METHODS FOR IDENTIFYING REMOVABLE DENTURES

Anca Mihaela VIȚALARIU[1], Diana DIACONU-POPA[2], Andra AUNGURENCEI[3], Odette LUCA[3], Monica TATARCIUC[1]

[1]Prof. PhD, „Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
[2]Assoc. Prof. PhD, „Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
[3]Univ. Assist., „Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
Corresponding author: Diana Diaconu-Popa; e-mail:diana_tpd@yahoo.com

Abstract

Identification of removable prostheses is extremely useful, from quite numerous reasons: humanitary, medical, legal and medico-legal. Identification of removable prostheses and, implicitly, of their carriers, is of utmost importance, eliminating the risk of their losing or substitution among the patients of an asylum or of an emergency hospital. Identification may make use of various techniques, starting from the most rudimentary ones (writing down patient's name with a marker or its engraving), up to modern methods – introduction of a microchip containing data registered in a national system of data storage. Unfortunately, the modern means are quite expensive and, therefore, less accessible to most practitioners.

Keywords: *removable prostheses, identification methods, marking of prostheses*.

Marking of removable prostheses and, respectively of their carriers, in view of their identification, is a less approached topic in the stomatological practice of Romania, yet largely applied abroad, where the system of social assistance and institutionalization of old people and of disable persons is extremely well-organized. More than that, in many countries, introduction of data on prostheses' identification is juridically settled [1].

Identification of removable, total or partial prostheses, is extremely useful, from quite numerous reasons: humanitary, medical, legal and medico-legal. Identification of removable prostheses and, implicitly, of their carriers, is of utmost importance, eliminating the risk of their losing or substitution among the patients of an asylum, convalescent home, or of an emergency hospital. It also permits identification of the victims of crimes, disasters or natural calamities, of amnesic patients, of those seized with faintness, of people affected by psychiatric problems, senile dementia, Alzheimer, etc. [2,3]. Marking of prostheses in view of their identification is the more important the higher is the number of people carrying removable prostheses.

Identification may make use of various techniques, starting from the most rudimentary ones (writing down patient's name with a water-proof marker or its engraving), up to modern methods – introduction of a containing data registered in a national system of data storage [4,5].

Most frequently applied is the introduction, at the bottom of the prosthesis, of a plastic or metallic plate containing the necessary identification data (name of the patient, a personal code, bar codes, etc).

The objects used for marking of prostheses should be biocompatible (biologically inert after their introduction inside the prosthesis) [6], easily and rapidly applicable, cheap, resistant to acids and high temperatures, aesthetically acceptable, legible and time-resistant, not endangering the mechanical resistance of the prosthesis. Also, they should resist to the daily contact with the hygienization solutions applied to prostheses [7].

The areas recommended for positioning the identification data are the posterior regions of the arch (the molar zone), the lingual side for mandibular prostheses and palatinal side, respectively, for the maxillary ones.

In 1989, Toolson and Taylor proposed a simple identification technique, applicable after the mechanical processing of the finite prosthesis, yet prior to its polishing, consting in printing, on a *plastic (celluloid) foil*, of the identification data (name, PIN, etc.). The part containing the data is

cut up with a scissor from the plastic foil, leaving a small space around the letters and/or figures. The piece of plastic will be minimized through its introduction in a pre-heating oven at 300°C for 30 seconds [5]. On the external side of prosthesis' bottom, in the molar area, a superficial cavity – within which the marked plate is introduced - is realized through burring. A translucent acrylic autopolymerizable or photopolymerizable resin is applied on the plate, followed, after polymerization, by its processing and polishing, up to obtaining a final, perfect gloss.

Another method involves printing of the identification data on a *metallic plate* at a high melting temperature (up to 1,100°C), to be insertted at the bottom of acrylic removable prostheses. Most frequently employed are the bands made of stainless steel or titanium alloys, characterized by good biocompatibility and high resistance to corrosion in the oral environment. On the average, plates' dimensions are the following: length - 1.5 cm, width - 0.5 cm and thickness - 0.8 mm. When the prosthesis is ready, a superficial cavity is made at the bottom of the prosthesis, by means of a diamond stone, according to the form and size of the metallic plate.

Fixation of the metallic plate is made with thermobaropolymerizable acrylate, introduced in the previously prepared space, at the bottom of the prosthesis. The plate is applied by slight pressure, followed by its covering with translucent acrylate and polymerization (Fig. 1).

Fig. 1. Final aspect of the prosthesis

The metallic plates have the advantage of being radio-opaque, which permits the radiological localization of a prosthesis or of small fragments of it, accidentally swollen or inspired. They are especially useful in the identification of the victims of fires or air crashes [8]. The disadvantages refer to the fact that they extend to a certain extent the working algorithm, they cannot contain too many letters/figures – due to their relatively reduced size and, more than that, they may affect the strength of the prosthesis in the respective area, once an acrylate layer is removed (which means a high fracture risk) [9].

To eliminate the disadvantages of metallic plates, new methods have been proposed, which do not require a space at the bottom of the prosthesis and, consequently, do not affect its mechanical strength. A procedure might be *to mark the identification data directly on the surface of the basis*. The data are printed on an ordinary sheet of paper, then on the surface of the prosthesis, where marking is to be made, and a metal metacrylate (monomer) is applied. Prior to its evaporation, the paper containing the identification data are pressed upon the respective area, which assures their direct printing on the surface of the prosthesis. Further on, a layer of autopolymerizable resin is applied, after which the whole area is polished with a rotative device for 4-5 minutes, until a perfect gloss is obtained [10-12].

Such "non-invasive" methods have two important advantages: the printed identification data may have a higher number of letters/figures, while the mechanical strength of the prosthesis is not at stake. More than that, the working technique is extremely simple and rapid, the studies devoted to it assuring long lasting results, as well [2].

Marking of the identification data is also applied for partially skeletal prostheses, the pieces of information being placed, in such cases, at the level of the metallic skeleton of the saddle (Fig. 2). The acrylic component of the saddle will cover completely the figures/letters from the metallic skeleton, assuring the comfort of the patient, while also permitting data vizualization, due to its transparency [13].

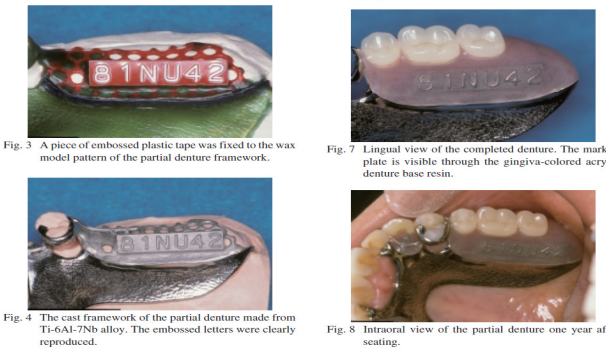

Fig. 3 A piece of embossed plastic tape was fixed to the wax model pattern of the partial denture framework.

Fig. 7 Lingual view of the completed denture. The mark plate is visible through the gingiva-colored acry denture base resin.

Fig. 4 The cast framework of the partial denture made from Ti-6Al-7Nb alloy. The embossed letters were clearly reproduced.

Fig. 8 Intraoral view of the partial denture one year af seating.

Fig.2. Identification data in a skeletal prosthesis [13]

In the case of partially skeletal prostheses, the method of *laser burning* (*copper vapor laser* - CVL) may be also applied, but only in a suitably equipped laboratory [14]. Unlike other methods, CVL permits burning – on a skeleton made of a Cobalt-Chromium alloy – of data with much more reduced dimensions (microns), therefore more information, however, it is a very expensive method, requiring special equipments and additional training for the technician.

Other modern methods for removable prostheses marking make use of elecronic microchips, lenticular systems, bar codes or identification with radio frequencies.

Identification may use *electronic microchips*, with sizes of 5 x 5 x 0.6 mm inserted in the acrylate of the basis, as they show a good behavior at very high temperatures (600°C), resist in an acid medium, are radio-opaque and have a very good adhesion to acrylic resins. However, the major shortcoming of microchips is that they may be burnt only by their manufacturer, and not by the practitioner (physician or technician) [15].

Insertion in the removable prostheses of certain labels (chips) that may be identified by *radio-frequency* appears as a rapid and efficient identification method. This type of labels is preferred for their reduced dimensions (8.5×2.2 mm) and for their capacity of storing a large amount of data [15]. The system includes the label containing the data and a "manual" reader which operates the transporter by means of an electromagnetic field produced by the aerial of the reader. The coded signal is received and converted into legible data.

These chips are resistant to the solutions usually applied for hygienization of removable prostheses (1% hypochlorite, 4% chlorhexidine, 4% sodium perborate). Due to such reduced dimensions, their insertion does not affect the mechanical resistance of the prostheses. An important advantage is the high resistance to extreme temperatures, the chip remaining intact and legible at negative temperatures, as well as after its keeping for 1 hour at 1,500°C. The method requires no special training from the part of the technician, for chip's insertion inside the prosthesis but, unfortunately, the high costs prevent its more extended application [16-17].

The bar code, another method recommended for marking dental prostheses, consist of a code containing bars and spaces that may be read by an electronic device. It provides precise information, and it is resistant to high temperatures and to the solutions applied for disinfectation and hygienization of the oral cavity. Unfortunately, it requires special, quite expensive equipments [18].

Another possibility, useful mainly in the geographic areas with a low teaching level, is the introduction of a *photography of the patient* at the bottom of the prosthesis and its covering with colourless acrylate, a type of burning which resists at temperatures of 200–300°C [19].

Out of all the above-described methods, the simplest and cheapest ones are those providing marks *on the surface of the prosthesis*, yet their lastingness in time is reduced. The methods involving introduction of markers *inside the bottom of the prosthesis* are definitely more time-resistant, even if they face the risk of a decreasing mechanical resistance of the acrylate and of the occurrence of porous zones in the respective areas. Another disadvantage is the high price and, sometimes, the necessity of a special training of the dental technician prior to the application of the markers (plate, chip).

The stomatologist should inform the patient, the future carrier of a removable prosthesis, on the advantages of having a marked prosthesis, even if the final decision on its acceptance or rejection belongs to the latter. Obviously, one of the reasons that may be involved is the cost of the identification, some prostheses being too expensive for the financial possibilities of the patients.

In Great Britain, the national assurance system offers discounts for marking of removable

prostheses for institutionalized patients [20] while, in the USA, markage is compulsory in some states, including the social assurance code of the patient. In Australia, burnt on the prostheses is the fiscal code while, in Sweden, the PNC [13,21]. In many other countries, Romania included, marking of prostheses in view of their identification is not applied, being absent in the curricula of the faculties of stomatology, as well.

As a conclusion, the most important reasons preventing markage of dental prostheses are: a too high cost, ignorance of the possible applicable methods and, probably, the idea of stomatologists that this is not a really important aspect. In certain dramatic situations, marking of dental protheses for the identification of a person might be decisive, as outlined by all specialists in legal medicine from all over the world.

References

1. Datta P, Sood S. The various methods and benefits of denture labeling. J Forensic Dent Sci. 2010;2(2);53-8.
2. Takahashi F, Koji T, Morita O. A new method for denture identification. Dent Mater J. 2008;27(2):278-83.
3. Phulari RG, Rathore R, Jariwala P. Importance of denture marking for human identification in forensic odontology. J Clin Diagn Res. 2014;8(11):IL01.
4. Borrman H, Thomas CJ, Engstrom EU. Denture Marking. Clinical and Technical Aspects. J Forensic Odontostomatol. 1995;13(1):14-7.
5. Toolson LB, Taylor TD. Method for denture identification. J Prosthet Dent 1989;61(1):114-5.
6. Savin C, Murariu A, Dragomir B, Gavrilă L, Balan A. Dental material biocompatibility: a cross-sectional study. Intenational Journal of Medical Dentistry. 2017;7(2):94-7.
7. Borrman HI, DiZinno JA, Wasén J, René N. On denture marking. J Forensic Odontostomatol. 1999;17(1):20-6.
8. Reeson MG. A simple and inexpensive inclusion technique for denture identification. J Prosthet Dent. 2001;86(4):441-2.
9. Mârțu I, Bosînceanu GD, Forna N, Vițalariu A, Luchian I, Bosînceanu D. Complete dentures fractures – causes and incidence. RJOR. 2017;9(1):54-9.
10. Ling BC. Computer-printer denture microlabeling system. J Prosthet Dent. 1998;79(3):363-4.
11. Coss P, Wolfaardt JF. Denture identification system. J Prosthet Dent. 1995;74(5):551-2.
12. Kanai H, Kasahara H, Ohta S, Koshiba K, Hosaka K, Watanabe T, Yamagishi T, Ito M. Denture identification for the disabled elderly- Effect of name marking on removable denture. J J Gerodont 1996;11:18-24.
13. Matsumura H, Shimoe S, Nagano K, Tanoue N. International telephone code used for citizenship identification in a denture. J Oral Sci. 2007;49(4):337-40.
14. Ling BC, Nambiar P, Low KS, Lee CK. Copper vapour laser ID labelling on metal dentures and restorations. J Forensic Odontostomatol. 2003;21(1):17–22.
15. Richmond R, Pretty IA. Contemporary methods of labeling dental prostheses. A review of the literature. J Forensic Sci. 2006;51(5):1120–6.
16. Richmond R, Pretty IA. A range of postmortem assault experiments conducted on a variety of denture labels used for the purpose of identification of edentulous individuals. J Forensic Sci. 2009;54(2):411-4.
17. Raymond R, Pretty IA. The use of radio-frequency identification tags for labeling dentures—scanning properties. J Forensic Sci. 2009;54(3):664–8.
18. Agülolu S, Zortuk M, Beydemi K. Denture barcoding: A new horizon. Br Dent J. 2009;206(11):589-90.
19. Anehosur GV, Acharya AB, Nadiger RK. Usefulness of patient photograph as a marker for identifying denture-wearers in India. Gerodontology. 2010;27(4):272-7.
20. Pretty IA, Sweet D. A look at forensic dentistry-Part 1: The role of teeth in the determination of human identity. Br Dent J. 2001;190(7):359–66.
21. Alexander PM, Taylor JA, Szuster FS, Brown KA. An assessment of attitudes to, and extent of, the practice of denture marking in South Australia. Aust Dent J. 1998;43(5):337-41.