

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Forensics in Pediatric Dentistry.

Rajalakshmi R<sup>1</sup>, Sarasa Kavitha D<sup>1</sup>, Rameshkumar K<sup>1</sup>, and Aneesa<sup>2</sup>.

<sup>1</sup>Department of Pedodontics, Sree Balaji Dental College & Hospital, Bharath University, Chennai, Tamil Nadu, India

<sup>2</sup>Consultant Dentist, Chennai, Tamil Nadu, India

### ABSTRACT

A pedodontist is often the first person to deal with children. Hence they play a very significant role in identification of crimes against them. The science of forensic odontology has evolved to be an innovation in the field of dentistry. This article highlights the importance of a dentist in the field of forensic odontology and the application of this science in pedodontics.

**Keywords:** Forensic odontology, Pedodontics, Cheiloscopy, Rugoscopy, Tooth prints

*\*Corresponding author*



## INTRODUCTION

Forensic science: is a study of physical information connected with crimes or collection of evidences by scientifically examining the objects or substances that are involved in the crime [1].

**Forensic dentistry or Forensic odontology:** is defined as that branch of forensic medicine, which in the interest of justice, deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of such evidence [2]. Some of the new innovations in this field include DNA and odontology, Cheiloscopy [3], Bite mark [4] Rugoscopy [5], & Tooth prints that deals with identification of humans.

In the recent era, dentists are key personnel for identifying the individual dentition which in turn can be used to find out/exclude a suspect in a crime investigation.

### **Significance in Pedodontics**

Creating social awareness along with special emphasis on the following areas:

#### **Child abuse/neglect [6]**

A dentist who handles children should be able to identify child abuse and neglect and hence plays a significant role in the eradication of this crime.

#### **Mass disaster [7]**

Children also become victims in mass disasters and their identification can be done by a skilled pedodontist.

#### **Accidental and Non-accidental oral trauma**

Trauma to oral and orofacial structures can be due to negligence mal practice or abuse.

#### **Age determination [8]**

Human dentition and bite marks can be used for age estimation.

#### **Bite marks evidence[9]**

Bite marks in children may be signs of child abuse, which should be brought under the law.

#### **Lip Print identification [10]**

No individuals will have same pattern of lip prints, hence this innovation is successfully employed in the identification.

## **Poisoning**

Metallic poisoning which could be accidental or intentional shows several oral manifestations.

## **Dental records**

Routine dental findings saved as odontograms could be used in forensic dentistry.

## **BITE MARKS**

A bite mark is defined as an elliptical or circular injury that records the specific characteristics of tooth/teeth [11].

Bite marks in children could be a sign of child abuse or malpractice. Since each individual has a characteristic bite pattern, analysis of bite mark could be done by matching the bite mark impression collected from the victim against modals of the suspect [12]. Hence bite mark analysis remains as a unique entity in the science of forensics.

Analysing the bite mark can be done skilfully by an experienced forensic odontologist. First of all, the mark should be identified as a bite mark followed by differentiating it from animal bites. An adult and a child's bites should be differentiated along with the exclusion of self inflicted bites. Finally, there should be enough evidence to convict the suspect [13].

## **The Characteristics of Human Bites**

Human bite mark appears as elliptical or ovoid arcs with superficial abrasion or sub surface haemorrhage [14]. Usually the mark measures 2-5 cm across canine to canine. An adult's bite measures 3-4.5 cm where as a child's bite measures 2.5 -3 cm. deciduous teeth measures less than 2.5 cm [11,13].

## **The Collection of Evidence in Bitemark**

While describing a bite mark, the location of the bite mark (colour, shape and size) and type of injury (bruise, laceration or avulsion) should be mentioned. Pattern left by the teeth along with the shape of the bite (circular, oblong or dual bite) should be recorded.

## **Collection of evidence from the victim**

For an accurate interpretation, the collection of bite mark evidence is relevant. The site of bite mark should be double swabbed for the collection of DNA [15]. Photographs or videos should be taken from different angulations for future clarifications. UV photography can be utilised if the injury is fading. If the victim is dead, samples of the skin can collected after the necessary consent is obtained. Similarly evidence can be collected from a suspect by taking impressions of the dentition and tissue samples .all the collected evidence should be analysed to reach a final conclusion.

The accidental deposition of saliva during biting is collected and processed by latest technologies which help in accurate identification of the suspect in crimes [16].

## CHEILOSCOPY

Cheiloscopy (in Greek *cheilos* - lips, *skopein* - see) is defined as a forensic investigation technique that deals with identification of humans based on lips traces [3,17].

Introduced by Fisher in 1902 [18]. It is a very simple and inexpensive technique which is applicable mostly in identification of living. It remains stable throughout life time & are unique to every individual, except in monozygotic twins. The lip print is formed by wrinkles and grooves which forms into a characteristic pattern. The thickness and position of the lip anatomy is also analyzed. Numerical superiority of the lines (vertical, intersected, branched or reticular) is the basis of classification [10]. If more than one line predominates, it is considered to be undetermined.

## CLASSIFICATION

Proposed by Tsuchihashi [10].

Type 1: Clear-cut vertical grooves that run across the entire lips

Type 1': Similar to type 1, but do not cover the entire lip

Type 2: Branched grooves

Type 3: Intersected grooves

Type 4: Reticular grooves

Type 5: Grooves do not fall into any of the type 1-4 and cannot be differentiated morphologically (undetermined).

The sex of the individual was determined as per the descriptions given by Vahanwala et al. According to him, Type 1, 1' and Type 2 patterns are predominant in females, whereas Type 3, 4 and 5 (varied) patterns are dominant in males [3].

## RUGOSCOPY

Palatal rugae: irregular, asymmetric ridges of the mucous membrane extending laterally from the incisive papilla and the anterior part of the median palatal raphe.

Rugoscopy is defined as the systematic study of palatal rugae aiming to contribute to the human identification process where other methods are not possible [20].

The classification of palatal rugae is based on the analysis on casts by Lysell. The rugae pattern was classified based on their length, shape, direction, and unification.

### Based on length as:

Primary: - 5 mm or more

Secondary: - 3 to 5 mm

Fragmentary: - 2 to 3 mm  
Rugae less than 2 mm were disregarded

#### **Based on their shape as:**

Curved: They had a crescent shape and curved gently.  
Wavy: slight curve at the origin or termination Of curved rugae,  
Straight: They ran directly from their origin to termination.  
Circular: Rugae that formed a definite continuous ring.

The direction of the rugae was determined by measuring the angle formed by the line joining its origin and termination and the line perpendicular to the median raphae.

Unification occurs when two rugae are joined at their origin or termination.

Palatal rugae are unique to every individual and it is not altered by heat, chemicals or other extreme conditions. This is due to its internal position in the oral cavity and insulation from the buccal fat pads and tongue <sup>(19, 20)</sup>. No alterations in rugae (except in length) occurs once they are formed [5].

#### **SIGNIFICANCE IN FORENSICS**

Total number of rugae is more in females compared to males, but the number of primary rugae is greater in males in contrast to fragmentary rugae which are more in females. No difference in the number of secondary rugae between males and females were present. The predominant pattern observed in both the sexes is curved.

#### **DNA & FORENSICS**

DNA and proteins are used as unique tools in personal identification. Genomic and mitochondrial DNA can be obtained from the pulp, dentin and cementum of the tooth. Desquamated cells in the saliva also contain DNA. With the help of DNA finger printing and Polymerase Chain Reaction (PCR) personal identification could be done with more accuracy. [15]. Other than tooth, biological materials used in the isolation of the DNA which of dental importance include bone and saliva. Salivary DNA is obtained by double swabbing the bite mark [16]. It can also be collected from cigarette butts or bite marks or skin surfaces.pulpal DNA can be retrieved from the cadavers up to a period of four weeks. Tooth also serves as an excellent source of DNA. The cryogenic grinding of the pulverised teeth under sterile conditions can yield adequate amount of DNA for amplification. The fact that physiologic conditions, pathoses and effect of dental therapy are unique to every individual remains the basis of this branch of forensics.

#### **TOOTH PRINTS**

It is the dental id for safeguarding children discovered by Dr.David Tensini (pediatric dentist).

## **MATERIAL**

Arch shaped, thermoplastic dental impression wafer. For anteriors the thickness is 7.5 mm and for posterior, 4 mm thickness.

## **UPDATING**

Updating is done at the age 3 years, 7 or 8 years & 12 to 13 years

## **Advantages**

- Accuracy
- Techniques based on sound scientific principle
- Reliability in caries free individuals
- Quickness and comfort
- Inexpensive and availability
- Storage is parents responsibility
- Can be done easily

## **Disadvantage**

- It needs updating

## **USES OF TOOTHPRINTS**

- The size and shape of the teeth
- Position of the teeth within the dental arch
- The relationship of the mandibular and maxillary arches
- Gum counters
- Marginal outlines of individual restoration and dental sealants.

## **METHODS OF INTERPRETATION**

- Pouring a toothprint impression material and visually comparing concordant point with the host.
- Flash scans
- Measuring line length and angle measurements from tooth prints.
- Digital imaging of tooth<sup>21</sup>

## **CONCLUSION**

Since teeth possess distinctive and singular features along with resistance to extreme conditions, mouth allows a myriad of possibilities in forensics. All the above mentioned innovations in dentistry can serve as an adjuvant in forensic medicine and can be successfully employed to identify the culprits.

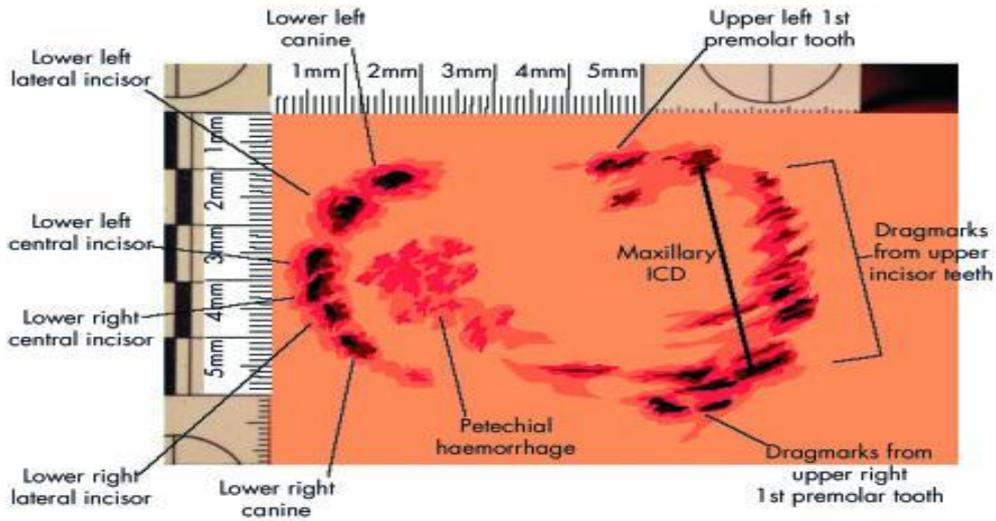


Figure-1 Identification of Bite marks.(A Kemp, S A Maguire, J Sibert, R Frost, C Adams, and M Mann Can we identify abusive bitemarks in children. Arch Dis Child. 2006 November; 91(11): 951.) [22]



Figure 2- Rugoscopy

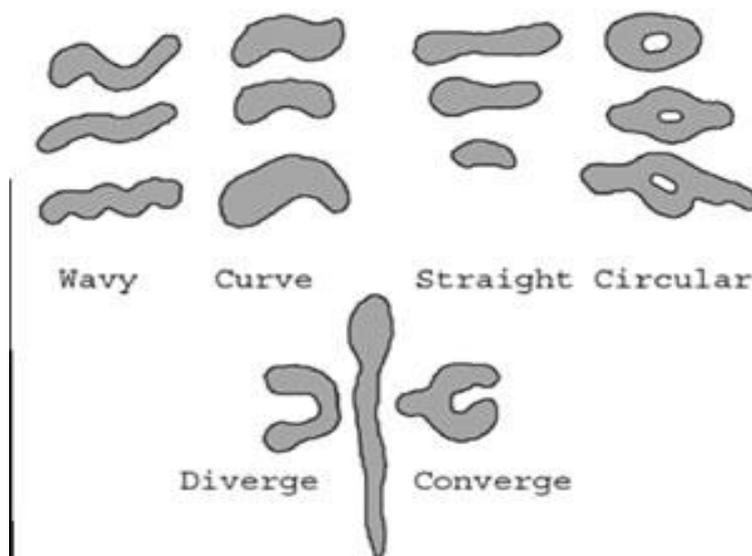


Figure 3- Rugae patterns (Martin S Filho IE.Sales-Peres SHC, Sales-Peres A,CarvalhoSPM.Palatal rugae patterns as bio indicators of identification in Forensic Dentistry RFO 2009,14(3):227-233.) [20]

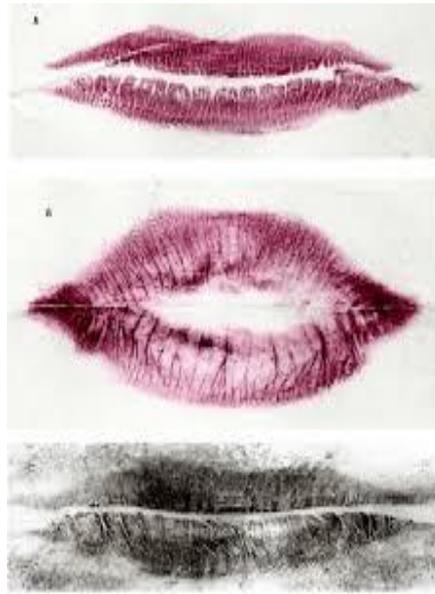


Figure 4- Chelioscopy (Tsuchihashi.Y.Studies on personel identification by means of lip prints. Forensic Sci.1974; 3:233-48.) [10]

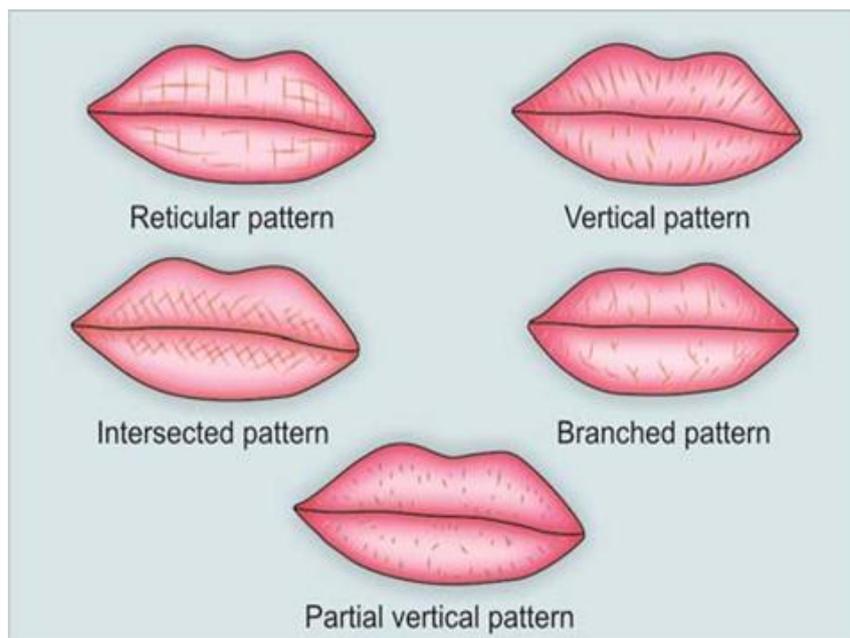


Figure 5- Chelioscopy (Tsuchihashi.Y.Studies on personel identification by means of lip prints. Forensic Sci.1974; 3:233-48.)

### REFERENCES

- [1] O'Shangnessy PE. Intro to Forensic Science. Dent Clin North Am 2001; 45:217-27.
- [2] Carl KK Leung. Forensic Odontology. Dental Bulletin 2008;13(11).
- [3] Vahanwala SP, Parekh BK. J Indian Dent Assoc 2000;71:16-9.
- [4] Forensic Dentistry: Update 2008; 35:048-061.
- [5] Ana A Barbieri, et al. J Forensic Sci 2013;58(S1):s235-s238.
- [6] Tsang A, Sweet D. J Can Dent Assoc 1999; 65:387-391.
- [7] [http://www.interpol.int/public/disaster\\_victim/default.asp](http://www.interpol.int/public/disaster_victim/default.asp).2008.

- [8] Renzi H, Radlanski R. *Homo J Comp Human Biol* 2006;57:29.
- [9] Furness J. *Am J Forensic Med Pathol* 1981; 2:49-52.
- [10] Tsuchihashi Y. *Forensic Sci* 1974; 3:233-48.
- [11] American Board of Forensic Odontology Guidelines and Standards. In Bowers C.M, Bell GL(Ed) *manual of forensic odontology* 3<sup>rd</sup> ed.pg.299-353.
- [12] Atsu SS, Gokdemirk, Kedici PS, Ikyazy Y. *J Forensic odontostomatol* 1998;16(2):30-4.
- [13] Sweet D-Human bite marks: examination, recovery and analysis. In Bowers c.m, Bell GL (Ed) 3<sup>rd</sup> ed. *Manual of Forensic Odontology*.pp148-170.
- [14] Prettyl A. *Dent Update* 2008;35(11)48-50,53-4,57-8.
- [15] Sweet D, Lorente JA, Valenzuela A, Lorente JA, Villanueva EJ *Forensic Sci* 1997;42(3):447-451.
- [16] Sweet D, Lorente JA, Valenzuela A, Lorente JA, Villanueva E. *J Forensic Sci* 1997;42(3):320-322.
- [17] Kasprzak J Cheiloscopy. In: Siegel JA, Saukko PJ, Knupfer GC, editors. *Encyclopedia of forensic science*.2<sup>nd</sup> edi.1.London: L Academic Press;2000.pp.358-61.
- [18] Caldasl M, Magalhaes T, Afonso A. *Forensic Sci Int* 2007;165:1-9.
- [19] Muthu Subramanian M, Limson KS, Julian R. *Forensic Odonto Stomat* 2005;23(1):26-9.
- [20] Martin S Filho IE.Sales-Peres SHC, Sales-Peres A, Carvalhospm.Palatal rugae patterns as bio indicators of identification in Forensic Dentistry *RFO* 2009,14(3):227-233.
- [21] Gupta N, Jadhav K, Ahmed Mujib BR, Amberkar VS. *Forensic Sci Int* 2009;192(1-3):67-71.
- [22] A Kemp, S A Maguire, J Sibert, R Frost, C Adams, and M Mann. *Arch Dis Child* 2006; 91(11): 951.