

# Role of Prosthodontics in Forensic Odontology

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## Abstract

Forensic odontology plays an important and often decisive role in the identification of disaster victims. Dental description of unknown or missing persons in cases of mass disasters is a very successful means of identification in forensic research. Difficulties arise if the natural dentition has been lost for one reason or another and has been replaced by dental prosthesis. From the prosthodontist view this difficulty can be prevented by delivering a prosthesis that carries patient identification.

Forensic identification based on assessment of prosthodontics appliances is assuming greater significance, as labeling of dentures and other prosthetic appliances could provide vital clues for patient identification.

**KEYWORDS:** Prosthodontics, forensic odontology, denture marking, palatal rugoscopy, bite marks, elder abuse

## Introduction

Through the specialty of forensic odontology, dentistry plays a small but significant role in the process of law and order. By identifying the victims of crime and disaster through dental records, dentists assist those involved in crime investigation. Always part of a bigger team, such personnel is dedicated to the common principles of all those involved in forensic casework: the rights of the dead and those who survive them.

### **History:**

One of the earliest known examples of forensic dentistry involved Agrippina, the mother of Roman emperor Nero. In 49 B.C., Agrippina ordered the death of her rival Lollia Paulina, who was in competition with her to be the wife of Emperor Claudius. Agrippina demanded to see Lollia Paulina's head as proof of her death, but she wasn't sure that her rival was dead until she noticed Lollia Paulina's distinctive discolored front teeth.

### **MAIN APPLICATION:**

Dental identification assumes a primary role in the identification of remains when postmortem changes, traumatic tissue injury or lack of a fingerprint record invalidate the use of visual or fingerprint methods. The identification of dental remains is of primary importance when the deceased person is skeletonized, decomposed, burned or dismembered. The principal advantage of dental evidence is that, like other hard tissues, it is often preserved after death.<sup>1</sup>

Reasons for identification:<sup>2</sup>

**Criminal** ---Typically an investigation to a criminal death cannot begin until the victim has been positively identified.

**Marriage**--- Individuals from many religious backgrounds cannot remarry unless their partners are confirmed deceased.

**Monetary**--- The payment of pensions, life assurance and other benefits relies upon positive confirmation of death.

**Burial**--- Many religions require that a positive identification be made prior to burial in geographical sites.

**Social**--- Society's duty to preserve human rights and dignity beyond life begins with the basic premise of an identity.

**Closure**--- The identification of individuals missing for prolonged periods can bring sorrowful relief to family members.

#### **DENTURE MARKING:**

Forensic identification based on assessment of prosthodontic appliances is assuming greater significance, as labeling of dentures and other prosthetic appliance could provide vital clues for patient identification.<sup>3</sup>

The various techniques for denture marking are:

1. Surface marking
2. Engraved fixed restorations
3. Lenticular cards
4. Bar coding
5. Microchips

#### **1. SURFACE MARKING: ( fig 1)**

Personal identification details are printed on paper with a laser printer. On the denture base palatal aspect, a depression approximately 1 mm deep is cut. This label is placed into the designated space, and then covered with an auto polymerizing acrylic resin. The acrylic resin is trimmed and finished in the usual manner.<sup>4,5</sup>

#### **2. ENGRAVED FIXED & REMOVABLE RESTORATIONS: ( fig 2)**

The incorporation of an identification mark on a cast partial denture framework would ensure identification even in more extreme situations, such as fires and traffic accidents.<sup>6,7</sup>

#### **3. LENTICULAR CARD: ( fig 3)**

It is a technology in which the lenticular lens is used to produce images with an illusion of depth, morphology

or the ability to change or move as the image is viewed from different angles. Lenticular printing is a multi step process consisting of creating a lenticular image from atleast two or more existing images, and combining it with a lenticular lens. Each image is sliced into strips, which are then interlaced with one or more of the other images. These are printed on the back of a synthetic paper and laminated on the lens.<sup>8</sup>

#### **4. BAR CODING: ( fig 4)**

Automatic identification using barcodes incorporated into dentures has been developed. Barcode systems can contain large amounts of data. However, the scanning of barcodes may be difficult due to the opacity of the acrylic resin, and for this reason the use of clear acrylic resin is recommended with this system.<sup>9,10</sup>

#### **5. MICRO CHIPS: ( fig 5)**

In medicine, radiofrequency identification (RFID) is used to reduce the errors of patient identification, particularly during blood transfusion and drug administration in hospitals. It seems reasonable to adopt this technology for denture identification.<sup>11</sup>

RFID is a method of identifying by using radio waves. The RFID system consists of a data carrier, generally referred to as tag or transponder, and an interrogator/reader with an antenna.

The tag consists of a microchip with a coiled antenna. The reader sends out electromagnetic waves that form a magnetic field when they couple with the antenna on the tag. The chip then modulates the waves that the tag sends back to the reader, and the reader converts the new waves into digital data. Tags are categorized as either read-only or read/write.

#### **BITE MARKS: (fig 6)**

The science of identification of bite mark identification can be used to link a suspect to a crime. Bite can be defined as the mark made by human or animal teeth in the skin of alive people, cadavers or unanimated objects with relatively softened consistency.

Bite marks depending upon the crime or circumstances are impressions left on food, skin or other items left at a scene. In assault cases they may be found on the victim. Besides the agent identification, bite mark analysis in a forensic investigation can elucidate the kind of violence and the elapsed time between its production and the examination. The interpretation of bite marks involves a three- dimensional reproduction. Prosthodontists are well versed in the properties of different impression materials applied in different situations and hence the specialist can aid in the construction of an accurate replica.<sup>12</sup>

The physical characteristics of bite marks include---<sup>13</sup>

1. Distance from cuspid to cuspid.
2. Tooth alignment.

Fig 1 Surface Marking



Fig 2 Engraved Fixed & Removable Restorations



Fig 3 Lenticular Card



Fig 4 Bar Coding

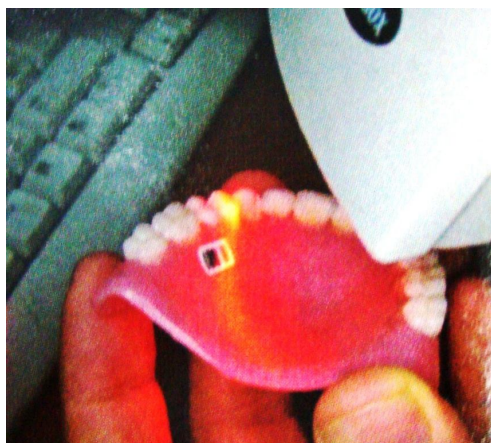


Fig 5 Micro Chips

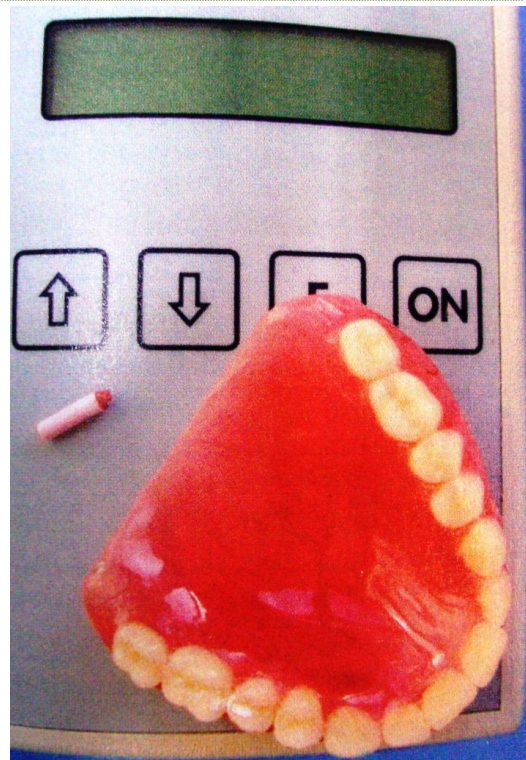


Fig 6 Bite Marks



Fig 7 Palatal Rugoscopy



3. Teeth width, thickness & spacing.
4. Missing teeth.
5. Wear patterns.
6. Dental history including fillings, crowns, etc.

### **PALATAL RUGOSCOPY:** (fig 7)

The study of palate in general is called as Palatoscopy and the study of the patterns of the grooves and ridges (rugae) of the palate to identify individual patterns is called as Rugoscopy.

Palatal rugae comprise about three to seven ridges radiating out tangentially from the incisive papilla. Venegas et al determined the shape, size, number and position of the palatal rugae.<sup>14</sup> The most prevalent palatal rugae shape was sinuous followed by curve, line, point and polymorphic varieties. The palatal rugae that were larger were the sinuous. The pattern of these rugae is considered unique to an individual and can be used as reliable method in postmortem cases. Palatal rugae have been equated with fingers and are unique to an individual.<sup>15</sup> It can be of special interest in edentulous cases and also in certain conditions where there are no fingers to be studied, such as burnt bodies or where bodies have undergone severe decomposition. Rugae pattern may be specific to racial groups therefore facilitating population identification.

The advantages of palatal rugae include---

1. Uniqueness
2. Post mortem resistance
3. Overall stability
4. Low utilization cost

It is a well-established fact that the rugae pattern is as unique to a human as are his or her fingerprints, and it retains its shape throughout life. The anatomical position of the rugae inside the mouth—surrounded by cheeks, lips, tongue, buccal pad of fat, teeth and bone—keeps them well-protected from trauma and high temperatures. Thus, they can be used reliably as a reference landmark during forensic identification.<sup>16</sup> Thomas and Kotz from their studies concluded that different patterns of rugae are genetically determined, and so can be rather used in population differentiation than individual identification.<sup>17</sup>

Thus the uniqueness, post mortem resistance, overall stability, and additionally low utilization cost makes palatal rugae an ideal forensic identification parameter.

By the identification of the rugal pattern a prosthodontist may identify the bearer of upper denture and some judgments are usually made by using ante-mortem impressions made for study models or prosthodontic consideration.

### **ELDER ABUSE:**

The dentist should be aware of child, elderly or spousal abuse when confronted with unusual oral injuries, especially in cases of persons with accompanying head or body injuries. Suspicion is

further aroused if, in the dentist's opinion, the nature of the injuries is inconsistent with the historical and chronological explanation of their origin. Abusive trauma to the face and mouth includes fractured teeth, laceration of the labial or lingual frenum, missing or displaced teeth, fractures of the maxilla and mandible, and bruised or scarred lips.<sup>18</sup>

Abuse is most often physical or in the form of psychological threats directed at the elderly, especially in old age homes & similar institutions.

A prosthodontist, who usually deals with geriatric patients, can help to identify abused patients by recording a detailed case history & understanding their psychology.<sup>19</sup>

For recognising an abuse a dentist should look for---

#### **1. HEAD**

1. bald spots (traumatic alopecia),
2. bruises behind ears (battle's sign),
3. skull injury

#### **2. EYES**

1. retinal haemorrhage,
2. Blackened eyes (raccoons sign).

#### **3. FACE**

1. fractures
2. bruises
3. lacerations
4. angular abrasions

#### **4. INTRA ORAL**

1. frenum tears,
2. palatal bruising
3. Residual tooth roots.

#### **5. TEETH**

1. Fractured, mobile, avulsed or discoloured teeth in the absence of reasonable explanations
2. Untreated obvious infections or bleeding.

### **CONCLUSION:**

Each practitioner has a responsibility to understand the forensic implications associated with the practice of his or her profession. Appreciation of the forensic field should give the dental clinician another reason to maintain legible and legally acceptable records, and assist legal authorities in the identification of victims and suspects. Role of forensic odontologists should include, that he is able to,

1. Recognising abuse,
2. Reassure the victim about confidentiality, and
3. Reporting to the proper agency.

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