J Forensic Sci, November 2007, Vol. 52, No. 6
doi: 10.1111/j.1556-4029.2007.00586.x
Available online at: www.blackwell-synergy.com

TECHNICAL NOTE

Raymond Richmond,[1] *B.Sc., M.Phil. and Iain A. Pretty,*[2] *B.D.S. (Hons), M.Sc., Ph.D., M.F.D.S. R.C.S. (Ed)*

Denture Marking—Patient Preference of Various Methods

ABSTRACT: Dental forensic organizations world wide have recommended that dental prostheses should be labeled with at least the patient's (wearer's) name and preferably with further unique identifiers such as social security number. A range of methods are available and the purpose of this study was to determine, via the means of a visual questionnaire, which are the most preferable to those patients who wear complete dentures. One hundred edentulous patients attending the Manchester Dental Hospital were shown a range of denture labeling methods and asked to rank these according to their preference. The most preferred method was that of an embedded radio frequency identification microchip (38% rated this as first) and the second was an inclusion technique using onion paper (24% rated this as first). The least preferred method was the use of a groove cut into the denture flange with 71% of patients rating this as the poorest in terms of esthetics. The study demonstrates that the method of denture labeling is important to patients and to ensure that denture labeling is performed routinely esthetic preferences must be considered.

KEYWORDS: forensic science, dentures, prostheses, labeling, identification, dental

The frequency of edentulousness has decreased in recent years due primarily to improvements in oral health brought about by factors such as fluoridation and increased patient awareness. However, owing to a wide variation in the oral status of populations in different countries, the need to address the issue of denture identification still remains since it is more difficult to identify an edentulous person than a dentate one (1,2). In such cases, in the absence of marked dentures, dental identification is problematic and hence may only be established by well trained examiners via the comparison of bone trabeculation patterns that have been recorded in antemortem and postmortem radiographs (3).

Following major disasters such as fires, floods, earthquakes, or the obvious and ever increasing effects of the proliferation of global terrorism, a definitive and early identification of the dead and injured becomes of the utmost importance. Given that only one marked denture can reveal the identity of a deceased person when all other methods fail to do so, makes the practice of denture marking worth while (4,5). Furthermore, the efficacy of establishing ownership of dentures in long-term care facilities is both self evident and well documented (6–8). However, despite numerous reports in the dental literature made over many years, beginning typically with statements similar to that of the above, there remains a general sense of apathy towards finding a universally agreeable solution to this problem (9).

Attitudes towards denture identification have been investigated by several authors. Cunningham and Hoad-Reddick (10) reported that patients were in favor of some form of denture marking. Furthermore, data collected from a survey undertaken by Borrman and Rene's (11) involving 79 dentists (together with their patients) indicated that it was the dental profession itself that was responsible for the nonmarking of dentures. The findings of Cunningham and Hoad-Reddick's (10) study appear to lend weight to Borrman and Rene's (11) perception in that, of the 63 subjects who took part in their survey, some 93.5% of them were found to be unaware that identification marks could have been placed in their dentures.

The purpose of this study was to conduct a survey of denture patients receiving complete dentures to determine both their attitudes toward denture marking, and also their preference for the type of marking in terms of esthetic value. Such information is crucial in order to design denture labeling methods that will be acceptable to patients and thus remove one potential barrier in the implementation of universal denture marking.

Materials and Methods

Ethical approval for this study was sought from the Stockport Local Research Ethics Committee and was this was granted with reference number 05/Q1401/58. A total of 100 edentulous patients seeking treatment at the Manchester Dental Hospital were randomly selected to complete a questionnaire. Signed consent was obtained from each subject.

Patients in the study were shown ten, 8 × 10 inch color photographs labeled A–J demonstrating each of the following denture identification methods:

Label (A)—showing a technique in which the patient's name was typed on a piece of "onion skin" paper and incorporated within the fitting surface of the denture during the packing procedure (Fig. 1).

Label (B)—showing a method involving the use of a typed, commercially produced metal strip (trade name: ID-Band) embedded into the polished surface of the denture (Fig. 2).

Label (C)—showing a radio frequency identification (RFID) system consisting of a data carrier, generally known as a tag or transponder. The tag consists of a torpedo shaped microchip with a coiled antenna, measuring 8.5 mm × 2.2 mm. The transponder may be embedded into either the polished or fitting surface of an existing denture (Fig. 3).

[1]Forensic Dentistry, School of Dentistry, University of Manchester, Higher Cambridge Street, Manchester M15 6FH, U.K.
[2]Dental Health Unit, School of Dentistry, University of Manchester, 3A Skelton House, Manchester Science Park, Manchester M15 6SH, U.K.

Received 18 Nov. 2006; and in revised form 4 June 2007; accepted 24 June 2007; published 21 Dec. 2007.

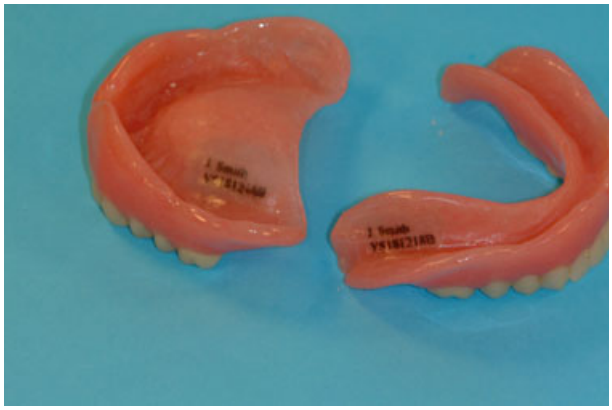

FIG. 1—*Label A, typed embedded onion skin (tissue paper).*

FIG. 2—*Label B, typed metal ID band.*

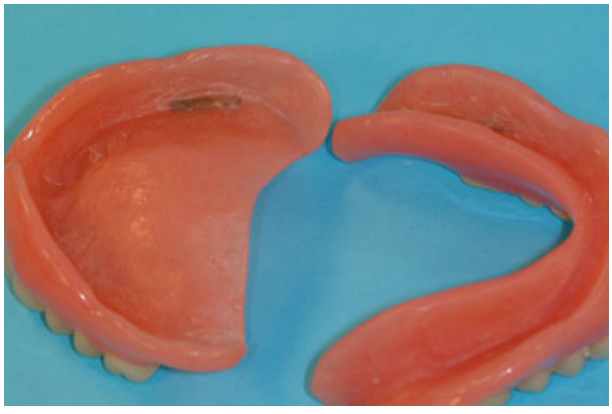

FIG. 3—*Label C, incorporating an RFID transponder chip.*

Label (D)—showing an example in which a fine fiber-tipped pen was used to mark a label made from a partially polymerized strip of polymethyl methracrylate before including in the fitting surface of the denture base during the trial packing procedure (Fig. 4).

Label (E)—shows an example of an ID label that had been produced in a "P-touch" electronic lettering system (P-touch; Brother Co., Toronto, Ontario, Canada). The label used consisted of a 103-μm thick, white or clear laminated strip onto which 2 mm characters are typed, after which it is incorporated into the denture subsequent to its fabrication (Fig. 5).

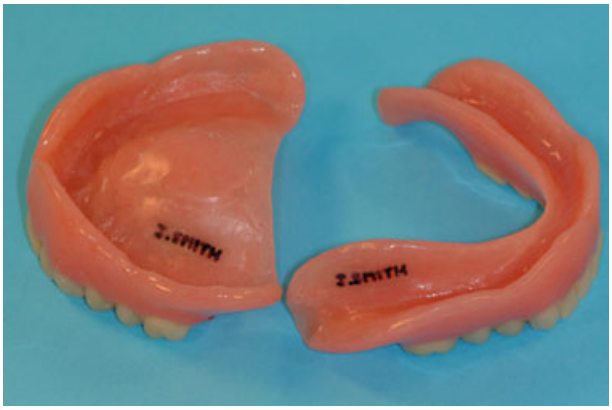

FIG. 4—*Label D, name on embedded PMMA strip.*

FIG. 5—*Label E, simulated version of a P-touch label printed and embedded.*

Label (F)—utilizing a standard soft metal band that is either typed or engraved with the patient's details before being rolled up and inserted into a predrilled cavity *c.* 2–3-mm wide. A small wax plug is then placed over the metal band prior to filling the remainder of the cavity with self-cure resin (Fig. 6).

Label (G)—is made from a label printed on 35 mm photographic slides via the use of a computer graphics package (Fig. 7).

Label (H)—utilizing piece of 0.125 mm thick stainless steel tape onto which the patient's details are engraved. The tape is then incorporated into the fitting surface of the denture during the trial packing stage (Fig. 8).

Label (I)—showing an example that involves cutting a groove of *c.* 0.5 to 1 mm deep into the buccal flange of the denture; the length of which would correspond to the length of the patient's name. An ordinary ballpoint pen or felt-tip pen is then used to print the patient's name in the recess before being sealed with fissure sealant (Fig. 9).

Label (J)—showing an example that allows the dentist to write on the surface of the denture using a spirit-based pen or pencil prior to covering the ID mark with a clear denture base polymer dissolved in chloroform (Fig. 10).

Patients were interviewed and asked to complete a questionnaire. Basic demographic details were obtained including age, sex, type of dentures, and frequency of dental attendance. They were also asked whether or not their dentures were marked and if not, would they object to having them marked. They were then asked to rank the photographs in order of preference i.e., best to worst in terms

FIG. 6—*(a) Label F, showing an engraved metal band that has been rolled up and inserted into a predrilled hole. (b) Label F, the band is covered with a wax plug and then with self cure PMMA.*

FIG. 7—*Label G, is made from a 35-mm photographic slide.*

FIG. 8—*Label H, utilizes an engraved piece of orthodontic band.*

FIG. 9—*Label I, engraved and covered with light cure resin.*

FIG. 10—*Label J, pencil mark covered with a polymer coating.*

of esthetics. Conversely, in order to assess the validity of their initial response, they were then asked to rank the photographs in reverse order i.e., worst to best. Patients were also asked to indicate, if their dentures were to be marked according to each of the methods depicted in the photographs, they would be either: "very satisfied, satisfied, dissatisfied, or very dissatisfied" with that method of labeling.

Prior to completing the questionnaire each of the methods of marking featured were carefully explained to each patient owing to the fact that not all of the ID marks (e.g., methods C and F) were visible. They were also made aware that all methods, with the exception of J, were embedded within the denture base material in order to reassure them that comfort would not be compromised. Subjects were not provided any information on the likely efficacy of any of the methods or their likely resilience to post or perimortem assaults. These steps ensured that the assessment was based purely on the esthetic impact of the method.

The anonymous data sheets were collected and the responses collated and entered in to SPSS (Version 11, SPSS Inc., Chicago, IL) for statistical analysis. The responses to the esthetic questions were analyzed using the rank feature and ANOVA was used to detect the influence of age or gender on the preferred method.

TABLE 1—*Mean Ranking for each denture labeling method and number of individual ranking as most and least preferable system.*

Brief description of method	Label	Mean rank	Number of individuals ranking as 1
Incorporating an RFID transponder chip	C	2.46	49.00
A typed embedded onion skin (tissue paper)	A	3.46	13.00
An engraved piece of orthodontic band	H	3.63	13.00
Name on embedded PMMA strip	D	4.81	4.00
A piece of 35 mm photographic slide	G	4.86	4.00
An engraved metal band that has been rolled up and inserted into a predrilled hole	F	5.40	4.00
A P-touch label printed and embedded	E	6.10	1.00
A typed metal ID band	B	6.99	9.00
Pencil mark covered with a polymer coating	J	7.81	2.00
Denture is engraved and covered with light cure resin	I	9.41	2.00

Kappa was employed to determine the intra-subject reliability between their two scores.

Results

The mean age of the subjects was 65 years (±11.80) and 48 of the 100 subjects were male. The overall rankings from each of the denture marking types are shown in Table 1. The mean Kappa between each subjects rating was 0.92 indicating excellent reliability of assessment between first and second ratings. ANOVA revealed no significant effect of age or gender on selection of labeling preference.

Ninety-nine percent of the subjects responded that they would be happy to have their dentures labeled in some way and that the esthetics of the method, allied with comfort would be the most important determinants in their selection of methods if they were offered a choice.

The denture incorporating the transponder (label C) was a clear favorite, preferred by 38 of the 100 patients. Second favorite was the onion skin paper denture (A); and was ranked 1 by 24 people. The denture with the name of the wearer engraved onto the flange (label I) was the most disliked ID mark with 71 patients ranking it least acceptable in terms of esthetics; only one patient ranked it number 1. This was followed closely by denture labeled by hand with a clear covering (label J), with only two patients ranked this ID mark number 1.

In terms of the satisfaction scores 51.8% of the subjects stated that they would be "very satisfied" if their dentures were labeled in this manner, with a further 31% stating that they would be "satisfied." Only one subject stated that they would be unsatisfied with this system of labeling. In contrast, for the least popular denture labeling method, method I, only one patient stated that they would be very satisfied with this system and 46% stating that they would be very dissatisfied with this method. Table 2 shows the percentage satisfaction scores for each of the denture labeling systems.

TABLE 2—*Percentage satisfaction scores for each labeling system if it was implemented on their own dentures.*

Label	% Very satisfied	% Satisfied	% Dissatisfied	% Very dissatisfied
A	51.8	36.5	9.4	0
B	14.1	34.1	48.2	3.5
C	58.8	36.5	3.5	1.2
D	9.4	67.1	21.2	2.4
E	9.4	60.0	27.1	3.5
F	16.5	42.4	37.6	3.6
G	42.4	47.1	10.6	0
H	51.8	29.4	17.6	1.2
I	1.2	14.1	22.4	56.5
J	2.4	15.3	52.9	27.1

Discussion

Perhaps the most important finding from the current study is that 99% of individuals would accept marking of their dentures. This is contrary to the anecdotal evidence of dentists who, when questioned about a failure to mark dentures, will often state that patients do not want it (10). However, when the reasons behind the procedure are explained, and photographs of the various methods available are demonstrated it is clear that patients are willing to have their prostheses labeled in this manner. When asked whether they would prefer some form of ID mark incorporated into their denture in the future, all but one of the 100 patients interviewed gave a positive response. With regard to the denture incorporating the transponder, most patients were very much in favor of this device when they were informed that additional information such as: type of medication, blood group or details of next of kin could be included. However, a number of patients were a little suspicious of the device, believing it to be a potential infringement of their privacy. Nevertheless, 81% of the 100 patients who took part in the survey appear to be willing to adopt this novel approach to denture labeling. Furthermore, their willingness to embrace the technology does not appear to be related to either their age nor sex, as the results of a standard *t*-test indicated no statistically significant difference in terms of preference for denture labeling technique.

Numerous studies and reports have highlighted the need for denture marking and the identification of edentulous individuals continues to be problematic (12–16). The current study has determined that patients themselves are not a barrier in the provision of such markings, although they must be esthetically acceptable (17). An overwhelming majority of patients within the current study would ask for their next set of dentures to be marked if offered this service. The barriers to routine denture labeling must lie elsewhere, perhaps with the dentist, the laboratory or perhaps in the training offered to dental undergraduates who may not be exposed to the methods or reasons for such labeling. Further research is required to fully elucidate the reasons for poor compliance with denture labeling and efforts made to remove such barriers.

References

1. Whittaker DK. Principles of forensic dentistry: 1. Identification procedures. Dent Update 1990;17(8):315–21.
2. Borrman H, Thomas CJ, Engstrom EU. Denture marking. Clinical and technical aspects. J Forensic Odontostomatol 1995;13(1):14–7.
3. Kullman L, Eklund B, Grundin R. Value of the frontal sinus in identification of unknown persons. J Forensic Odontostomatol 1990;8(1):3–10.
4. Bushick RD Forensic dentistry: an overview for the general dentist. Gen Dent 2006;54(1):48–52; quiz 53.
5. 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.

6. Heath JR, Zoitopoulos L, Griffiths C. Simple methods for denture identification: a clinical trial. J Oral Rehabil 1988;15(6):587–92.
7. Heath JR. Denture identification—a simple approach. J Oral Rehabil 1987;14(2):147–63.
8. Deb AK, Heath MR. Marking dentures in geriatric institutions. The relevance and appropriate methods. Br Dent J 1979;146(9):282–4.
9. Thomas CJ, Mori T, Miyakawa O, Chung HG. In search of a suitable denture marker. J Forensic Odontostomatol 1995;13(1):9–13.
10. Cunningham M, Hoad-Reddick G. Attitudes to identification of dentures: the patients' perspective. Quintessence Int 1993;24(4):267–70.
11. Borrman HI, Rene N. Denture marking—a questionnaire for patients and dentists. J Forensic Odontostomatol 1997;8:3–10.
12. Borrman HI, DiZinno JA, Wasen J, Rene N. On denture marking. J Forensic Odontostomatol 1999;17(1):20–6.
13. Newman M. A plea to mark dentures (letter). Br Dent J 1982;153(10):353–4.
14. Seals RR Jr., Gangwer GL. Denture identification: an application of preventative dentistry. J Okla Dent Assoc 1981;72(2):7–9.
15. Dorion RB. Denture making: a public service. Ont Dent 1980;57(12):27.
16. Woodward JD. Denture marking for identification. J Am Dent Assoc 1979;99(1):59–60.
17. Richmond R, Pretty IA. Contemporary methods of labelling dental prostheses—a review of the literature. J Forensic Sci 2006;51(5):1120–6.

Additional information and reprint requests:
Iain A Pretty, B.D.S., Ph.D.
Dental Health Unit
3A Skelton House, Lloyd Street North
Manchester Science Park
Manchester M15 6SH, U.K.
E-mail: iain.pretty@manchester.ac.uk