Denture marking: a mandatory procedure to aid forensic identification

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Abstract
Purpose – The purpose of this paper is to highlight the significance of placing identification marks on dentures.

Design/methodology/approach – This paper reviews the legislation with regard to denture marking in certain countries, various methods of denture marking and describes a simple, inexpensive, paper-based labelling system.

Findings – Various methods have been proposed for denture marking but it is important to use a method that is simple, practical, affordable and universally acceptable.

Practical implications – The identification of unknown or missing persons by means of denture marking is a very successful method of identification in forensic investigation. It is also useful for patients residing in hospitals and community homes where dentures could be misplaced, particularly during cleaning by personnel where there is a chance of loss or mix-up. The importance of denture marking should be emphasized by all law-enforcing authorities and should be promoted among all dentists, towards making it a compulsory routine dental procedure throughout the world.

Originality/value – In Malaysia, denture marking, as recommended by its Ministry of Health, uses a unique coding system which can readily provide information about the wearer in whichever part of the world the person is found. The method applied is simple, practical and affordable and can easily be adapted by others. It can be of great value during times of crisis.

Keywords Malaysia, Denture marking, Denture labeling, Disaster victim identification, Person identification, Mass casualties, Identification, Forensic science

Paper type General review

Introduction
Despite an improvement in the oral health of the general populations, there are still many who are edentulous and who have and need to be treated with removable dentures. The significance of placing identification marks on dentures has long been acknowledged by the dental profession and its routine practice has been urged by forensic odontologists internationally for many years (Richmond and Pretty, 2009).

Dental identification plays an important role in successfully identifying victims of mass disasters such as fire, drowning and accidents (Brannon and Morlang, 2001; Goodman and Himmelberger, 2002; Valenzuela et al., 2000). The Tsunami catastrophe
of December 2004 left around 230,000 dead. Disaster victim identification teams were presented with the unprecedented challenge of identifying thousands of badly mutilated, disfigured and severely putrefied bodies (James, 2005). On January 12, 2010 an earthquake of 7.0 magnitude struck Haiti and it is estimated to have caused the loss of more than 200,000 lives. Reliance on circumstantial evidence to identify remains can often lead to mistaken identification. It is interesting to note that it takes only one marked denture to accurately and cost efficiently identify a deceased when all other methods may fail (Borrman et al., 1995).

Other useful indications for denture marking are for patients residing in institutions such as hospitals and community homes (Stenberg and Borrman, 1998) where dentures could be misplaced, particularly during cleaning by staff leading to confusion of ownership. It also serves similar purpose in identifying mouth guards worn by sportspersons involved in contact sports (Reeson and Jepson, 2000). Denture marking can also aid in the ritual of burial of an unidentified body according to the individual’s religious rites and even in the disposal of the property of the deceased, insurance or claim for compensation where negligence may be involved.

Weissenstein first proposed that dentures should have some form of identifiable markings in 1931 (Murray et al., 2007). In some countries, the marking of dentures is regulated by legislation, but in most places there seems to be reluctance to effect this practice. The National Health Services in the UK encourages dentists to label their patients’ denture by allowing them to add the cost to their fee, while it is a mandatory procedure for servicemen of the UK armed forces to be provided with this service (Murray et al., 2007). The Nursing Home Standards in Australia (Alexander et al., 1998) require that dentures of residents be labeled. The marking of dentures is not regulated by law in Sweden, but it is recommended by the Swedish Board of Health and Welfare (Borrman et al., 1995), that all patients should be offered the opportunity to have their dentures marked, which they may refuse. In the USA, the marking of removable prosthesis is regulated by legislation in 21 states (Collins, 2004). The Ministry of Health (MOH) in Malaysia (Oral Health Division (OHD), 2006) recommends that all new complete dentures be marked before being issued to the patients and this is strongly supported (Ling and Nambiar, 1996; Nambiar et al., 1997) as no country is immune to natural and artificial disaster.

Over the years, various methods of denture marking have been reported in the literature and they can be divided broadly into “surface marking” and “inclusion methods.” In the surface-marking techniques (Heath, 1987; Stevenson, 1987), identification marks are scratched, engraved or written onto the surface of the denture or denture cast. This method is simple and cheap but possesses poor abrasion, plaque and fire resistance and can cause irritation of the patient’s mucosal tissue that may contribute to candidal infections. In contrast to surface-marking techniques, inclusion methods (Ling, 1993; Lose, 1958) enclose the identifying marks within the denture base material, hence rendering them relatively permanent. A number of inclusion labeling materials exist namely metallic (Reeson, 2001) or non-metallic materials (Bernitz and Blignaut, 1998), as well as the more high-tech method of using microchips (Rajan and Julian, 2002) and barcoding (Agu ¨log˘lu et al., 2009). Various studies (Richmond and Pretty, 2006, 2007, 2009) have been undertaken to determine the most suitable method. However, it is essential that whichever method used should satisfy all the criteria outlined by the Council on Prosthetic Services and Dental Laboratory Relations (Vestermark, 1975) as well as be cost effective and be favored by patients and dentists.
As indicated earlier, the importance of placing identification markers in dentures is well documented throughout the world. This paper describes a simple, practical and affordable, post-fabrication paper-based marking system and more importantly, emphasizing on the advantages of using the unique identification number for data retrieval.

**Technique**

1. Key in the patient’s identification information, namely identity card (ID) number and/or name along with the international country code into a computer using a clear and legible but adequately small font (e.g. Arial, using eight-point font size). Print out this information using any standard bubble jet or laser printer on an A4-size oil paper (Figure 1a). In order to save time and cost, the printing can be done collectively for a number of patients who are already on the treatment list.

2. Cut/trim the printed paper to the size that is required.

3. Denture processing is completed according to the manufacturers’ instructions.

4. Determine the area where the label is intended to be placed in the denture. For the maxillary denture, it is suitable to place the label in the area adjacent to the palatal slope of the posterior alveolar ridge apical to the molars. For lower dentures, it is recommended to place the label in the disto-lingual flange in a position apical to the molars.

5. Make a trench in the acrylic on the polished (external) surface (Figure 1b) of the denture, to the size of the identification label (approximately 1 mm deep × 4 mm wide) using a pear-shaped acrylic bur on a slow-speed hand piece.

6. Place the identification label in the trench (Figure 1c).

7. Mix clear self-curing acrylic resin and place the dough over the label. Slightly overfill the trench (Figure 2).

8. Allow the acrylic to cure on the bench or in a pressure pot. Curing in a pressure pot in 100°F and 20 psi pressure for 20 minutes will reduce porosity of the resin.

9. Trim and polish the cured denture.

**Discussion**

Forensic odontology is today considered a specialized and reliable method of identifying the deceased and the living, for both single identification as well as in disaster situations. Major disasters (Figure 3), regardless of their origin, have one thing in common, an enormous number of fatalities and the community’s desire for victims to be identified as quickly as possible. Identification of the victims is of utmost importance for both legal and humanitarian purposes. Each disaster has yielded important evidence about handling bodies, particularly when the number of dead overwhelms the capacity of a country to effectively respond to an emergency (Clement et al., 2006; Jusoff, 2010; Pate, 2008; Sweet, 2006).

Denture marking has long been accepted as a means of identifying persons in geriatric institutions and for assisting in postmortem identification of unidentified
human remains during war, crimes and civil unrest as well as natural and even mass disasters. The use of denture in forensic investigation was recorded as early as 1835 when a gold denture helped identify the burnt body of the Countess of Salisbury (Turner et al., 1976). The significance of denture marking in mass disaster identification (MacEntee and Campbell, 1979) was appreciated after the Second World War when it was discovered that 819 of the 3,000 unidentified dead soldiers were denture wearers. But unfortunately, only nine persons of those who wore dentures could be identified. Following the Bradford football fire on May 11, 1985, the first of 20 recommendations made by the inquest jury was “[...] clearer marking of dentures, preferably with the name of the owner, should be mandatory” (Ayton et al., 1985).

Most dental personnel do not mark dentures on a routine basis. Cost, lack of awareness of standards and recommendations, infringement of patient privacy and a
belief that it was of little importance are some of the reasons cited (Alexander et al., 1998) for not marking these dentures. However, a recent study (Richmond and Pretty, 2007) showed that patients were rarely made aware about the need for marking dentures and that a majority of them would accept denture marking provided it is esthetically placed.

Various methods have been proposed for denture marking and this includes the insertion of an identifying label during the fabrication of the dentures with the utilization of a number of materials and coding systems. Paper-based marking system can be done at various stages and by different methods. The method of placing the label after denture processing with clear autopolymerizing resin has many advantages. This simple procedure takes little time, has almost no cost, and is permanent and effective. Moreover, it is easily applied, very resistant to abrasion, non-interfering with oral functions, unaffected by immersion denture cleansers, antiseptics and mouthwashes, and does not affect the transverse strength of acrylic resin because of its position away from the fracture prone area. These micromarkings, with a clear foreground, will have minimal esthetic impact on the patient yet remaining easily visible.

Labeling inclusions should be placed in areas of the denture where the acrylic resin is thick in order to accommodate the inclusion material and also away from fracture-prone areas like the denture midline. The marking should be placed in areas where denture adjustment is minimal, to avoid the possibility of the marking being removed during trimming.

**Figure 3.**
List of major disasters in the last ten years with large numbers of fatality

<table>
<thead>
<tr>
<th>Disaster Description</th>
<th>Estimated Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major air crashes throughout the world in the last ten years</td>
<td>Estimate 10,000 died</td>
</tr>
<tr>
<td>Indian Ocean Tsunami of 2004</td>
<td>Estimate 230,210 died</td>
</tr>
<tr>
<td>Haiti earthquake 2010</td>
<td>Estimate 220,000 died</td>
</tr>
<tr>
<td>Kashmir earthquake 2005</td>
<td>Estimate 79,000 died</td>
</tr>
<tr>
<td>Cyclone Nargis 2008</td>
<td>Estimate 146,000 died</td>
</tr>
<tr>
<td>Sichuan earthquake 2008</td>
<td>Estimate 68,712 died</td>
</tr>
</tbody>
</table>

**Note:** All figures are approximate and subject to change.
The disadvantages of any marking technique are that it is vulnerable to extreme chemical and physical degradation. In situations where the deceased body is badly burned, the denture and its identification strip may be burned, too. However, this risk can be minimized if the strip is placed in the most posterior part of the denture, namely palatal in the maxillary denture and disto-lingual in the mandibular denture. Should the deceased be involved in a fire and be burnt beyond recognition, the heat will have to pass through the cheek muscle, then the buccal flange of the denture and lastly the alveolar ridge before it can reach the labeled area and degrade it (Figure 4).

According to Privacy International, as of 1996, around 100 countries had compulsory ID (Wikipedia, 2007). Certain countries do not have national ID cards, but have other official documents, such as a passport birth certificate, social security number or driver’s license that play the same role in practice. In Malaysia, the microchip incorporated MyKad or Government Multipurpose Card, regarded as the world's first smart ID and represented by an unique number, provides information such as bearer’s full name, photograph, gender, place of birth, birth date, address, religion and citizenship status of the individual. With this unique number and more detailed information, quick identification of a person can be made.

Denture marking, as recommendation by the MOH, Malaysia, uses a unique coding system, the standard country code and the individual’s MyKad number: MY yymmdd-BP-###G. MY stands for Malaysia and BP is the code of the state in Malaysia where the individual was born. Both of these codes, as part of the ISO 3166 standard published by the International Organization for Standardization (ISO, 2007) and accepted by the United Nations, are commonly used and accepted standard worldwide. The yymmdd denotes the year, month and date of birth of the individual. The ###G represents a randomly generated serial number. The last digit, G, denotes the gender of the individual; odd numbers for males and even numbers for females. Equipped with this information, one can trace the details of owner of the denture through the Malaysian National Registration Department.

Conclusion

The importance of denture marking, particularly in terms of forensic and humanitarian issues, remains a valid and worthy endeavor to be undertaken by all dentists. The Federation Dentaire International, should work toward enforcing all member countries
to adopt it as a compulsory dental procedure. A simple, inexpensive, internationally acceptable denture marking and coding procedure and guideline, acceptable by any court of law, should be made available for all denture wearers.

References


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