Role of Denture Marking in Human identification- A Clinical Review

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Abstract

Identification is an essential requirement of any medico legal investigations. Identification of recovered bodies of those killed in accidents, aviation disasters, and/ or cataclysmic holocausts is important not only from a humanitarian point of view but also for legal reasons and in connection with insurance. Given that only one marked denture can reveal the identity of a deceased person when all other methods fail to do so, makes it worthwhile. The concept of personal ID from dental prostheses has been around for hundreds of years. Dentist can become valuable member of the dental identification process by using various denture marking techniques, which would be valuable in restoring patient's identity. This article is intended to review the available denture identification systems that makes the denture a self-addressing denture. Each of the commonly described systems are reviewed with an assessment of their strengths and weaknesses.

Keywords: *Denture identification; Denture labeling; Denture marking; Forensic dentistry*

Introduction

Denture marking is an acceptable means of identifying recovered bodies of those killed in accidents, aviation disasters, and/or cataclysmic holocausts. It also helps in identifying misplaced dentures in hospitals, nursing homes and geriatric institutions where hard-pressed nurse may remove the dentures from all the patients for cleaning en masse, to be subsequently confronted with the problem of returning the dentures to their rightful owners.

The concept of personal ID from dental prostheses has been around for hundreds of years. Paul Revere in 1775, made a set of dentures for Dr. Joseph Warren, who was killed at the Battle and was buried in a mass grave. Revere was able to identify his body through the dentures he had made, since his family wanted the body for a private burial.[1]

In the Bradford City, England, football club fire in May 1985, 50 persons died. Of these victims, 19 wore a denture of some sort, yet only one (2%) was identified by a marking on the dentures. If all the dentures had been marked, the identification of the victims by dental means would have risen to an impressive level. At the inquest on this tragedy in 1985, the jury made 20 recommendations, the first one being: "Clearer marking of dentures".[2]

In the attacks on the World Trade Center on September 11, 2001, around half of the estimated victims were ever identified through a mixture of DNA, jewelry, and dental records. In order to facilitate the ID of such individuals a number of forensic and governmental organizations have recommended that dental prostheses should be marked with, at a minimum, the patient's name , gender, phone number, address and preferably with further unique identifiers such as a social security number. Given that only one marked denture can reveal the identity of a deceased person when all other methods fail to do so, makes it worthwhile.

As suggested by Kruger-Monson[3] denture markers should be biologically inert when incorporated into the denture, in-expensive, easy to inscribe, possible to retrieve after an accident, strength of the prosthesis must not be jeopardized and must survive elevated temperature for a reasonable time. The recommended areas for marking are the posterio-lateral region of the palate in maxillary denture or lingual flange area in mandible denture for esthetic region. The recommendation issued by the National Board of

Health and Welfare states that "the patients shall always be offered denture marking and be informed about the benefit there of. Denture marking is not permitted if the patient refuses it".

Over the years, several methods have been reported which can be broadly separated into surface marking system, inclusion system and novel methods.

Surface marking systems

In the surface marking methods, marks are scratched, engraved or written onto the surface of the denture or denture cast. Heath[4] employed a method of writing on the surface of the denture using a spirit based pen or pencil before covering the ID mark with a clear denture base polymer dissolved in chloroform. Though simple and cheap, it does have disadvantages. ID mark possesses poor abrasion resistance hence cannot be considered permanent. Secondly, chloroform is a known carcinogen.

Stevenson[5] described a method in which a scalpel blade is used to scribe a mark on surface of the denture which is then highlighted with a graphite pencil. The technique appears quite crude, unaesthetic, and possesses poor potential in terms of plaque.

Another technique involves scribing an ID mark directly into the working cast before denture processing. This produces a positive embossed mark on the fitting surface of the processed denture. However, this type of ID mark has proved less popular owing to the fact that it can cause irritation of the patient's mucosal tissue and may result in a plaque trap that may contribute to candidal infections.[6]

Inclusion systems: In contrast to surface marking, inclusion methods enclose the identifying marks within the denture base material, hence rendering them relatively permanent. Harvey[7] cited several materials suitable as identification markers: waxed papers, onion papers, cloth nylon, kitchen foil, mixing pad paper. These can be placed in the denture by making appropriate space and covering it with clear polymethyl methacrylate (PMMA). The characters are coated with cyanoacrylic acid (superglue) prior to incorporating the label into the denture in order to protect them from the solvent effects of the denture base monomer.

Lead foil can also be used for the same purpose[8] cut a piece of lead foil from a used IOPA radiographic film and write the patient details with ball tipped pen on it. Place the lead foil in the specified area and cover it with acrylic. The idea is to place the foil in the layers of acrylic. The patient details that the lead foil contains can be viewed in the intra oral periapical radiograph (Fig. 1 & 2).

Another means include patient's details on **A4 paper** (Fig. 3) and **tranparency film** (Fig. 4). A character with a font size of 10 was used to produce a readable label. The processed slide is then cut to the correct size before being placed into a space 1mm in depth and is moistened with the monomer.

The above mentioned methods are ''simple, non-time consuming, and effective.'' However, such a system would be ineffective against fire Because of the flammable nature of many of the identifying materials. Furst[9] advocated use of thin (0.001 inch) metal strip of stainless steel commonly referred to as shim stock, on which details of the patients can be engraved with electropen or bur. This material, he claims, has a melting point of 1500^0C and can withstand thermal insult. Stainless steel has a good biocompatibility and high corrosion resistance in oral environment and does not cause any allergies.

Fig. 1: Lead foil inclusion method

Fig. 2: IOPA radiograph of lead foil in the denture

Fig. 3: A4 sheet inclusion method

Fig. 4: Transparency sheet inclusion method

Patient photograph

The major advantage of the photographic marker is that identity is easily ascertained by lay persons with the unassisted eye (Fig. 5). Photographic markers are also relevant in the Indian context where one-third of the population is illiterate and diverse scripts are used across the country, making interpretation of written data challenging at times. Although the photographic marker has low fire resistance, it may be useful in forensic contexts since dentures retained in the mouth are well-protected by the oro-facial tissues and may survive incineration.[10]

Fig. 5: Photograph inclusion method

Fixed Partial Denture

In this tech, only initials can be carved in crowns and bridges due to lack of available space. Initials can be carved on the lingual surface of the anteriors and posteriors (Fig. 6). Occlusal surface of posteriors is not preferred because of possible occlusal adjustments. The opaque is removed in areas of carving. After baking, dentin porcelain is applied and Initials or letters can be carved in it with the brush and Stains can be applied on the carved initials. Then enamel porcelain is applied and shaped with soft brush. Thus, the initials are maintained. Baking has to be done according to manufacturer's instructions. Now With the help of diamond points, the grooves of the carved initials can be defined properly. Transparent porcelain is applied carefully over the initials to fill the grooves and baked. Then the final glazing is done.[11]

One of the major drawbacks common to all of the methods reviewed so far relates to the limitation of actual amount of data that can be written onto an ID label. So other methods need to be employed in order to maximize the amount of data that can be incorporated in the denture.

Fig. 6: Marking on FPD

Fig. 7: Microchip inclusion method

Lenticular card

Lenticular printing is a technology in which a lenticular lens is used to produce images with an illusion of depth, 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 existing images and combining it with a lenticular lens. This process can be used to create various frames of animation (for a motion effect), offsetting the various layers at different increments (for a 3D effect), or simply to show a set of alternate images which may appear to transform into each other. This technology can also be used in dentistry to store a large amount of patient information. Lenticular card having patient detail information can be placed into an existing denture. It is a simple, cheap, and non-time consuming technique and does not require special glasses or devices to read the data. The disadvantage of this technique is that the information can never been changed, moreover the lenticular card does not withstand fire.[12]

Electronic chip

This technique involves use of electronic microchip. Microchip is placed inside the denture (Fig. 7). Patients Information is transferred to the chip via the read/ write pen and backed up via an SSD and/or a PC to ensure data preservation. The higher is the memory of the chip large is the amount of data that can be stored in it.[13]

Radio frequency identification tag

The acronym RFID stands for radio-frequency identification, which is a wireless electronic communication technology. It can also be employed as an aid for forensic dental identification by placing it in dental prostheses. The RFID system consist of a data carrier, generally referred to as a tag or transpoder and a reader with an antenna (Fig. 8). 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 that are then passed to a computer with applications to interpret it. Tags are categorized as either read or read/ write. The tags are so positioned in the denture that their long axis parallel to occlusal plane, with the antenna orientated mesially (Fig. 9). There are several advantages in using this system. The dentist can easily set the tag in the denture without requiring special training. There is no real weakening of the denture because of the tag's size. Finally, the procedure is economical, making it a viable option.[14]

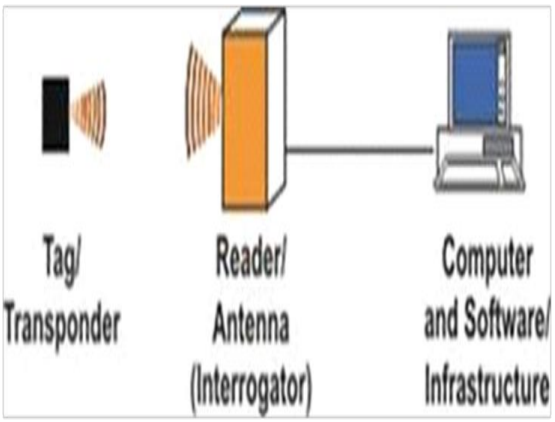

Fig. 8: RFID system

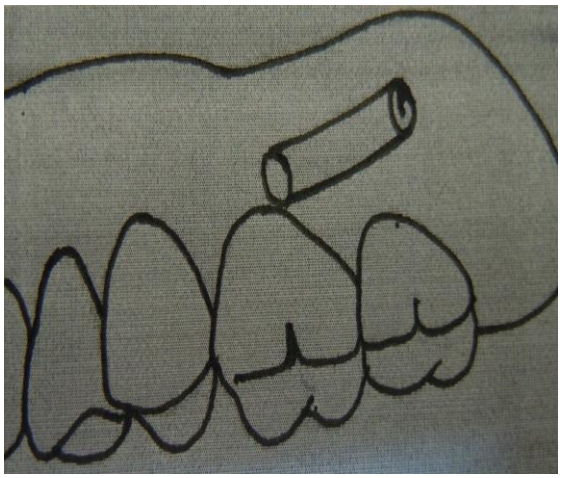

Fig. 9: Position of tag in denture

Bar code

Barcode, in its simplest form, is a set of bars and spaces representing alphabet or numeric data for identification of a particular product, service or a process (Fig. 10). Barcode technology is the best-known and most widely used method of Automatic Identification. Automatic identification encompasses the automatic recognition and recording of data, most commonly through the printing and reading of information encoded in barcodes thereby eliminating risk of human error.

A Barcode system, typically, consists of three components:

1. **Origin:** source of barcodes. These can be printed on source or on-demand using thermal barcode printer, and software.
2. **Reader:** A reader (scanner or a data terminal) is used to read, and decode barcodes. A reader can be either hand-held or portable or mounted as a fixed device.
3. **Computer System:** Finally, a barcode system is usually a part of larger system or application software for collecting and managing information.

Barcodes allow for rapid, simple and accurate reading and transmission of data for items that need to be tracked or managed. Barcode containing patient's details can be included in the denture in the same way the other inclusions are done. The advantage it owes is that the high amount of information can be stored in this with in the same dimension of inclusions as used above.[15]

Fig. 10: Bar code system

Discussion

Denture marking or labeling is not a new concept in either prosthetic or forensic dentistry and its routine practice has been urged by forensic dentists internationally for many years. Various methods of denture marking have been reported in the literatures over the years. Surface methods seemed easy to apply and inexpensive but they worn off easily. The inclusion methods are relatively more permanent and provided a positive result, but the amount of data that can written on them is limited and a well trained personnel in laboratory is required. Sophisticated alternatives like barcode system, RFID system, microchip inclusions and lenticular system may provide valuable information but prove too expensive to be commercially viable. However, considering the social and practical value of the denture marking, there is urgent need for denture marking by the dentist. Further research is required to determine the ability for each of these methods to withstand the commonest of perimortem assaults and also which are most favored by patient and doctor. Without the acceptance of denture labeling by

patients the uptake of any technology will be limited.

Conclusion

Everyone has a right to recognition everywhere as a person. Identification of living as well as dead in essential. The importance of placing identification marks on dentures has long been acknowledged. Individuals who have been subjected to these identification marks may be carrying their visiting cards in their oral cavity. Prosthodontists can become valuable members of identification process by using the above mentioned techniques to mark dentures.

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