

PAPER REF: 7316

## **FORENSIC IDENTIFICATION TOOL IN DENTAL REMOVABLE PROSTHODONTICS**

**Adélia Fernandes, André Correia, Ana Margarida Silva, Cristina Figueiredo<sup>(\*)</sup>**

Universidade Católica Portuguesa, Institute of Health Sciences, Viseu

<sup>(\*)</sup>*Email: cristinapaivafigueiredo@gmail.com*

### **ABSTRACT**

The aim of this research was to help in the identification of individuals for medico-legal purposes by introducing an identification method in a dental prosthesis. For this purpose this research compares two different systems: a T microchip transponder and a QR code. The QR code was printed in three different materials: paper, aluminium-titanium and chrome-cobalt plaques. All of the materials were analysed respecting the possible location, the response to the action of temperature and the efficiency of the reading method. The tests performed allowed to identify differences between methods. The chrome-cobalt plaque was the one that presented better mechanical properties when subjected to the action of temperature.

**Keywords:** biomechanics, human identification, forensic dentistry, dental prosthesis, removable prosthodontics

### **INTRODUCTION**

According to the American Board of Forensic Odontology, most of forensic identifications are based in the combination of missing teeth, presence of dental cavity's, restored or unrestored teeth and prosthetic devices [1] The number of combinations that are possible to exist in the human dentition can give rise to trillions of possibilities, making dental patterns an important tool in human identification [2].

In fully edentulous patients, dental features are unavailable, the loss of all tooth promote bone reabsorption and identification become difficult or even impossible [1]. As so, dental prosthesis may become an important element for forensic identification.

Denture labeling is not a new concept in forensic odontology and it has been promoted for many years [3]. The purpose is to add identification of edentulous patients, e.g., in cases of elderly that suffer memory loss. Over the years various methods of denture marking have been reported in the literature [3]. These methods can vary from surface marking to inclusion methods using metal or non-metal materials, chips, among others.

The aim of this research was to help in the identification of individuals for medico-legal purposes by introducing an identification method in a dental prosthesis.

### **MATERIALS AND METHOD**

Two different identification methods were selected for the purpose of this research: a QR code and a T-microchip transponder (commonly used in veterinary control). The technique for application of these methods in a dental prosthesis (complete denture) is described in the

following paragraphs:

1. Generation of a QR code using a freely available website <http://www.qr-code-generator.com/> with the information previously selected (e.g. person's name, age, telephone, address, and dental office information)
2. Impression of the QR code in plaques made of different materials (paper, aluminium-titanium and cobalt-chrome). A 1cm<sup>2</sup> dimension was selected.
3. Inclusion of the selected method in the lingual surface of the denture acrylic base (channel of 12mm width \* 3mm depth for the T-microchip transponder (Figure1); cavity of 10mm width \* 1mm depth for QR codes plaques) with acrylic resin (Unifast Trad; GC Corp, Tokyo, Japan) (Figure 2).



Fig. 1 - Channel for the T-microchip transponder



Fig. 2 - Cavity QR codes plaques

4. Finishing and polishing of the denture lingual surface to complete the procedure.
5. Reading procedure for the selected method:
  - a. QR code: installation of the smartphone application (QR reader for iPhone), and place it near the removable denture to make the reading (Figure 3).
  - b. T-microchip transponder: turn the read/write reader on, and place it near the removable denture, and verify data transmission between the tag and read/write reader.

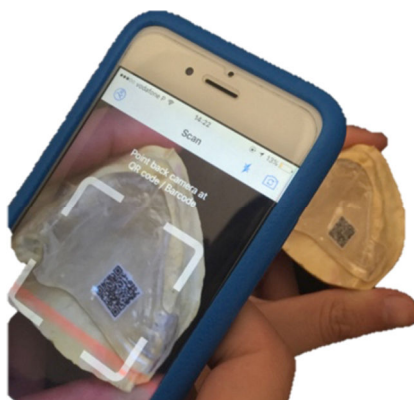


Fig. 3 - QR reader for iPhone

6. Application of high temperatures on the complete denture to simulate a catastrophic / forensic situation: (Heating was performed in a furnace (EDG, S1/4o Carlos, SP, Brazil) at temperatures of 600°C, 1000°C and 1200°C for 5 min.)
7. Removal of the dirt on the lingual surface of the denture base, with a polishing paste and a rubber bur.

## RESULTS

The results from the high temperatures tests are shown in Table 1. The Microchip transponder burned at 600°C, and for that reason it wasn't tested in higher temperatures. This destruction was restricted to the glass part, but it was proved that that part contained the readable chip.

The QR code in paper and the one in aluminium and titanium were also damaged and unreadable at 600°C and, as so, were not tested at high temperatures.

The QR code plaque in cobalt-chrome was still readable at 1000° C. At 1200°C the plaque was damaged and unreadable.

Table 1 - High Temperatures results

Materials	600°C	1000°C	1200°C
QR code paper	Burned Unreadable	-	-
QR code Al-Ti	Color change Unreadable	-	-
Qr code Co-Cr	Changeless Readable	Color change Readable	Morphological and Color changes Unreadable
Microchip T	Changeless Unreadable	-	-

## CONCLUSION

Marking of dental prostheses has become increasingly important in forensic investigations, not only to identify an unknown denture holder in cases of amnesia, memory loss or psychiatric cases, e.g., but also in cases of fire victims, explosions, earthquakes, plane crashes or even war.

Our results indicate that Cr-Co QR Code, placed in the removable denture will provide a source of forensic evidence after exposure to temperatures of up to 1000°C, indicating that these materials can be used as means of comparison in human identification even for high temperature fire victims.

In this situation it is important that the method used is simple and quick. Reading a QR code with a common smartphone allows the identification of the user of the dental prosthesis in a simple and fast way.

## **REFERENCES**

- [1] Phulari RG, Rathore R, Jariwala P. Importance of denture marking for human identification in forensic odontology. *Journal of clinical and diagnostic research: JCDR*. 2014;8(11):IL01.
- [2] Martin-de-Las-Heras S, Valenzuela A, Luna Jde D, Bravo M. The utility of dental patterns in forensic dentistry. *Forensic Sci Int*. 2010;195(1-3):166 e1-5.
- [3] Millet C, Jeannin C. Incorporation of microchips to facilitate denture identification by radio frequency tagging. *J Prosthet Dent*. 2004;92(6); pp. 588-90.