



Barcoding in Orthodontic Appliances: An Application-based Perspective in Forensic Odontology

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ABSTRACT-

Background: Barcoding has been used in prosthodontic dentures for identification since time immemorial. However, its incorporation in orthodontic appliances is yet to be done. The current study aims to assess the potential of barcoding in orthodontics for removable appliances.

Aim: To study if barcodes can be incorporated in various orthodontic appliances, making them an efficient tool in forensics.

Methodology: With prior patient consent, 5 study models of different categories of Removable Orthodontic appliances (Hawley's appliance, Hawley's with tongue crib, Twin block, Translingual arch, Nance appliance) were included in the study. These models were incorporated with the barcodes containing patient's data. The code decoder-enabled scanner was used to decipher patient records from incorporated barcodes.

Results and Conclusion: Barcoding removable orthodontic appliances can be extremely valuable when establishing a person's identity, particularly in the context of forensic odontology. Barcoding technology has the potential to revolutionize forensic odontology by providing a more accurate and efficient way to identify human remains. To guarantee that dentists and dental students are exposed to marking procedures for removable orthodontic appliances, a suitable framework for dental education is necessary.

Keywords: Barcode, forensics, removable orthodontic appliances

Introduction:

Forensic odontology is a specialized field that uses dental evidence to assist in criminal investigations, identify unknown victims, and provide information about the deceased in mass disasters. In recent years, Barcoding, an automated identification method has emerged as a revolutionary technology in the fields of healthcare and forensics to identify people and assets in mass disasters¹.

Traditionally, dental identification has been a time-consuming and labor-intensive process that relies on visual comparison of dental records and radiographs. However, with the advent of barcoding technology, this process can be streamlined and made more accurate. In orthodontics, barcoding can revolutionize forensic odontology by providing a more accurate and efficient way to identify human remains².

Barcoding in orthodontics involves the use of unique barcodes to identify individual teeth and dental appliances such as removable appliances, myofunctional appliances, and removable retainers. This technology allows for the

creation of a digital dental record that can be easily accessed and shared between healthcare providers and forensic investigators. By scanning the barcode dental records can be quickly retrieved and compared to those found at a crime scene or mass disaster site.

Barcoding also provides an added layer of security by preventing mix-ups or errors in dental identification. Each tooth or dental appliance is assigned a unique barcode which cannot be duplicated or confused with another's. This ensures that the correct dental records are matched

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with the correct remains, reducing the risk of misidentification or false matches.

Moreover, barcoding technology allows for real-time tracking of dental appliances such as removable appliances, myofunctional appliances, and retainers. This is particularly useful in cases where individuals are wearing these appliances at the time of their death or disappearance. By scanning the barcode on the appliance, investigators can quickly determine if it belongs to a missing person or if it is associated with a crime scene.

Identification is a crucial aspect of any medicolegal investigation in forensics³. Labelled dentures serve as a means of easy identification for dental professionals and forensic experts. International dental associations and forensic odontologists highly recommend this practice, and it is even regulated by legislation in the USA⁴.

the orthodontic appliances with a barcode may:

1. Serve as a tool to Compare the post-mortem with anti-mortem records during mass casualties.
2. Help in the Identification of deceased individuals in Forensic Odontology.

However, the barcode should be easy to incorporate, Inexpensive, not alter the structure, and not affect the adaptation of the dentures. It should resist high labelling temperatures.

This study aims to incorporate barcodes in the various orthodontic appliances so that they may serve as an efficient tool in forensics.

Materials and Methods:

This study was conducted in the Department of Orthodontics & Dentofacial Orthopedics, Faculty of Dentistry, Jamia Millia Islamia. With prior patient consent,⁵ study models of different categories of Removable Orthodontic appliances were included in the study. These appliances were:

1. Hawley's appliance (Figure 1)
2. Hawley's with tongue crib (Figure 2)
3. Twin block (Figure 3)
4. Translingual arch (Figure 4)
5. Nance appliance (Figure 5)

The following step-wise procedure was done to incorporate a 2-D barcode in the removable appliance: (Figure 6)

Step 1: A two-dimensional barcode containing name, gender, age, address, phone number, and medical history was created using a code generator accessible within the



Figure 1: Removable Maxillary Hawley's orthodontic appliance with barcoding



Figure 2: Barcoding in Removable Maxillary Hawley's orthodontic appliance with Tongue Crib.



Figure 3: Barcoding in Removable Twin Block myofunctional appliance



Figure 4: Barcoding in Translingual arch appliance



Figure 5: Barcoding in Nance palatal arch appliance

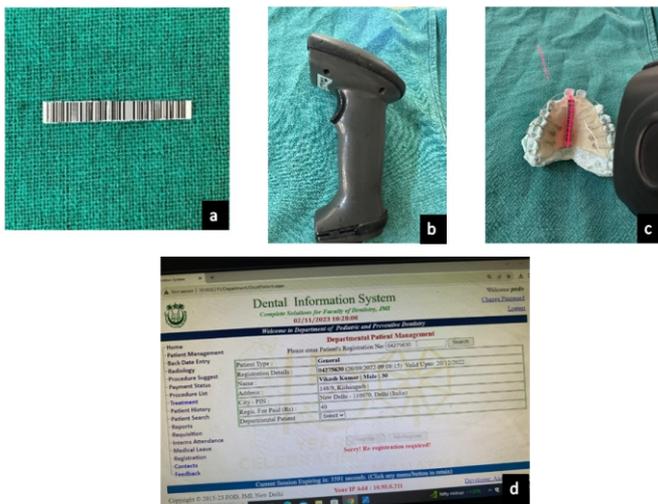


Figure 6: Step-wise procedure to incorporate a 2-D barcode in the removable orthodontic appliance: a) 2-D bar code label b) Scanner c) Laminated code incorporated within thin layers of transparent auto-polymerizing acrylic resin d) Patients' dental information system.

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Step 2: The 2-D bar code label was printed on paper and laminated.

Step 3: Subsequently, the laminated code was incorporated within thin layers of transparent auto-polymerizing acrylic resin (DPI-RR Cold Cure DPI Products and Services Limited, Mumbai, India).

Step 4: The bar code was placed on removable orthodontic appliances, followed by conventional curing procedures.

Step 5: The recess was filled with clear auto-polymerizing acrylic resin before trimming and polishing. After finishing and polishing we scanned the 2-D barcode in all the removable orthodontic appliances. The code decoder-enabled scanner was used to decipher patient records from incorporated barcodes.

Declaration of patient consent: The authors confirm that they have acquired all necessary patient consent forms. In

these forms, patients have granted consent for the publication of their images and other clinical information in the journal as required.

Results and Discussion

Within a brief moment, the identified code was converted into text and appeared on a computer screen, presenting the patient's data. During our experiment it was found that barcoding of removable orthodontic appliances was inexpensive, durable, biologically acceptable and sufficient to generate identification on scanning. Barcoded removable orthodontic appliances were aesthetically acceptable and impervious to routine cleaning with disinfectant agents.

Barcoding has been used for patient identification in complete dentures and partial dentures for a long time, but its use in orthodontic appliances is yet to be established. This can be a valuable tool to aid individual identification for forensic purposes. A study by Kapoor P et.al demonstrates the potential of barcoding in orthodontics for inventory management, record keeping, patient and student education, appliance tracking, and the scope of barcoding as an adjunct forensic tool¹⁰. The authors have compiled the scientific literature related to the practical application of using barcodes in dental appliances (Table 1).

identification and as an adjunct in forensic identification

Conclusion:

Barcoding removable orthodontic appliances can be extremely valuable when establishing a person's identity, particularly in the context of forensic odontology. Barcoding technology has the potential to revolutionize forensic odontology by providing a more accurate and efficient way to identify human remains.

Barcoding of removal orthodontic appliances can serve a crucial role for forensic investigators in identifying individuals during accidents, cases of dementia, states of unconsciousness, or instances of missing persons. It is also instrumental in the identification of deceased individuals in natural disasters. Various marking systems for removable orthodontic appliances have been documented. To guarantee that dentists and dental students are exposed to marking procedures for removable orthodontic appliances, a suitable framework for dental education is necessary.

Conflict of interest:

The authors declare that they have no conflict of interest.