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Smart Dentures - QR Code Integration in Complete Dentures for Personalized Patient Data – A Dental Technique

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Abstract

Incorporating technology into healthcare has opened new possibilities for improving patient care and treatment efficiency. This article explores the innovative use of QR code integration in complete dentures, offering a modern solution for managing patient details. The procedure involves embedding a unique QR code into the denture, allowing for easy access to essential patient information. This integration not only enhances communication between dental professionals and patients but also provides a secure and efficient way to manage patient records, ensuring better care continuity. Beyond clinical applications, this integration provides a valuable tool for forensic identification in cases of missing persons or unidentifiable remains, offering a secure and efficient way to link dental records with patient identity. The article outlines the step-by-step process of incorporating QR codes into dentures, discusses the benefits, addresses potential challenges, and highlights its role in both patient care and forensic science, ultimately presenting this technique as a pioneering advancement in prosthodontics.

Keywords: Dental Flask, Prosthodontics, Palatal Area

Introduction

In recent years, the integration of technology in healthcare has vastly improved the way medical professionals manage patient care and data.[1] One area that has seen promising advancements is prosthodontics, particularly in the design and customization of complete dentures.[2] Traditionally, dentures serve the primary function of restoring oral function and aesthetics for patients, but as technology progresses, so too does the potential for enhancing these devices with additional features.[3] One such advancement is the incorporation of QR codes into dentures, which enables seamless access to critical patient information and offers novel applications in forensic identification.[4,5]

In dentistry, QR codes have been explored for applications such as patient record management, appointment tracking, and medication reminders [6,7]. However, integrating QR codes directly into the denture

itself provides a unique and practical solution for both clinical use and forensic identification. This approach allows dental professionals to access patient details such as medical history, treatment plans, and follow-up care at the point of treatment [8]. Furthermore, in the event of a forensic investigation, the embedded QR code can offer a means of identifying patients in cases where dental records are the primary source of identification, such as in disaster response or when dealing with unidentifiable remains [9].

This article outlines the procedure for incorporating QR codes into complete dentures, highlighting its benefits for clinical practice and forensic applications. The methodology presented not only addresses the technical aspects of QR code embedding but also examines its potential to improve patient care, enhance record management, and offer significant contributions to forensic dentistry.

Dental Technique

Step 1: Formation of QR code

A QR (Quick Response) code is a two-dimensional barcode that stores encoded information, such as text, URLs, or other data, in a scannable format. When scanned using a smartphone or a QR code reader, the embedded data is quickly retrieved and processed. In our dental record management system, each QR code encodes a Google Drive link to the patient's digital records. Affixed to dentures, these codes allow healthcare providers to instantly access patient information by scanning them, ensuring quick verification and retrieval of essential clinical details. The QR codes are designed with high error correction, ensuring readability even if partially damaged or worn over time.

To generate these QR codes, the Python-based script utilises the `qrcode` library to create scannable codes with a high error correction level. The QR code is resized to 22mm (220x220 pixels) for optimal readability and embedded in an image alongside the patient's name for clear identification. The `PIL` library is used to overlay the patient's name beneath the QR code, ensuring a structured and intuitive design. This QR code is an integral part of our dental record management system, complementing the PDF generator that compiles standardised patient reports. Each report includes demographic details (name, age, Aadhaar number), clinical information (denture fabrication date, doctor, hospital), and patient photographs. By integrating these components, our system enables instant identification of dentures and seamless access to comprehensive records, enhancing continuity of care across dental facilities. (Figure 1)

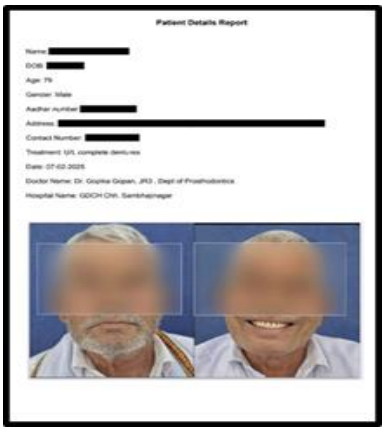

Figure 1: patient details incorporated in QR code

Step 2: Incorporation of QR code in dentures.

1. After the intraoral trial of the dentures, the waxed dentures are sealed to the master cast with additional wax. Subsequently, it is invested in the dental flask. (Figure 2)

Figure 2: invested waxed up dentures

2. A putty index was made over the teeth and the waxed up surface of the invested dentures. (Figure 3)

Figure 3: putty index

3. Dewaxing of the dentures done and a thin layer of heat cure clear acrylic resin (DPI, The Bombay Burmah Trading Corporation Ltd, Mumbai, India), is placed on the palate surface over which the heat resistant thermal label paper which is printed with QR code is placed such that the printed side is visible to the polishing surface of palate of maxillary denture. (Figure 4)

Figure 4: dewaxed maxillary teeth with QR code placed

4. Packing of the denture done with heat cure acrylic resin (DPI, The Bombay Burmah Trading Corporation Ltd, Mumbai, India). Care should be taken to apply gentle pressure while packing the acrylic to prevent displacement of the QR code. Application of a small amount of monomer on the label surface will improve the adhesion of the QR code with the acrylic resin.(Figure 5)

Figure 5: packing of denture

5. Processed maxillary denture with the QR code. (Figure 6)

Figure 6: processed denture with the QR code

6. Scanning of the QR code can be done with help of google lens in any smart phone. (Figure 7) and display of the patient's details on the phone. (Figure 8)

Figure 7: scanning using smart phone

Figure 8: information displayed on the Phone

Discussion

The described dental technique of embedding a QR code into a maxillary denture offers a modern method for denture identification. It enhances patient safety, supports emergency identification, and aids record-keeping in long-term or geriatric care.

A key advantage is its non-invasive and discreet design, the QR code is placed in the palatal area, preserving the denture's comfort, function, and appearance. Transparent acrylic keeps the code visible and scannable without compromising structure. The QR code also stores detailed patient data, accessible via smartphone applications like Google Lens, improving practicality in clinical and emergency settings.

However, its long-term durability against moisture, wear, and cleaning agents needs evaluation. Over time, the code may degrade or become unclear, and care is required during processing to ensure proper bonding.

Denture identification practices vary globally, some countries mandate them, while others rarely use them, often due to limited awareness of simple, cost-effective labeling methods. Yet, this approach can significantly benefit patient care.[10]

For these reasons, we strongly believe that the advantages of denture identification far outweigh the minimal effort required to implement it. We recommend that all dental professionals who construct and deliver prostheses incorporate this valuable service for the benefit of their patients.

Summary

The article discusses a simplified technique for incorporating QR codes into dentures for identification purposes. The use of QR codes on dentures offers a practical and efficient solution for labeling prosthetics. By embedding a QR code into the denture, critical patient information can be accessed quickly in case of emergencies, loss, or accidents. The technique is designed to be easy to implement, cost-effective, and non-invasive, requiring minimal modifications to the denture itself.

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