

Denture Marking for Forensic Identification Using Memory Card: An Innovative Technique

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Abstract Identification of individuals in crime or mass disaster is a daunting task for the forensic experts. The purpose of this study is to evaluate the feasibility of using a memory card for the forensic identification of dentures. The memory card was programmed with all the relevant information regarding the patient identification and the photograph of the patient. A recess was made in the maxillary denture's polished surface on the palatal aspect. The card was wrapped in cellophane, placed in the recess and then covered with pink auto polymerizing acrylic resin. On retrieval of the card from the denture, the entire data could be read as before without any distortion. The identification cards did not pose any problems in function and speech and were esthetically acceptable by the patients.

Keywords Forensic odontology · Memory card · Denture identification

Introduction

Forensic odontology, or forensic dentistry, was defined by Keiser-Neilson in 1970 as “that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings” [1].

It is mandatory on the part of a dentist to identify and treat oral disease. Equally important is to prepare the detailed records of the patients, maintain them for longer durations and be able to retrieve them as and when required. These records include detailed personal history like patient's name, date of birth, address, contact numbers, e-mail, contact numbers of spouse or close relatives, treatment records with photographs and the X-rays, names and contact numbers of the family physician and the treating dentist. Advancement of the computer technology has made it possible to store the data of a large number of patients for long periods of time. This data can be of immense help in case of injury, unconsciousness, crime or disaster.

In the edentulous individuals, charts of dentition, DMF indices and restoration records are not possible but a set of complete dentures with identification markers can be of some help.

Different methods of denture marking have been tried over the years.

The aim of this article is to demonstrate the feasibility of making a dental prosthesis with an incorporated memory card, the technical protocols for its implantation in the denture resin and its working principles.

Review of Literature

Many instances can be quoted in the history where forensic identification of the dentition of the slain has been carried out like in the cases of Hitler, the late Indian Prime Minister Mr. Rajiv Gandhi and the late president of Pakistan, Zia-ul-Haq [2]. Rai and Anand [3] studied the use of forensic odontology in identification cases of earthquake of Sumatra in 2004.

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Table 1 Various techniques of denture marking

Name and year of contribution	Technique	Advantages	Disadvantages
Surface marking techniques			
Stevenson (1987) [5]	Scraping patient's name with the tip of a surgical blade highlighted with a graphite pencil	Simple and quick Cost effective	Can make denture rough and difficult to clean Tissue irritation
Heath (1987) [6]; (1988) [7]	Writing on the surface of the denture using a spirit based pen and then covering it with dental sealants	Simple and quick Cost effective	Can be removed during cleaning procedures or relining
Inclusion techniques			
Lose (1958) [8]	Patient's name is typed on a thin paper, then included in the denture during the trial closure	Simple and quick Cost effective	Limited amount of information Not fire resistant
Dippennar (1986) [9]	Insertion of a rolled soft metal band into a predrilled cavity and then the plugging it with self cure resin	Fire resistant	Markings not readily visible Difficulty in writing on a thin metal strip with a bur
Cotter (1988) [10]	A small round micro-metal chip embedded in the denture and covered by clear acrylic	Cosmetically discrete Chip readable after burning for one hour at 1,500 °C	High cost Limited information
Reeson et al. (2001) [11]	Stainless steel tape	Fire resistant	Limited information
Rajan and Julian (2002) [12]	Microchips	Small size Aesthetic	High cost
Ling et al. (2003) [13]	A copper vapor laser (CVL) can be used to label the cobalt-chromium components of metallic dentures		Cannot be used for acrylic prostheses Special equipment required
Venkat and Shenoy (2006) [14]	Use of a lead foil	Simple and quick Cost effective	Limited information
Agulo et al. (2009) [15]	Barcodes incorporated into dentures	It can survive temperatures above 600 °C	Scanning of barcodes may be difficult, needs a computer database
Rajendran et al. (2012) [16]		Barcode systems can contain large amounts of data	The curvature of the denture may cause distortion of the barcode, making it unreadable
Millet and Jeannin (2004) [17]	Radiofrequency identification (RFID) system consists of a data carrier (tag or transponder), and a reader with an antenna	In contrast to the barcode system, there is no need to have a database on a computer	The hand held reader may not exist in every hospital
Nuzzolese et al. (2010) [18]			The chips do not have a large amount of data space
Madrid et al. (2012) [19]			Cellular phones in the vicinity can affect readout ranges

Denture marking to assist in the identification was first proposed by Cunningham [4] and brought into focus by Dr. Robert H. Griffiths during his tenure as president (1982) of the American Dental Association [5].

According to the requirements for denture markers outlined by the council of Prosthetic Services and Dental Laboratory Relations, denture labeling should in no way affect the strength of denture, it should be biologically inert, must withstand fire and humidity, be esthetic and durable. [4]. So far, none of denture marking systems have been able to satisfy all of these requirements.

Various methods have been reported in the literature for the insertion of an identifying label during or after the fabrication of dentures. These include *surface marking* and *inclusion* techniques [5]. The various techniques with their advantages and disadvantages are given in the Table 1.

Materials and Method

A memory card is an electronic data storage device used for storing a wide range of data files, such as audio and



Fig. 1 Memory card

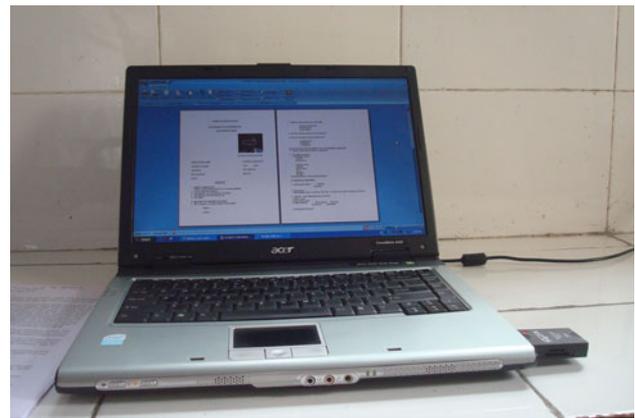


Fig. 4 Stored data being read on computer using a card reader



Fig. 2 Memory card reader



Fig. 5 Recess prepared in denture for memory card



Fig. 3 Memory card inserted into card reader

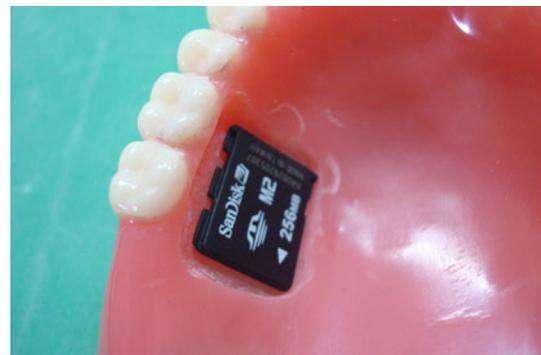


Fig. 6 Memory card placed in recess

video clips, images and text documents (Fig. 1). It is small in size, re-recordable and it can retain data without power. There is a wide range of memory cards of variable sizes and storage capacities available in the market by different brand names like SanDisk, Kingston, Sony, Samsung etc. SanDisk SD (Secure Digital) memory card was chosen in

this study for the purpose of denture marking because of its easy availability and universal acceptance.

The data in the card can be read on any personal computer using Windows Operating System with the help of a memory card reader (ATEK China) (Figs. 2, 3, 4). A memory card reader is a device using a USB interface, for accessing the data on the card. Together with the card, this can function as a pen drive.



Fig. 7 Wrapping of card with cellophane



Fig. 8 Embedded memory card covered with pink acrylic

The patients were fully informed and gave their written consent to participate in the study. The study was presented in front of the Institutional Ethical Committee and the approval was taken.

All the relevant information regarding the patient identification and the photograph of the patient were stored in the memory card. The memory card with the patient details was inserted in dentures of four patients as well as in a sample denture. The technique of insertion is described below.

- (1) For the selected patient, the complete dentures were fabricated following the routine standard clinical and laboratory procedures.
- (2) The routine denture insertion process was completed.

(3) The prosthesis was cleaned, disinfected and dried before beginning the incorporation process.

(4) An (18 × 15 × 1) mm recess was made in the maxillary denture's external surface on the palatal aspect with a carbide bur (Fig. 5). This dimension is required to incorporate the card (15 × 11 × 0.7) mm without structurally weakening the denture (Fig. 6).

(5) The previously programmed card containing patient details was wrapped in a thin cellophane sheet to protect it from polymer powder and liquid. Care was taken not to increase the thickness (Fig. 7).

(6) The card wrapped in cellophane was placed in the recess and covered with pink auto polymerizing acrylic resin (DPI-RR Cold Cure, Dental Products of India Ltd., Mumbai) eliminating any trapped air bubbles (Fig. 8).

(7) The denture was then processed in a pressurized container with warm water (40°, 25 psi) and was finished and polished.

The card was visible through the pink acrylic resin and was esthetically acceptable to the patient.

The card from the sample denture was retrieved and the cellophane covering was removed. It was inserted in the card reader and checked for its contents. The entire data could be read as before without any distortion. The marked dentures given to the patients were also checked at regular intervals. The identification cards did not pose any problems in function and speech and were well accepted by the patients.

With the introduction of Triad VLC System (Dentsply International Inc., York, PA) the procedure can be simplified by the use of a special light polymerized Triad gel in place of chemically cured resin. This eliminates the need of a pressurized curing unit [20].

Discussion

There are several advantages in using this labeling system. It does not interfere with the oral function or the strength of the denture because of its small size. There is often sufficient thickness of resin for the card to be incorporated without any technical difficulties. No special training or a dental technician is required and the device incorporation can be made in the dental office. Finally, the cost of a 2 GB memory card is around 250 Indian rupees making the procedure a viable option. The data will remain stable in the card. In the event of a disaster, the card can be retrieved from the denture and read on any computer using a card reader which is easily available.

There are certain limitations to the use of memory card as a denture marking system.

In the event of excessive impact which can damage or fracture the denture, the card can also be damaged which otherwise is cushioned by the dentures and the tissues of the head and mouth. Samsung has announced a line of memory cards that are shock proof and resistant to water [21].

The heat resistance of these cards has not been established. Sony micro SD memory cards claim to be both shock resistant and temperature tolerant from -25 to 85 °C [22].

Exposure to fire can cause damage to the card. In a study conducted by Rotzcher et al. [23], it was found that if the acrylic dentures in the skull were heated at 400 – 600 °C for 30 min, only the front teeth of the acrylic dentures were burned after 10 min and after 16 min anterior parts of dentures until premolars were burned. In fire accidents or aviation disasters, temperatures of 600 °C are usually encountered [15]. The memory card is inserted in the palatal aspect of the posterior region of the maxillary denture. Hence it is afforded some protection in case of fire. However, in extreme cases the card will get burnt and may not provide the necessary link to prove identity.

Another limitation of using a memory card for denture marking is that retrieval of the card is done by a dentist or a trained dental technician with a laboratory micromotor using a straight handpiece which may not be always available at the site of the disaster.

Further research should be carried out into improving and simplifying methods of labeling dentures. Advantages of the denture marking should be presented to all patients [24]. The profession must be encouraged to routinely mark all dentures.

Conclusion

Forensic dentistry has long considered marking of dentures, although no standardized method has been developed. The incorporation of a memory card into the denture base and its subsequent retrieval for post-mortem identification of victims of murder, suicide or in case of a disaster like floods, train accidents, building collapse or earthquakes, could make it a valuable tool in the hands of the dentist for forensic purposes.

Further investigation is needed to evaluate memory cards' technical performance under a range of post-mortem trauma such as high temperatures and impact during a disaster or for damage resulting from everyday wear and tear and other environmental conditions.

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