

Role of Prosthodontist in patient identification in forensic odontology - An Overview

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Abstract:- *Victim identification is important in cases of natural and manmade disasters, especially in mass casualties. Dental Records have proven to be one of the useful methods of identification when all other methods fail. Prosthodontists play a key role in forensics by incorporating patient's records into the prosthesis they provide, by implant identification and also by using rugae anatomy in edentulous patients. Denture marking/labeling should be made mandatory and should be followed as a standard routine procedure as they provide valuable information and easy identification. This article will emphasize the role of prosthodontist in forensics, especially the various techniques and methods to incorporate a patient's dental records in the prosthesis.*

Key words: - denture marking, denture labeling, forensic odontology, victim identification, patient identification

INTRODUCTION

Forensic dentistry is that branch of dentistry, in the interest of justice, related with handling, examination, evaluation, and dental findings presentation.^[1] Victim identification in natural calamities, mass accidents especially in cases of unknown records or in demorphed cases is very important. The most commonly used methods of victim identification are visual identification, fingerprints, DNA profiling and dental records.^[2] Dentists play a major role in identification of the deceased in forensics. Dental records and the resistance of the dental structures in case of disasters make them valuable records for patient identification.

Dental records created before the death of the individual can be used for comparison of postmortem records. The records should be updated without any delay in the patient's record to prevent inconclusive identification or misidentification.^[3]

Prosthodontists can be of prime importance in patient identification by incorporation of patient records and details during the denture fabrication. They can be very useful in forensics by providing clues to the deceased or demorphed victims.^[3,4] Denture marking or labeling can be done routinely as a standard procedure which will be very much helpful.^[5] It also facilitates the identification of a patient in cases of unconsciousness, loss of memory and dementia especially in geriatric patients.^[6] In case of implant patients, the use of implant identification systems can be helpful in tracking the identification.^[7]

Rugae anatomy have been found to be specific and unique for individuals and rugoscopy has been tried as means for identification in edentulous patients in whom teeth cannot be utilized for identification.^[8]

This article will emphasize the role of prosthodontist in forensics, especially the various techniques and methods to incorporate a patient's dental records in the prosthesis and its use in victim identification in forensic odontology.

Denture Labeling/ Denture Marking:

Denture labeling is a well-documented technique useful in the victim identification in cases of disasters and also for patients who suffer from loss of memory.

Requisites of Denture Labeling/ Marking System:

The British Council on Prosthetic Services and Dental laboratory Relations has given standard guidelines on the requirements for denture markers:^[9]

- The strength of the prosthesis must not be compromised;
- It should not be technique sensitive, must be easy and inexpensive to apply;
- The identification system must be efficient;
- The marking must be visible and durable;
- The denture marker must withstand humidity and fire;
- The Labeling should be aesthetically acceptable;
- The mark should be biologically inert.

The marking should be permanent and resistant chemically and mechanically to daily cleansing procedures.

Significance of Denture Labeling in forensics:

1. It helps in identification of the dead or deceased when all other means have failed.
2. It helps in identification of individuals for forensics, social and legal reasons.
3. Identification of victims in mass disasters like terrorism, bombings, earthquakes, hurricanes, mass aviation crashes and road traffic accidents.
4. Identification of demorped/ mutilated and decomposed bodies

Denture Labeling Methods:

They can be broadly classified into

- Surface Marking methods
- Inclusion methods

Surface Marking Methods:

Scribing or Engraving method:

In this method the engraving is done directly on the denture with the help of a round bur on the tissue surface of the denture. The disadvantage of this technique is there is a possibility of food lodged on the surface irregularities of the engraving which may create an environment for bacterial infections.^[11-12]

Embossing Method:

In this method the patient's details are scrapped on the surface of the master cast and after the processing the details are transferred to the prosthesis on the intaglio surface. This technique is not recommended as there was a report of carcinoma due to constant irritation.^[11]

Invisible Ink Method:

In this method the patient's details are written with an invisible ink that will be visible only using an ultraviolet light. This method can be used in patients who are more aesthetically concerned. The disadvantage of this technique requires special conditions to view the identity details.^[13]

Fibre tip pen method:

This is a temporary method of denture labelling by writing using a fibre - tip pen on the surface of the denture and applying a layer of clear varnish over it.^[11]

Heath's Method:

In this technique the identity mark was made with spirit based pen or pencil and covered with a clear base polymer dissolved in chloroform. As chloroform is carcinogenic, this technique was later modified by the author by replacing chloroform with dental sealants.^[10]

Stevenson's Method:

Identification mark is made using a scalpel blade on the distobuccal flange of the denture and then the mark is highlighted with a graphite pencil. But the disadvantage is the mark did not last for long.^[10]

Wecker's Electro Pen Method:

The patient's details are engraved using an electopen on metallic removable and fixed partial dentures.^[10]

Laser Etching Technique:

This technique is used in cases of cast partial dentures. The etching was done using a copper vapor laser and the patient's details are etched into the metal surface of a partial denture. The copper vapour laser beam is focused and delivered to the material surface by the two-axis scanner mounted with mirrors.^[12]

Onion Skin Paper Method:

The patient's identification details are written on an onion-skin paper with a carbon marker and incorporated in the denture during the packing state at the trial closure. The onion paper is peeled from the denture after processing is complete, which leaves a carbon impregnation of the details on the surface layer of acrylic resin.^[10]

Denture Barcoding Method:

Barcoding is now commonly used for product details and billing in all the commercially available products. A bar code consists of a machine-readable code of a series of bars and spaces printed in defined ratios. Denture bar coding technique involves printing a number code on paper, photographing the paper and transferring the negative on a piece of silk. The barcode is directly placed onto the denture surface and cyanoacrylate resin is painted to conceal the marking.^[12]

Inclusion methods

These are methods where in the patient's details are incorporated within the contours of the denture without any alteration of the surface contour of the denture. These methods are more preferable as they don't alter the surface contour of the denture. Disadvantages include technique sensitivity, dislocation of the materials during the process of packing of the denture.

The different inclusion techniques are :

Lose Inclusion Method:

This is a simple and inexpensive technique wherein the patient's name is written on a piece of onion skin paper and incorporated within the fitting surface of the denture during the packing procedure.^[10]

Young's Method:

In this technique, a groove of 0.5–1 mm deep is created using a round bur in the buccal flange of the denture. The patient's name is written using a pen in the trough and sealed with fissure sealant.^[10]

Dippennar's Method:

Engraving of the patient's detail is done on a soft metal band and incorporated into the denture after making space in the denture. The metal band is resistant to fire accidents.^[10]

Reeson's Method:

Stainless steel tape of 9.5 * 0.125 mm thickness is engraved with patient's details and incorporated into the fitting surface of the denture during trial packing.^[14]

Resin T-bar Method:

A clear acrylic resin bar constructed in the shape of the letter T. Patient details are printed on label and fixed against the flat section of the bar with

the print facing inward. The surface of the resin is polished to produce a clear window displaying the identity label.^[10]

Oliver's Method: The patient's details are written with a permanent marker on a 0.3 mm thick rectangular sheet of heat cure acrylic resin strip and packed during the trial closure stage and covered with a thin layer of acrylic resin dough. Using acrylic resin sheet as marking material provides advantages that even if the tag moves during packing, and a corner protrudes through the denture surface, it can be corrected easily.^[15]

Lenticular Card Method:

Lenticular lens technology is used to produce images with an illusion of depth, morph 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 at least 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. They are printed on the back of a synthetic paper and laminated on the lens. The materials used for making lenticular images are polyvinyl chloride (PVC), amorphous polyethylene terephthalate (APET), acrylic, spectra, and polyethylene terephthalate glycol (PETG). The lens is incorporated in the recess cut on the denture and auto-polymerizing clear acrylic resin is added around the identifier.^[16]

Barcoding:

A barcode is an optical machine-readable representation of data which can be read with a barcode scanner. QR (Quick response) code is a form of bar code which is widely used nowadays. The patient's details can be entered in the qr code generator website and a QR code can be generated and printed on to paper or metal strips according to the desired size. The code is placed into the denture by creating space in the denture and covering it with autopolymerizing resin. The code can be read using a QR code application in smart mobile phones.^[17] In the technique described by Priya et al, they fed the patient's Aadhar unique ID in a QR code generator and obtained a QR code label which was incorporated into the denture.^[18]

Radio-Frequency Identification Tag:

Radio-frequency identification (RFID) is a wireless electronic communication technology used during World War II to identify aero planes. In this technique the patient's details are stored in a microchip. The RFID tag will be incorporated into the denture and the details can be read using a reader. The reader converts the radio waves transmitted by the transponder antenna into digital information which is then passed to a computer with applications to interpret it. This technique requires special equipment for reading the data.^[19,20]

Lead Foil Technique:

Lead foil with patient details on it is sandwiched between two layers of resin during processing of the denture. A radiograph of the denture will help in visualizing the patient details marked in the lead foil.^[21]

Metallic ID Bands:

In this technique foil of metal band (6*3 mm) with patient's details are incorporated within the denture by making space for the metal foil by creating recess using a round bur in the denture and sealing the band using clear acrylic resin. Example: Swedish ID bands. The Swedish ID-Band is a stainless steel band engraved with a ten figure personal number of patient details. The personal number consists of a letter (S- for Sweden) and a ten-figure number. The first six digits are the patient's birth date, date month, year with zero as a prefix to numbers smaller than ten. The next three digits is the birth number and the last digit indicates the sex.

This technique is easy and simple, the bands are corrosion resistant, temperature resistant but not more than 1100 deg C, do not require any special equipment and esthetically acceptable.^[22]

Photograph Inclusion Method:

In this technique the patient's details are written on a photograph with a graphite pencil and then incorporating the photograph in a clear acrylic denture base.^[23]

Incorporation of Min. I. Dent:

The Min. I. Dent denture identification strip is used for typing the patient information and then the strip is heated in an oven at 325 deg C for 30 sec to 1 min, which causes the letters to shrink and it becomes a chip. This chip is incorporated into the denture after creating space in the denture and clear acrylic resin is covered over the chip.^[24]

Data Matrix Code:

Thermally resistant substrate wafer consisting of two dimensional data matrix of light and dark colored regions representing binary 0 and 1 is scanned using a handheld scanner. It was found that auto polymerizing resin causes the wafer to dissolve partially making it unusable. So, direct laser engraving of the code into ceramic discs was carried out. The coded discs were incorporated into the heat cured clear resin at the packing stage of denture fabrication.^[25]

Micro Labeling Technique:

The following are the different techniques that have been used for micro labeling:

- (i) In the technique described by Coss, the patient's information was printed either on a 9 or 12 mm, white or clear label tape and it was incorporated at the time of denture processing or can be inserted after denture finishing.^[26]
- (ii) Ibrahim proposed his technique wherein, micro label was in a graphic image after incorporating patient details and recording the image on an instant Polaroid slide film. The patient information was keyed into the PowerPoint slide making format with a font size of 22 to produce a 15* 3 mm label. The graphic image on the computer was sent to the Polaroid digital palette, which contained an instant digital slide film. Then it was transformed into a 35 mm slide which was later cut as per the requirements and placed into a 1 mm groove prepared on the denture surface. The label was sealed using auto polymerizing clear acrylic resin.^[27]

(iii) In Ling's method the patient details are printed and photocopied onto a transparent film with 50% reduction in size and then treated with cyanoacrylate resin.^[28]

(iv) In the modified Ling's method the patient data is directly printed onto the overhead transparency sheet. Cyanoacrylate adhesive is applied over the printed matter and a same size blank transparency sheet is placed over it. This prevents the monomer from deteriorating the printer toner.^[10]

(v) In the technique proposed by Kamath, the patient's data is typed on a strip of absorbent tissue paper and placed on the tissue surface of the denture.^[29]

Incorporation of Embossed Identification Plate into Partial Denture Framework:

In this method, casting of the partial denture is done after incorporation of an embossed tape with patient details embedded into the major connector portion of the plastic pattern of the partial denture framework. As the marking is on the metal framework the identification is possible even in extremely disastrous conditions.^[21]

Ceramic Crown Engraving Method:

This method was tried in order to incorporate denture identification in fixed dental prosthesis. But the main disadvantage is the lack of space to incorporate the details. Here, the patient's initials are carved with a brush during the application of dentin porcelain and stains are applied over it followed by application of enamel porcelain.^[29]

Incorporation of Memory Card:

Memory card is an electronic storage device which can be used to store data files such as audio and video files, images and text documents. The patient's details such as personal information with the photograph can be stored in the memory card. The memory card is enclosed in a cellophane sheet and incorporated on the external surface of the palatal aspect of the denture and covered with a layer of auto polymerizing acrylic resin. This technique is simple and easy does not require special equipment and lies within the contours of the denture.^[30]

Implant Identification:

There are a wide range of implant systems with different designs available in the market of over 230 implant systems worldwide. Implant Recognition Software (IRS) is a software algorithm that helps in matching the implant, based on the data available in the web portal database. There are nine questions to be answered even if not all the information is known, then the data bank will be searched and those implant systems which meet the criteria will be listed. The following details are required: radiographic images of the implant, clinical images of the implant from above showing the trans-mucosal connector, and clinical images of the implant itself can be checked against the patient. Once the software has identified the implant system then a summed up report of that implant system outlining all the implant features, contact details for the implant manufacturer (e-mail addresses, web- page and conventional address and phone numbers) is provided.

This software program could be very much useful in victim identification by tracking the implant manufacturer, dealer, the dentist and the probable location of the patient.

Implant systems from StraumannTM, Nobel biocare and Ankylos contain batch numbers etched within the implants which are also useful tools in implant identification and also victim tracking.^[7]

Advantages of denture

Labeling/Marking^{[21]:}

- Patient identification
- Appliance identification
- Retrieval of dental records
- Diagnostic and decision support
- Recording and storage
- Quality assurance and quality control
- Complete and assurance documentation
- Improved accountability for purchasers/providers
- Ability to trace suppliers, materials, equipment

Rugoscopy:

The study of palatal rugae is called rugoscopy. The rugae are soft, irregular, asymmetrical ridges of mucous membrane extending laterally from the incisive papilla located in the anterior part of the mid palatine raphe. The arrangement pattern of rugae is considered to be unique to an individual. They can be used in cases of edentulous patients without dentures for identification. But the ante mortem data of the rugae pattern has to be stored by the dentist which can be utilized for comparison after death.^[8]

Conclusion:

Prosthodontists can play a major role in victim identification in forensic odontology by incorporation of the patient's details in the appliance or the prosthesis they provide. Different techniques have been proposed by various authors for denture marking. The technique should be simple, easy to fabricate, made of material which will withstand high temperatures and should be easily readable without any requirement of specialized equipment. Denture marking should be made mandatory and as a standard routine procedure as it provides valuable information in victim identification. In the future, more studies have to be done to incorporate patient details in fixed prosthesis.

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