

Denture labels: Various types and their abilities to resist different assaults

Rashmi G. S. Phulari,
Rajendrasinh S. Rathore,
Prachi Nitin Jariwala,
Aalap D. Kapuriya¹,
Arpan K. Shah

*Departments of Oral and
Maxillofacial Pathology and
'Prosthodontics, Manubhai Patel
Dental College and Hospital, Oral
Research Institute, Vadodara,
Gujarat, India*

Address for correspondence:

*Dr. Prachi Nitin Jariwala,
M. P. Dental College Staff
Quarters, Vishwamitri,
Mujmahuda, Vadodara - 390 011,
Gujarat, India.
E-mail: prachi_pnj@yahoo.co.in*

Abstract

Introduction: The use of denture labels for the purpose of identification has been well documented. A number of labels for marking the denture are documented till date demonstrating the ease of fabrication and its potential value in identification. Therefore, it becomes essential that these denture labels fulfill the requisites of an ideal denture label and thus should be able to sustain the various assaults to which they might be subjected simulating a crime scene. **Aim:** The aim of this study was to determine the ability of various denture labels to withstand different types of assaults thereby evaluating the performance of routinely used denture labels. **Materials and Methods:** Four polymethylmethacrylate blocks were fabricated where the inclusion labels were incorporated on one side, and the surface labels were marked on the other side. Each of the blocks was then placed in different containers to be subjected to different assaults such as acid, alkali, water, and heat of increasing temperature. **Results:** Inclusion labels performed better as compared to surface marking labels. Among the inclusion labels, the metallic labels performed the best. **Conclusion:** The metallic inclusion labels were able to withstand most assaults than any other inclusion labels or surface marking labels. Due to easy availability, cost-effectiveness, ease of incorporation and inertness, metallic labels are best suited as denture labels for personal identification.

Key words: Assaults, denture labels, forensic odontology, human identification

Introduction

The confluence of legal and dental professions – forensic dentistry has played a magnificent role in the acquittal of victim as well as for the conviction of the culprit. Teeth are considered the strongest structures of the human body that can resist most severe forms of assaults. Thus, dental identification is the best source of identification in the absence of other means of identification such as fingerprints.^[1] The identification from a dental perspective is usually by recognition and comparison which requires

the presence of an antemortem record. Broken teeth, fillings, decay, and/or missing ones serve for the purpose of matching.^[2] Since edentulous jaws lack the constant features needed for comparison,^[3] dentures with characteristic traits or marked with labels play its part. The type of the denture, its size, shape, and the material used for fabrication, all contribute to impart uniqueness to the denture.^[4]

The advantages of labeling the denture are well known. Denture labeling has been considered legal in Sweden

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Phulari RG, Rathore RS, Jariwala PN, Kapuriya AD, Shah AK. Denture labels: Various types and their abilities to resist different assaults. J Forensic Dent Sci 2017;9:175-6.

Access this article online

Website:

www.jfds.org

DOI:

10.4103/jfo.jfds_12_15

Quick Response Code



and 21 states of the United States.^[3] Mainly two types of denture labeling methods have been known – surface method and inclusion method.^[5] The Surface labeling involves marking on the surface of the denture whereas the inclusion labels need to be inserted in the denture either during fabrication (prefabrication) or after complete fabrication (post fabrication) which involves cutting a groove in the denture, insertion of the label, and covering with transparent acrylic so as to render the label readable. The most common site for label insertion in a denture is the posterior palatal slope of the maxillary and the lingual flange of the mandibular denture. Selection of this area is partly because even in most decomposed bodies, this area remains safe owing to protection by the teeth and soft tissue in front and partly for esthetic reasons.^[6]

With the vitriol attacks on old age taking a rampage in the country, a call for more resilient methods for identification needs to be developed to counteract such crisis. In a recent incident in the city, an adopted girl of 16 years drugged her foster parents before stabbing them to death over misgivings about a love affair. Unable to dispose of the bodies, she kept pouring acid over the bodies hoping them to dissolve. The bodies were later recovered found mutilated and decomposed.

With the rise in toll of such events, means to combat such a situation need to be developed prehandedly. Facing such a crisis in old age edentulous patients would rise up the odds manifolds.

Various types of labels have been employed for the ease of identification. What remains to be seen is that whether these labels can fulfill the requirements of an ideal denture label and sustain extreme conditions remaining true to their purpose of identification. Therefore, the aim of this study was to ascertain the performance of the readily available and commonly used denture labels when subjected to a range of hostile environments simulating the assaults to which a body might be subjected.

Materials and Methods

Blocks were made out of heat-cured Polymethyl Methacrylate Resin (PMMA) (DPI™) which were to simulate the posterior flanges of denture base. The block measured 5 cm × 5 cm × 0.5 cm. Four such blocks were fabricated.

Ten different easily available denture labels were considered for the study. These included both the surface as well as inclusion labels. The surface labels were marked on one side of the block whereas the other side contained the inclusion labels [Figures 1 and 2].

The surface labels included engraving, embossing, and marking whereas the inclusion labels included paper, OHP

sheet, lead foil, stainless steel (SS) matrix band, Ni-Cr plate, brass palette, and barcode sticker.

Surface labels

1. Engraving: A round head dental bur was used to etch information “230” [Figure 1]
2. Embossing: The information “230” was engraved into the stone mold used for denture flasking in mirror image so that it appeared as elevated symbols on the block [Figure 1]
3. Marking: The information “230” was written with a spirit-based marker pen, and a coat of varnish was applied over it [Figure 1].

Inclusion labels

Two milliliters deep troughs were made on the other side of the block where surface labels were placed to accommodate the inclusion labels. The grooves were 2 mm larger than the length and width of the labels for its easy placement.

1. Barcode Sticker: A barcode sticker routinely used in dental setups for patient discretion and misconfusion was used. It was covered by cello tape on both the sides, cut of size, and placed in position A [Figure 2]
2. Lead foil: The lead foil commonly found in an X-ray film packet (Kodak™) was written upon “230” in mirror image so that it appeared as embossed letters on the other side. It was cut of size and placed at position B [Figure 2]
3. Ni-Cr plate: A Ni-Cr plate written “LEMMI” was prefabricated in the laboratory using the material routinely used for fabrication of metal jacket crowns at position C [Figure 2]
4. Paper: A paper with printed information “230” was cut to size after being coated in between cello tape at position D [Figure 2]
5. SS matrix band: The band commonly used for restoration and banding of molars was stamped with “230” and cut to size at position E [Figure 2]

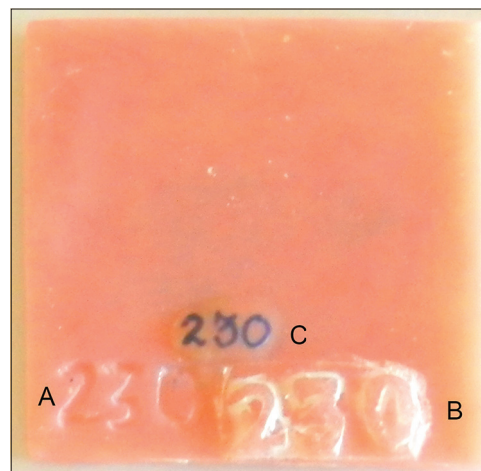


Figure 1: Surface labels: (A) Engraving (B) Embossing (C) Marking

6. OHP sheet: "230" was written using a marker pen and cut of size at Position F [Figure 2]
7. Brass palette: A brass palette was also stamped with "230" and placed in the groove at position G [Figure 2].

After placing the labels in their grooves, they were covered by transparent cold-cured acrylic resin and cured under pressure at 30 psi pressure for 20 min. The blocks were then trimmed and polished.

Each of the four blocks thus fabricated was subjected to:

1. Assault I: Immersion in concentrated sulfuric acid for 24 h [Figure 3]
2. Assault II: Immersion in concentrated sodium hydroxide for 24 h [Figure 3]



Figure 2: Inclusion labels: (A) Barcode Sticker (B): Lead Foil (C): Ni-Cr Plate (D): Paper (E): SS band (F): OHP Sheet (G): Brass palette

Results

The exposure of denture blocks to various hostile environments showed the following effects [Table 1]:

1. Assault I: Exposure to concentrated acid showed that the surface labels were disfigured. The embossed label was read with least effort. The other two labels were disfigured and incompatible to read accurately. On the other hand, the inclusion labels did not reveal much change. After retrieval of the block from the acid container and placing it in running water for 24 h, a chalky white precipitate was observed to form on the surface of the labels. Finishing and polishing stone burs to remove the white surface rendered all the labels readable including the barcode which was easily read by its reader [Figure 3]
2. Assault II: No gross changes were noted in the surface as well as the inclusion labels on placing the denture block in concentrated sodium hydroxide (alkali) for 24 h [Figure 3]
3. Assault III: No changes whatsoever were noted in any of the labels [Figure 3]
4. Assault IV: The block was placed in a ceramic furnace starting at room temperature and raised up to 800°C which took nearly 10 min. At this temperature, it was kept for another 20 min to simulate a crematory furnace. At the end, on removal, only the three metallic labels, namely, SS matrix band, Ni-Cr plate, and brass palette

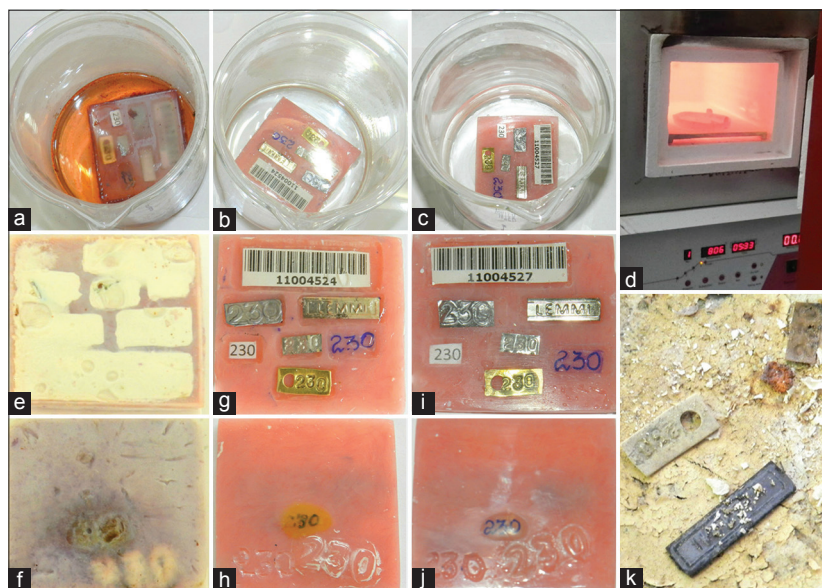


Figure 3: Assaults and Results: (a) Block in concentrated sulfuric acid after 24 h (b): Block in concentrated sodium hydroxide after 24 h (c): Block in water after 24 h (d): Block in furnace at 800°C (e and f): Inclusion and surface labels after acid assault and passes through running water (g and h): Inclusion and surface labels after alkali attack (i and j): Inclusion and surface labels on placing in water (k): end excerpts from thermal assault at 800°C

Table 1: Reaction of various labels to different assaults

Assault	Surface labels			Inclusion labels						
	Engraving	Embossing	Marking	Barcode	Lead foil	Ni-Cr plate	Paper	SS band	OHP sheet	Brass palette
I. Concentration acid	✓	✓	✓	x	x	x	x	x	x	x
II. Concentration alkali	x	x	x	x	x	x	x	x	x	x
III. Water	x	x	x	x	x	x	x	x	x	x
IV. Thermal 800°C	✓	✓	✓	✓	✓	x	✓	x	✓	x
V. Thermal 1000°C	✓	✓	✓	✓	✓	x	✓	x	✓	x
VI. Thermal 1200°C	✓	✓	✓	✓	✓	x	✓	✓	✓	x

x: No change, ✓: Disfigurement/distortion/destroyed, SS: Stainless steel



Figure 4: Result of thermal assault at higher temperatures: (a) At 1000°C (b): At 1200°C

remained with little residues left behind of the acrylic blocks. All the three metallic labels were intact with the etched information readable [Figure 3]

5. Assault V: The block was placed in a ceramic furnace starting at room temperature and raised up to 1000°C. At this temperature, it was kept for another 20 min. No changes were observed from the results of Assault IV with all three metallic labels being discernible [Figure 4]
6. Assault VI: The block was placed in a ceramic furnace starting at room temperature and raised up to 1200°C. At this temperature, it was kept for another 20 min. When removed, it was observed that the SS matrix band label showed some distortion where the embossed details were difficult to read. The Ni-Cr plate although readable exhibited significant color change.

The brass palette turned out to be the best denture label in the present study which withstood all the assaults retaining its original color and shape along with the details.

Discussion

Identification through dental means does not have a point specification as to the minimum number of matches required to establish a positive identification since there are numerous possibilities. However, in edentulous patients, these possibilities are drastically reduced. Hence, their best chance of identification by dental means could be a labeled dental prosthesis. According to Thomas *et al.*, placing the label at the far end of the denture will enable protection even in case of extreme burns.^[7]

The British Council on Prosthetic Services and Dental laboratory Relations have laid down certain specifications for an ideal label, which are as follows:^[8]

1. It must not jeopardize the strength of the prosthesis
2. It must be easy and inexpensive to apply
3. The identification system must be efficient
4. The marking must be visible and durable
5. The identification must withstand humidity and fire
6. The identification mark should be esthetically acceptable
7. The identification mark should be biologically inert (when incorporated into the denture)
8. In addition, the marking should be permanent and resistant to everyday cleansing and withstand the cleansing and disinfecting agents.

The surface labels are easy to apply, inexpensive, and readily visible but are not durable and need reapplication and might harbor food lodgment and act as focus of irritation to the oral soft tissues. On the other hand, the inclusion labels are permanent. The postfabrication method allows for easy viewing of the labels without the need of any other means for its identification. The nonmetallic inclusion labels considered in the study are inexpensive, nontechnique sensitive, and easily available to be incorporated in routine dental practice. They also performed reasonably well with the exception of incineration. The metallic labels (except the lead foil) irrespective of the make are ones that have performed exceptionally well among all the other labels.

Subjecting the labels to the acidic assaults altered the surface of the block. This deteriorated the surface labels and hampering the readability of the inclusion labels which is similar to the results obtained by Richmond and Pretty.^[9] The block was then immersed in water for a further 24 h to neutralize the acid which led to the formation of white chalky precipitates on the surface. When the precipitates were abraded using trimming burs and finishing burs, all the inclusion labels were rendered completely readable including the barcode which could be easily scanned using the barcode reader as was radio frequency identification (RFID) tag in their experiment.

Both the surface as well as the inclusion labels seemed unaffected by immersion in alkali and water which is in accordance with the study by Richmond and Pretty.^[9]

The thermal test at 800°C, 1000°C, and 1200°C destroyed the entire acrylic block along with the labels with the exception of SS band, Ni-Cr plate, and Brass palette. The Brass palette remained unchanged even at the highest temperature in our study with other two metal labels exhibiting some distortion or color change although the details were readable. The incineration and naked flame both produced similar results in the study by Richmond and Pretty.^[9] RFID tags also performed well next to the metallic labels in their study. However, microchips and RFID tags were not included in the present study because in developing countries like India, these are not only difficult to procure but also expensive thereby increasing the cost of the prosthesis.

Hence, the metallic labels come to be the near-ideal labels. The esthetic requirement is fulfilled as the labels are inserted at the posterior end of the denture. Moreover, the metal inserts in a denture enhanced the fracture resistance of the denture resins increasing the strength of the denture in contrast to the possibility of dislocation, wrinkling, or tear during prefabrication.^[10]

Olsson *et al.* conducted a study to test three different types of steel bands (Jasch, Remanit, ID-band) exposed to temperature levels of 1100°C, 1200°C, and 1300°C. At 1100°C, only the ID-band and the Jasch band were readable, but none of them at 1200°C and 1300°C. However, there is a doubt whether their reliability at such high temperatures needs to be studied as the routine temperatures in a crematorium furnace lies around 800°C.^[8]

Thomas *et al.* tested ID-band, Ho-band (SS matrix), and titanium foil at 700°C and 900°C and showed that performance of ID-band and Ho-band was similar.^[7]

The stability of these denture labels over a period time also proves to be a challenging factor for identification. This largely depends on the color stability, surface roughness, water sorption, general oral hygiene, and maintenance of the prosthesis using various cleaning agents. Although the color stability of autopolymerizing acrylic resin is poorer as compared to heat-polymerized acrylic resin,^[11] the water sorption that occurs starting from fabrication of a denture to its constant use in oral fluids is grossly insignificant.^[11,12]

A number of different equipments and materials have been used to create more proficient denture labels. These range from simple paper to the most advanced microchips and RFID tags.^[13-19] However, the denture labels used in the present study are readily available in dental clinic or dental laboratory setup and economical than such more sophisticated materials. The location and position of denture label placement offer protection to most hostile environments irrespective of their make. What is of greater importance is the chance at identification that the denture wearer has in situations of mass disasters, crime scenes,

memory loss or in trivial cases such as inadvertent loss or exchange in a hospital setup.

Conclusion

Among various denture labels, surface marking labels did not withstand majority of the assaults; hence, they are least recommended. However, the metallic denture labels performed superiorly over all other different labels. Some of these, i.e., brass palette could even withstand extreme temperatures. Metallic inclusion labels are readily available, economical, easy to incorporate, and inert. Thus, metallic inclusion denture labels are the most recommended denture labels for personal identification.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Avon SL. Forensic odontology: The roles and responsibilities of the dentist. *J Can Dent Assoc* 2004;70:453-8.
2. 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;190:359-66.
3. Richmond R, Pretty IA. Identification of the edentulous individual: An investigation into the accuracy of radiographic identifications. *J Forensic Sci* 2010;55:984-7.
4. Thomas CJ. The role of the denture in identification: A review. *J Forensic Odontostomatol* 1984;2:13-6.
5. Richmond R, Pretty IA. Contemporary methods of labeling dental prostheses – A review of the literature. *J Forensic Sci* 2006;51:1120-6.
6. Millet C, Jeannin C. Incorporation of microchips to facilitate denture identification by radio frequency tagging. *J Prosthet Dent* 2004;92:588-90.
7. Thomas CJ, Mori T, Miyakawa O, Chung HG. In search of a suitable denture marker. *J Forensic Odontostomatol* 1995;13:9-13.
8. Stavrianos C, Petalotis N, Metska M, Stavrianou I, Papadopoulos C. The value of identification marking on dentures. *Balkan J Stomatol* 2007;11:212-6.
9. 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;54:411-4.
10. Polyzois GL. Reinforcement of denture acrylic resin: The effect of metal inserts and denture resin type on fracture resistance. *Eur J Prosthodont Restor Dent* 1995;3:275-8.
11. Joshi NP, Sanghvi SJ. Water sorption by maxillary acrylic resin denture base and consequent changes in vertical dimension. *J Pierre Fauchard Acad* 1994;8:97-106.
12. May KB, Razzoog ME, Koran A 3rd, Robinson E. Denture base resins: Comparison study of color stability. *J Prosthet Dent* 1992;68:78-82.
13. Colvenkar SS. Lenticular card: A new method for denture identification. *Indian J Dent Res* 2010;21:112-4.
14. Bansal PK, Sharma A, Bhanot R. Denture labelling: A new approach. *Contemp Clin Dent* 2011;2:76-8.

15. Rajendran V, Karthigeyan S, Manoharan S. Denture marker using a two-dimensional bar code. J Prosthet Dent 2012;107:207-8.
16. Ling BC, Nambiar P, Low KS, Lee CK. Copper vapour laser ID labelling on metal dentures and restorations. J Forensic Sci 2010;55: 984-7.
17. Anehosur GV, Acharya AB, Nadiger RK. Usefulness of patient photograph as a marker for identifying denture-wearers in India. Gerodontology 2010;27:272-7.
18. Luthra R, Arora S, Meshram S. Denture marking for forensic identification using memory card: An innovative technique. J Indian Prosthodont Soc 2012;12:231-5.
19. Nuzzolese E, Marcario V, Di Vella G. Incorporation of radio frequency identification tag in dentures to facilitate recognition and forensic human identification. Open Dent J 2010;4:33-6.