ascertain the characteristics of individual marks within the arch. Areas of injuries may indicate occlusal level of particular tooth or sharp cusp. Tooth numbers should be identified. Pattern analysis in bite marks It is the assessment of the bite pattern that often serves to be most revealing. Comparison techniques for bite mark analysis can be classified as direct and indirect methods. They use life-size 1:1 photographs and models of teeth. In direct method, model from the suspect can be directly placed over the photograph of the bite mark to demonstrate concordant points. Videotape can be used to show slippage of teeth producing distorted images and to study dynamics of the bite marks.

Pratik Tarvadi Mahabalesh Shetty (2016) studied Intercanine distance and bite marks analysis using metric method ; Reliability of intercanine distance while analysing bite mark using metric method .Impressions of both , maxillary and mandibular arches of 50 people were taken and dentition cast were prepared. Each parameter of the bite mark is compared to the similar parameter in the dentition of the people. The relation of all parameters with intercanine distance was observed. The findings resulted in 14 true positives, and considering only intercanine distance as parameter resulted in only 6 true positives. Observations showed a significant error of 72 an 88 percent respectively. The conclusion is that using intercanine distance as a parameter for bite mark analysis is an unreliable method.

Sachidanand Giri et.al (2019) studied analysis of bite marks in food stuffs by CBCT 3D-reconstruction. Bite mark analysis plays a vital role in forensic investigations. It is a mark created

by teeth, either alone or in combination with other oral structures. Bite marks are characteristic of an individual and these are different, even in identical twins. This inimitability of an individual's dentition forms the scientific basis for bite mark identification which is used to match a bite mark to suspected perpetrators. Bi-dimensional methods are more commonly used in bite mark analysis. The bi-dimensional (2D) registration of 3Dimensional (3D) structures leads to loss of information. The three factors of the 3-dimensionality involved when a person bites are the curvature of the object, the shape of the biting dentition and the depth of the penetration. Cone Beam Computed Tomography (CBCT) is specially developed for the imaging of the structures related to dentistry and uses relatively small equipment with lower radiation doses at comparatively lower than a conventional CT.[16] The images are obtained in series of DICOM files (Digital Imaging and Communication in Medicine), that can be analyzed through several different software suitesThe aim of this paper was to evaluate ease of using Cone Beam Computed Tomography (CBCT) in studying the bite marks by analyzing the surface and interior of the bitten objects. In this study, CBCT is applied to the analysis of bite marks in foodstuffs, which may be found in a forensic case scenario. Materials and methods100 healthy subjects (50 males and 50 females) in the age group of 18–52 years were randomly selected from the out-patient department of the hospital. Individuals having all anterior teeth were included in the study while individuals with missing anterior teeth, chronic periodontitis, mobile anterior teeth and with wasting disease of teeth such as severe attrition of anterior teeth were excluded from the study. All subjects were informed about the study in their understandable language and included in study after taking written consent. Bite mark registration and study cast preparation-The selected individuals were asked to bite on apple. Alginate impressions of maxillary and mandibular anterior teeth of every individual were taken. The alginate impression was disinfected by rinsing the impression with gently running water followed by immersion of impression in 5.25% sodium hypochlorite (diluted to 1:10) for less than 10 min. Finally the impressions were thoroughly rinsed with water and casts were poured. CBCT scanning-bitten apples were stored in a refrigerator in a sealed plastic bag within an hour and then were subjected to scan using Carestream CS 9300 CBCT machine. All the images are captured with field of view (FOV) of 11 × 17 cm, a voxel size of 90 and an exposure time of 20 s at 80 kV and 5 mA. The volumetric data were collected. Maxillary and mandibular casts were also scanned individually with same parameters as in bitten apple and volumetric data were collected. Mesio-distal dimensions at 3 D images of upper and lower anterior teeth on dental cast was statistically significant ($p < 0.05$) for all anterior teeth in males and females except for left and right mandibular lateral incisor teeth .Similarly, mesio-distal dimensions of bite marks of upper and lower anterior teeth on 3 D images of apple was also found statistically significant ($p < 0.05$) for all anterior teeth of both genders except for mandibular left lateral incisor only.

D. N. Silva et.al (2018) studied Bite marks in foodstuffs – An approach for genetic identification of the bitter. Biological evidences from partially eaten food, left in a crime scene, may contain genetic information of the bitter that can generate a DNA profile. The aim of this paper is to study two different methods to obtain DNA on foodstuff.14 apples were cleaned with sodium hypochlorite before being bitten by two operators whose genetic profile was known. Then, they were stored and allowed to dry at environment temperature for 24 h. Each bitten apple had been previously partially divided vertically into two equal size parts. In one of the two areas, DNA was collected from the inner and in the other part from the periphery of the bite mark. For both of them the double swab technique was performed. DNA extraction was executed using the PrepFiler™BTA kit according to the manufacturer's instructions and its quantification was realized with the Quantifiler™Duo kit (both from Applied Bio systems). The results, associated with this study were analysed with SPSS Statistics™ 19th version. Quantification values were between 0.0219 ng/µl and 1.7054 ng/µl and the null hypothesis was rejected ($p < 0.05$). The difference between the two methods was proved. In human skin, as well as in previous studies on foodstuff, DNA was just collected from the inner part of the bite mark using this method and extraction results, only of saliva, were lower. This new experimental condition of collecting DNA at periphery allowed, in quantity and quality, statistically better results through collection of epithelial lip cells that escaped from apple enzymatic activity.The periphery technique reveals itself as the technique of choice in obtaining greater quantification of DNA in the bite mark of the apple.

RK Gorea et.al (2014) studied A comparitive analysis of Bite marks on skin and clay; Bite marks are always unique because teeth are distinctive. Bite marks are observed at the crime scene in sexual and in physical assault cases. This piece of evidences is often ignored. Due to the importance of evidence, we conducted a progressive randomized study. A total 188 bite marks in the clay is studied. Based on these findings ,93.34% of volunteers could identify from the bite marks on the clay. In addition ,201 impressions on skin were studied, and out of these cases ,41.01 %of the same volunteers could be identified based on the bite mark impressions on skin.

Shivam Chourasiya (2017) studied Odontometric Parameteres in Gender Identification**,** Bite mark pattern was analysed to study the odontometric measurements like meso –distal incisor width and inter canine ratio and to check for the presence of sexual dimorphism between the ages of 16-25. A total od 40 samples ie 20 males and 20 females were considered for the study. On the basis of odontometric parameters lik arch length and inter canine ratio sexual dimorphism in males and females can be determined. Also, the study revealed class characteristics and the individual characteristics ie odontometric parameters. The study consisted of 40 subjects from Mumbai.

Impressions of Maxillary and Mandibular arches of 40 individuals participating in the study were mad and wax study models prepared on modelling wax. The study revealed that the traced bite mark patterns could be used to match the sample bitemarks and measurements could be carried out of the odontometric parameters like number of tooth marks, arch length, central incisoral width, inter canine ratio. The number of tooth marks was more in the Mandibular arch than the maxillary arch. The arch length was found to be higher in males than that of the females. The width incisors were found to be more in maxilla than in mandible with no significant sexual dimorphism in males and females.

CHAPTER 3

AIM AND OBJECTIVES

Aim:

To determine the sex from bite marks in juveniles.

Objectives:

- To identify the morphological structure of juvenile bite mark

CHAPTER 4

MATERIALS AND METHODOLOGY

Materials:

1. Potatoes
2. Measuring scale
3. Marker
4. Papers

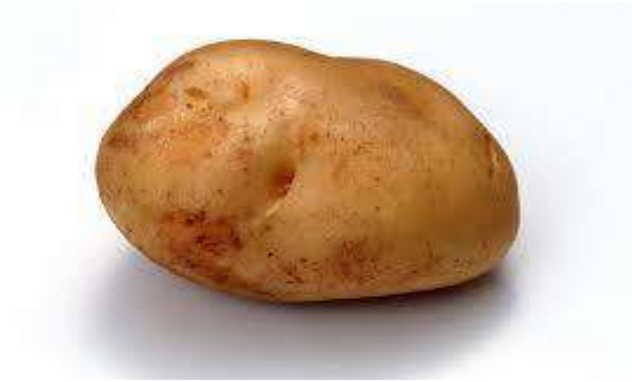


Figure 2: Potato

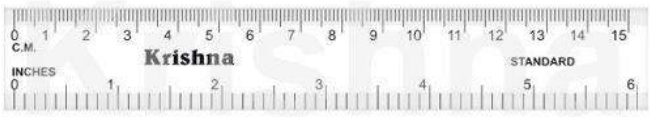


Figure 3 Scale

Method:

The bite marks of juvenile from age group 15-17 had been collected by using potato and documented as photographs. The impression were compared based on odontometric measurements. The samples were collected from the age group 15- 17yrs children from Govt. Higher secondary school Kuzhimathicadu. The potatoes were given to 30 males and 30 females and their bite mark patterns are collected. Parameters such as upper arch length, upper incisor width, lower arch length, lower incisor width are measured by using scale and pencil. Then the patterns are documented as photographs.

CHAPTER 5

OBSERVATIONS AND CALCULATIONS

		Parameters (Male)									
		Arch Length					Incisioral Width				
Sr. No.	Samples	Upper Jaw	Average of Upper Jaw	Lower Jaw	Average of Lower Jaw	Average of Upper Jaw and Lower Jaw	Upper Jaw	Average of Upper Jaw	Lower Jaw	Average of Lower Jaw	Average of Upper Jaw and Lower Jaw
1	1	3.7		3			0.3		0.2		
2	2	3.6		3.1			0.3		0.3		
3	3	3.9		2.9			0.3		0.2		
4	4	3.1		2.6			0.3		0.2		
5	5	3.7		4			0.3		0.2		
6	6	3.3		3.5			0.3		0.2		
7	7	3.1		4.1			0.3		0.3		
8	8	3.9		3.2			0.3		0.3		
9	9	3.3		3.7			0.2		0.2		
10	10	3.9		4			0.2		0.3		
11	11	3.1		2.3			0.3		0.3		
12	12	4.3		3.1			0.3		0.2		
13	13	2.9		2.9			0.2		0.3		
14	14	3.8		3.3			0.3		0.3		
15	15	1.7	3.27	2.4	3.14	3.20	0.3	0.25	0.3	0.21	0.23
16	16	2.8		3.3			0.3		0.3		
17	17	2.3		2.9			0.3		0.2		
18	18	3.1		2.9			0.4		0.2		
19	19	3.9		3			0.3		0.3		
20	20	2.4		2.6			0.3		0.2		
21	21	2.9		2.7			0.2		0.1		
22	22	3.8		3.7			0.1		0.2		
23	23	3.4		3			0.1		0.1		
24	24	3.3		2.9			0.1		0.1		
25	25	3.7		3.1			0.1		0.1		
26	26	3.1		3.5			0.2		0.1		
27	27	2.8		3.2			0.2		0.2		
28	28	3.7		3.8			0.2		0.2		
29	29	2.6		2.6			0.2		0.2		
30	30	2.9		2.8			0.2		0.1		

Table 1 Parameters of Male

Sr. No.	Samples	Parameters (Female)									
		Arch Length					Incisioral Width				
		Upper Jaw	Average of Upper Jaw	Lower Jaw	Average of Lower Jaw	Average of Upper Jaw and Lower Jaw	Upper Ja	Average of Upper Jaw	Lower J	Average of Lower Jaw	Average of Upper Jaw and Lower Jaw
1	1	3.2		3.9			0.3		0.3		
2	2	3.5		3.6			0.2		0.2		
3	3	3.2		3			0.3		0.3		
4	4	3.1		3.5			0.3		0.3		
5	5	3.8		3.9			0.3		0.3		
6	6	3.2		4			0.1		0.1		
7	7	3.5		3			0.3		0.3		
8	8	2.3		2.9			0.2		0.2		
9	9	2.1		2.7			0.2		0.2		
10	10	2.8		2.5			0.3		0.3		
11	11	2.9		3			0.2		0.2		
12	12	2.8		3.3			0.2		0.2		
13	13	2.5		3.4			0.2		0.2		
14	14	2.3		3.1			0.2		0.2		
15	15	2.5	2.86	3	3	2.93	0.3	1.07	0.2	0.18	0.63
16	16	2.9		3			0.3		0.2		
17	17	2.9		3.1			0.3		0.2		
18	18	3.1		2.8			0.2		0.1		
19	19	1.7		2.4			0.2		0.1		
20	20	2.8		2.7			0.3		0.2		
21	21	3.1		3.2			3.2		0.2		
22	22	3		2.7			2.7		0.1		
23	23	3		2.8			2.8		0.1		
24	24	2.9		2.6			2.6		0.2		
25	25	2.7		2.6			2.6		0.2		
26	26	2.9		2.6			2.6		0.1		
27	27	2.8		2.7			2.7		0		
28	28	3.3		2.5			2.5		0.2		
29	29	2.4		2.9			2.9		0.1		
30	30	2.5		2.6			2.6		0		

Table 2 Parameters of Female

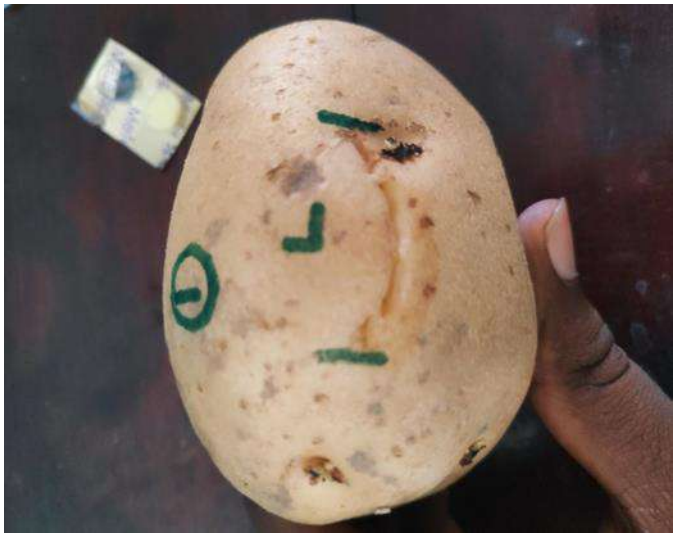
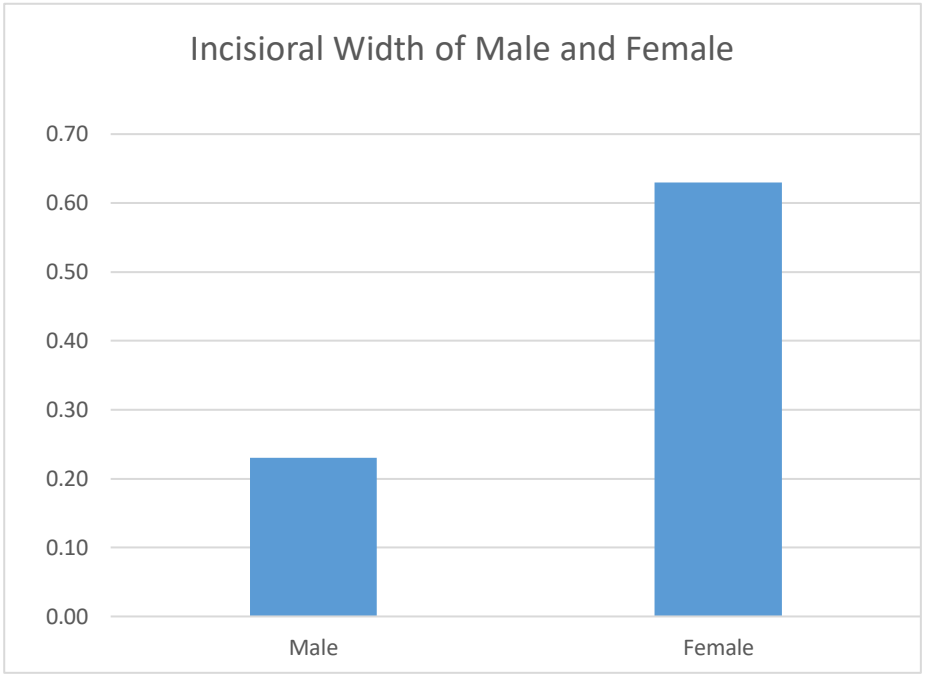


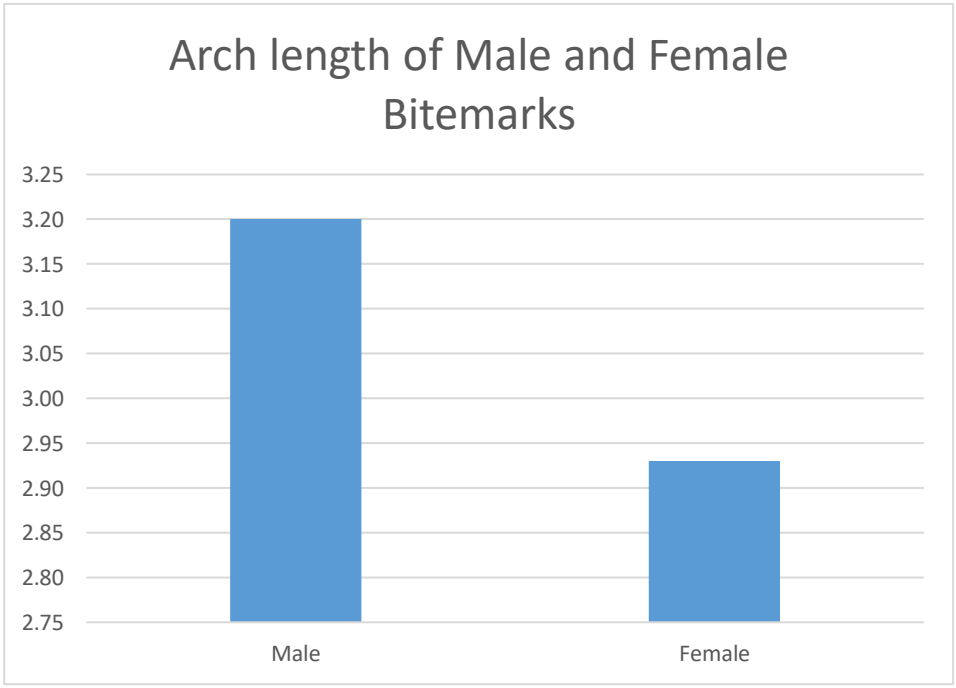
Figure 4: Collected sample 1

Figure 5: Collected sample 2

Graphical representation of Incisoral width and Arch lengt



Graph 1 Incisoral width of male and female



Graph 2 Arch length of male and female

CHAPTER 6

RESULTS AND CONCLUSION

Result:

In the present study of male and female juvenile's bite mark patterns, Arch length of male is 3.20 and female is 2.93. Incisoral width of male is having 0.23 and female is 0.63.

Conclusion

Determination of sex from bite marks in juvenile can be find out by considering the parameters such as Arch length and Incisoral width. Arch length is greater in males and lesser in females. Incisoral width is greater in females and lesser in males. In future other parameters such as Number of teeth, Distance between teeth can be used for sex determination.

CHAPTER 7

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