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Denture bar-coding: An innovative technique in forensic dentistry

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ABSTRACT

Denture markers play an important role in forensic odontology and also in identifying a person. A number of methods are there for identifying dentures from a less expensive technique to a more expensive technique. Out of different denture markers, the bar-coding system is a way of collecting data from the mobile. Even a huge amount of data can be stored in that. It can be easily incorporated during acrylization of the denture and thus could be helpful in identification. This article reviews the strengths of bar-coding and how easily it can be used in the routine procedure.

KEY WORDS: Barcode, denture markers, forensic dentistry, mobile camera

The main challenge faced by a man in early days is to provide the identity of an individual.[1] Human Identification is a prerequisite for personal, legal and social reason. Forensic dentistry is one of the most innovative branches of dentistry, which helps identify victims in mass disasters and in many medico-legal investigations.[2] Various recommendations have been made concerning the importance of denture identification. Identification of dentures provides vital clues in recognizing the denture-wearer and takes vital significance especially in the field forensic dentistry effectively bringing closure to the case.[1]

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Labeling the denture is recommended by forensic odontologists and most international dental associations. In few countries, the

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labeling of dentures is regulated by legislation. As an obligation, the dentist has to maintain meticulous dental records of his patients. This would also include documenting the identity of dentures.[3] The American Board of Forensic Odontology guidelines indicates that most dental identifications are based on caries, missing teeth, prosthetic devices, and restorations. The purpose of denture marking thereby not only assists in the return of a lost denture, but also it will also add the identification of edentulous persons who are either living or deceased.[4]

Bar-coding is a way of transferring data from the camera attached mobile. We can obtain general data's like name, sex, age, occupation, phone number, address, and nationality of the patient, which can be scanned. After barcode scanning, the information can be retrieved, added, or subtracted. In advancing world, every product has a barcode associated with it.[5]

Requirements of Denture Bar Coding Identification[6]

- The strength of the prosthesis must not be jeopardized
- It must be easy and inexpensive to apply
- The identification system must be efficient[6]
- The marking must be visible and durable
- The identification must withstand humidity and fire
- The identification mark should be aesthetics acceptable[7]
- The identification mark should be biologically inert
- The marking should be permanent and resistant to everyday cleansing an disinfecting agents.[6]

Technique of Denture Bar-coding

First we have to generate a two-dimensional (2D) barcode which should have details such as name, age, gender, address, phone number, and social security number with a code generator (QR 2, Kaywa-Code Generator, beta v1.000, Kaywa AG, Zurich, Switzerland). Make the 2D barcode label 10 mm × 10 mm in size and square in shape to decode information with ease [Figure 1].[5] Print the code on paper and laminate it to prevent the ink from scattering on contact with the methyl methacrylate during denture fabrication.[8] Position the laminated label in a recess 1 mm deep created on the palatal surface of the complete denture or in a more suitable site. Note that the marker may fail to decode if placed on a deep curved surface.[5] Fill the recess with clear autopolymerizing resin (DPI-RR Cold Cure, DPI Products and Services Ltd., Mumbai, India) before trimming and polishing in a conventional manner[9] [Figure 1]. Hold a code decoder-enabled mobile camera (i-nigma, v3.10.02, 3GVision, or Yehuda, Israel) against the label for the code to be deciphered [Figure 2]. Observe that the recognized code is translated into text on a mobile phone display[5] [Figure 3].

Advantage of Denture Bar-coding

- The system speed allows tracking to be done quickly
- Barcode verification is the best way to ensure 100% scanning[10]

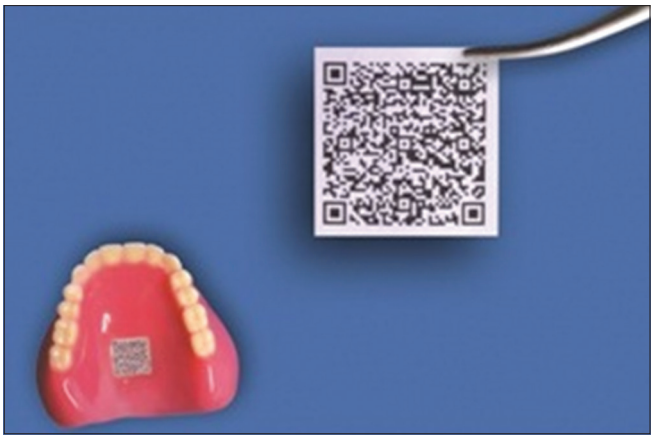


Figure 1: Barcode incorporated into denture



Figure 2: Mobile is used to decode the barcode



Figure 3: The barcode decrypted

- They are reliable method of entering data and it is least expensive
- Bar-coding is useful in forensic odontology and in medico-legal aspects.[5]

Disadvantage of Denture Bar-coding

- Patients need to carry their dentures wherever they go
- Denture incorporated with a barcode if not in use should be thoroughly discarded on medicolegal grounds.[5]

Table 1: Comparison of barcode denture marker with other marking systems

	Engraving	Photograph	Stainless steel	Labeling	RFID	2D bar-coding
Readability	+++	+++	+++	+++	++	++
Volume of information	−	+	+	−	+	+++
Ease of fabrication	++	+	++	+	++	+++
Cost effectiveness	+++	++	++	++	+	+++
Resistance to fire	−	−	+++	−	+++	++
Advantage points	8	8	11	6	9	13

(+): Advantages, (−): Disadvantages. RFID: Radio-frequency identification, 2D: Two-dimensional

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Discussion

In a developing country like India, an insufficient database of the citizens, antemortem medical and dental records have challenged the forensic science. The 2D barcode can hold voluminous information like case sheets and images. This technique is very simple, cost effective, and the incorporation of the marker does not need any special laboratory techniques. They can be very useful in dental hospitals with large patient volumes and where students have multiple complete denture patients at any given time ensuring rapid recognition and minimal risk of denture exchange and cross-infection. Furthermore, the equipment is necessary to produce the markers are universal, and the marker itself is easy to generate and cost effective, which is in contrast to other markers. From the forensic point of view, dentures with barcode markers recovered from the deceased may be easily recognized by the help of a mobile camera. Since the 2D barcode can hold photographic details [Figures 2 and 3]. The denture can also be connected with antemortem photographic records to facilitate identification. Nevertheless, thermal tests revealed that the photographic marker and barcode were only resistant to around 200–300°C, which is considerably lower than for the metal matrix band (1050°C), this being similar to that of other metal marker. That's why the metal markers are considered as most ideal for postmortem identification.[8] However, very high temperatures are reached only in extreme circumstances and conditions in different fire situations. Certainly, others have questioned whether the denture markers need to withstand high temperature at all as dentures are well-protected by the buccal pad of fat of the cheeks and the muscular tongue; therefore, any type of mark in the denture is placed posteriorly which can be retained in the mouth during a fire will remain reasonably undamaged and survive incineration. Richmond and Pretty have stated five idea requirements of a denture marker, one of that is, if fire resistant is not there in the mark "then it has to be positioned palatally or lingually in the maxillary or mandibular molar region, and hence that it can be protected by the tongue"; positions adopted by the barcode marker in this study. Moreover, Rajendran *et al*.[5] reported that a great majority of edentulous individuals who require to be identified are recovered in a decomposed state (usually from their home) and incineration may not be an issue. The main drawback of metal markers is that comparatively less patient information can be gathered. Furthermore, with the obsolescence of type-writers, the information needs to be engraved by hand, which may not be read easily. In fact, some authors have criticized the metal markers and questioned the logic behind the use. In contrary to the existing denture markers, the electronic denture marker using barcodes have considerable amounts of patient data and can be written and read using mobile devices. A more recent innovation denture marker using a radio-frequency identification appears encouraging in its storage capacity, but it is also associated with the cost and availability of raw material can make its use very limited. A barcode marker has a minor disadvantage, which is that related to the size. The size requirement of at least 12 mm^2 may limit its use in removable partial dentures. This technique has a major advantage that a mobile camera would sufficient to encrypt and decode the information in and from the code. With the above-mentioned advantages and the comparison among different denture markers which are showed in the [Table 1], the use of barcode as a denture marker can be definitely encouraged in our day-to-day denture practice. Patient consent has to obtain before the incorporation of the barcode in the denture, which will avoid certain legal problems.

Conclusions

The major reason for not marking dentures is a lack of awareness of the various methods and a belief that it has very little importance. The value of labeling dentures is immense when a positive identity of an individual is required. This has been emphasized frequently by the forensic odontologists. Therefore, an appropriate framework within dental education is required to ensure that both dentists and dental students are exposed to denture marking methodologies. Among the denture labeling, bar-coding technique provides us the better data's and because of improving technologies every person have a smartphone with the help of that we can easily view the details present in the denture barcodes. Accordingly, in future, researches should shift their focus on developing the barcode technique so as to increase the domain of its usage.

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