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An Examination of Dental Prostheses as Tools for Individual Identification

Dr. Zaid Alaa[1], Reem Majeed Hameed[2], Prof. Dr. Nihad Khalawe Tektook[3*], Dr. Shailesh N.Medatwal[4]

[1]B.D.S PG Dip. In Orthodontics M. Sc Orthodontics/ College of Dentistry/ Al-Ameen University;

[2]Department of Pedodontics, Orthodontics, and Preventive Dentistry, College of Dentistry, Ashur University/Iraq;

[*3]Middle Technical University/ College of Health & Medical techniques/Medical laboratory techniques Department;

[4]Department of Pathology & laboratory medicine /All india institute of medical scinces (AIIMS)/ New Delhi/ India.

[*]**Corresponding author:**

Prof. Dr. Nihad Khalawe Tektook

Email ID: drinhadkhalawe@gmail.com

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ABSTRACT

Dentistry offers significant support to law enforcement in the detection and resolution of crimes, as well as in clinical proceedings. Prosthodontics, as a specialised branch, can play a crucial role in identifying individuals. Dental prostheses can serve as valuable tools in identifying individuals who have lost their memory, are in unconscious states, or in recognising the bodies of those who have died in accidents, disasters, or natural calamities. Forensic odontology plays a vital role in identifying individuals in cases involving criminal investigations, mass disasters, or unrecognisable remains. Among the various tools available to forensic experts, dental prostheses have emerged as significant identifiers. Prosthodontics, a specialized branch of dentistry, provides unique markers through customized prosthetic devices such as dentures, bridges, and implants. These dental appliances, when appropriately marked or labeled, can offer critical information regarding a person's identity, especially in cases of memory loss, unconsciousness, or fatalities in accidents and natural calamities. This review aims to explore the forensic relevance of dental prostheses, their identification potential, and the methods used for labelling and recording them. Dental prostheses, such as dentures, crowns, bridges, and implants, are not only functional replacements for missing oral structures but can also serve as valuable forensic tools. In forensic dentistry, these prosthetic devices can carry unique identifiers such as serial numbers, embedded barcodes, or customised inscriptions, aiding in the identification of unknown individuals, especially in cases involving trauma, memory loss, unconsciousness, or mass disasters. This paper examines the role of dental prostheses in individual identification and discusses various methods used to mark and record these devices for forensic and clinical purposes. Dentistry offers significant support to law enforcement in the detection and resolution of crimes, as well as in clinical proceedings. Prosthodontics, as a specialised branch, can play a crucial role in the identification of individuals. Dental prostheses can serve as valuable tools in identifying individuals who have lost their memory, are in unconscious states, or in recognising the bodies of those who have died in accidents, disasters, or natural calamities.

Keywords: *Denture Identification: Surface Marking Methods, Inclusion Techniques, and Palatal Rugae Pattern*

1. INTRODUCTION

The majority of dental identities are predicated on the existence of reconstruction, cavities, missing teeth, and/or replacements, as recommended by the American Board of Forensic Odontology. [1] Following significant calamities like volcanic eruptions, fires, or floods, it is vital to accurately and promptly identify the dead and injured. Sometimes, a victim's partial or complete dentures may be the only distinguishable remnant. The techniques for the private recognition of toothless (toothless) victims in investigative odontology are far more restricted than those used for dentate individuals. Some identifying methods, including comparing the morphology of the sinus cavities with the bone structures seen on imaging studies, are still helpful, though. Additionally, the victim's dentures, which are often found in their mouth or at home, may contain important personally identifiable information. These could include information about the materials, manufacturing, and unique shapes of dentures, which could be utilised as either antemortem or posthumous testimony. [3] biologically inert, affordable, quick and straightforward to apply, obtainable after an incident, acid-resistant, and able to tolerate extreme conditions are the fundamental standards for prosthetic markers. In addition, the marks need to be visually appealing,

readable, and long-lasting, despite sacrificing some of the prosthesis's toughness. The markings should also be durable and impervious to standard cleaning and disinfection solutions. As a result, the prosthesis's maxillary or sublingual portions are typically the recommended areas for branding. [4] In criminal cases, confirmation of identity using tagged dental appliances is essential. Several techniques for marking partial and total prosthetics are reviewed in this article.

2. REMOVABLE PARTIAL DENTURE MARKING TECHNIQUE

A method for adding a cast-embossed identifying plate to a complete denture structure was presented by Hideo Matsumura et al.[5] Using this technique, an identifiable sheet of metal is inserted into the prosthetic structure after an imprinted thermoplastic design is created with a branded marker. Using an old-fashioned la-bel indicator, type the identifying symbols on the laminating tape following the wax template has been created on the fireproof cast. For the plastic foundation arrangement, individually cut an expanse of tape that is 15 mm long and 5 mm wide. (Fig. 1).

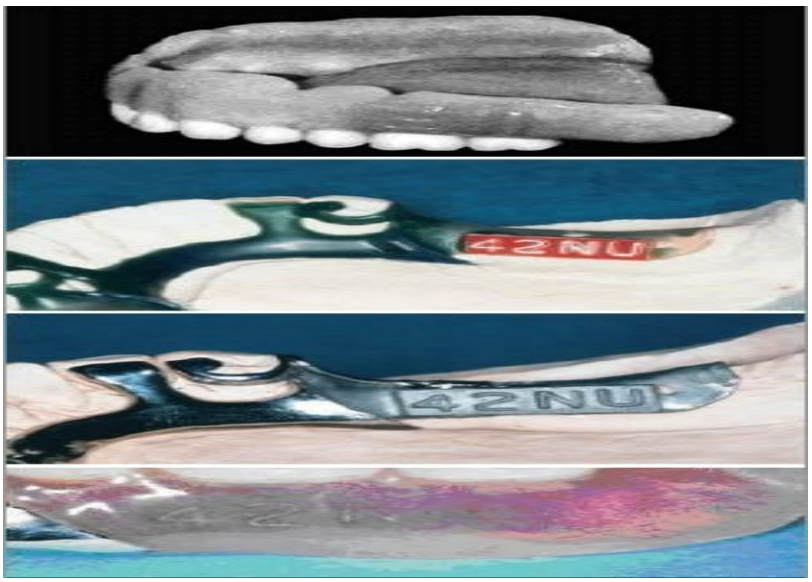


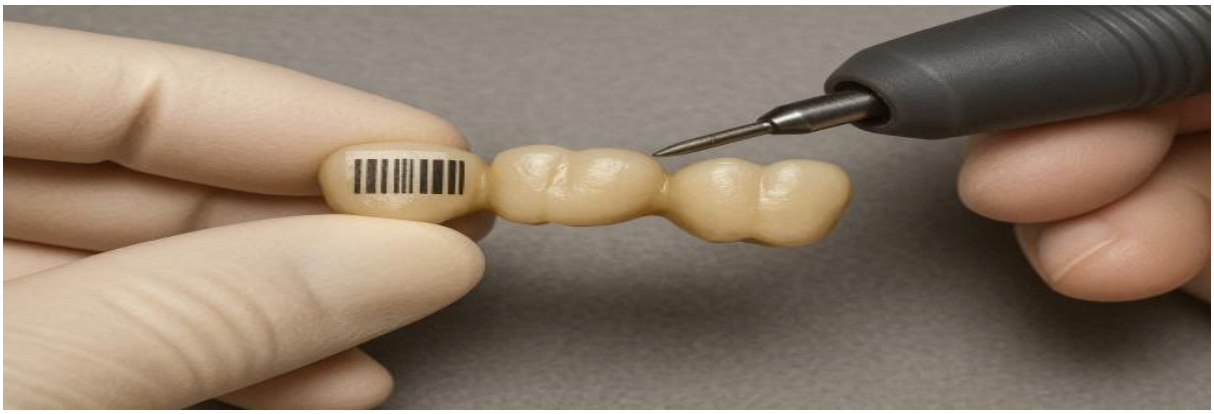
Figure (1): Polymer template preparation with a manually operated labelling printer.

Figure (2):the cast framing of a partial denture

Figure 2 shows the cast framing of a partial denture made of the Ti-6Al-7Nb alloy with a piece of textured plastic tape placed to the wax template. Clearly replicated with metallic lettering. Apply the trimming tape to the proper location on the frame of the wax image once the wax mold has been fabricated on the fireproof cast. Invest in the preferred detachable complete prosthesis alloy and cast the wax template. (Fig. 2) Tissue-colored acrylic bases for dentures resin makes the embossing calligraphy that results recognizable.

2) Fixed identification marker for partial dentures

During final interactions, the fixed complete denture or crowned in the chair was marked using an electric engraving driven by an AC motor, according to a method suggested by M.R. Diwashkich et al. 6. Crowns and Fpds crafted from gold or aluminum alloys can be effortlessly worked with the sharpened steel engraved needle (fig 4). A different method to label crowns and bridges for recognizing patients is with a bar code. PFM or all porcelain caps can have a bar code written on their mandibular or pharyngeal the outside, which is then decoding using bar code reading technology. (Figure 3)



Figures- 3 : Bar Code Identification And Engraving On The Headpiece Using A Diamond Bar

Fig:4: Entire Dental Prosthesis The Marketing Techniques

Numerous prosthetic labelling techniques have been documented in the scientific community. Nonetheless, there are actually two primary approaches to prosthesis identification: the integration approach and the outermost methodology.

3. SURFACE METHODS

Techniques of carving or recording:

This technique uses a tiny spherical orthodontic bur to imprint characters or numerals on the outermost layer of the tooth. Although this method is simple to use and cost-effective, it has drawbacks, including food enticement, bacterial infection, and discomfort.

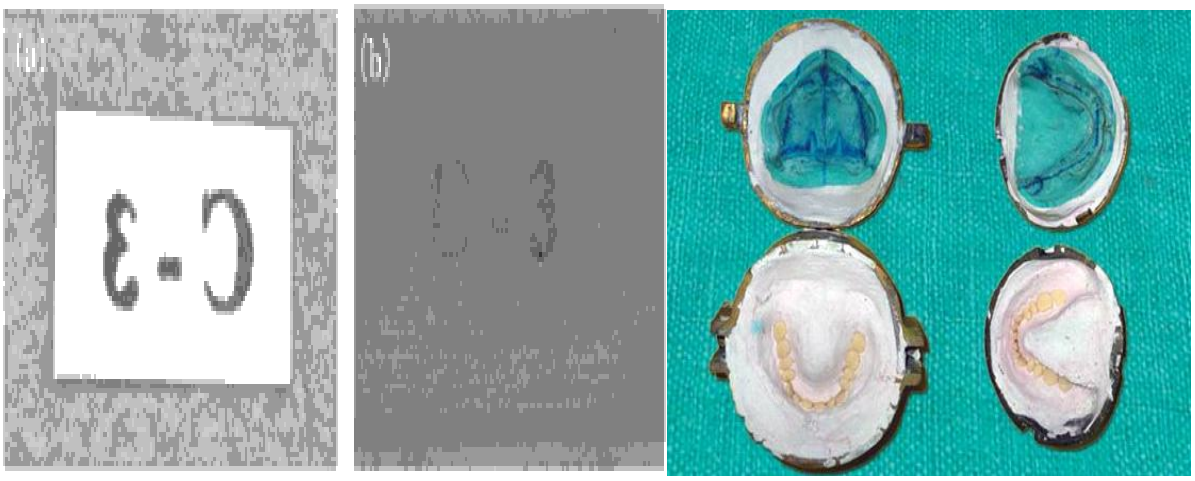
Embossing method:

Using this method, the person's name and other personal information were utilised to remove the original cast. It creates embossing or imprinted lettering on the pressed surface that covers prostheses after manufacturing. This method is cost-effective, but because it continuously irritates structures, it has been linked to cancer.

Technique for immediately imprinting an individual identifying number on the exterior of a prosthesis

The process of imprinting an individually identifying mark on prosthetic edges was explained by Fumi Takahashi et al.7. Using a photograph manipulation tool, identity information was entered into a machine, with the characters inverted. A laser printer was used to produce the inverted mark on paper. The area of the dentures, where the mark would be placed, was then covered with an acrylic copolymer. Before the MMA monomers evaporated, the marked paper was pushed onto the

experimental plate. As a result, the denture bore the mark. MMA copolymer functions as a naturally occurring solvent that dissolves the adhesive resin found in LaserJet ink, allowing colour to be produced on a denture's exterior.



Figure(5) :

Technique of Incorporation ID of an aluminum plate or tape A method for identifying dentures was presented by Michael G. Reeson et al.8. It involved using a small rose-head bur for engraving the patient's name and identity on an aluminum Reactivate the flask after the dentures trial a conclusion before flacking, and place an extension of aluminum tape that has the identical size as the engraving plate but twice as thick as the plate to make room for transparent heat-cured Plexiglas to be placed over it. Close the flask when the metal plate has been placed and covered with packaging plastic. lingual flanges in the temporomandibular prosthesis and posterolaterally in the roof of the mouth, up the flask, and take off the double-thick metal tape and wrapping material. To complete the process, place the designation plaque in position, add some clear plastic, and polymerise the artificial tooth according to the manufacturer's directions. Deflask the sleek material and polish the restoration. (Figures 6 and 7)

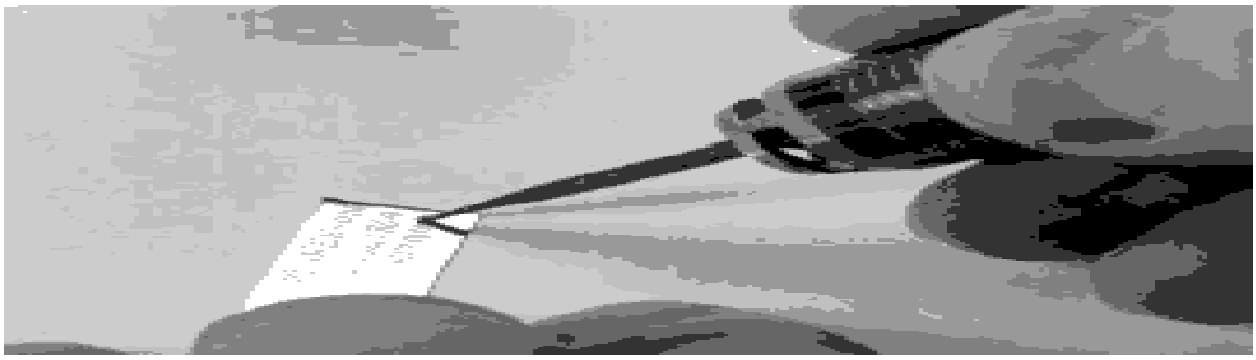


Fig. 6: Stain-less metallic tape with an individual's initials and identity details.

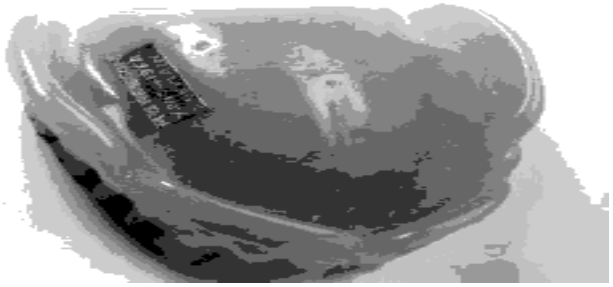


FIG.7 :The finished nameplate is positioned posterolateral in the mandibular dentition

The finished nameplate is positioned posterolateral in the mandibular dentition (Fig. 7).

5) A computer-printer method for mislabeling dentures

According to Booi C. Ling et al. (9), a method of prosthesis identification involves entering particulars into a machine employing an 8-point font size, including designation, sex, national identity card number, and county of residence. The content was printed on paper goods, then resized by 50% and recorded onto transparent film. To guard against monomer destruction, an entirely acid derivative sticky solution is used before the film is inserted into the dentures. The wax spacing approach can be used to insert the packaging label into the prosthesis throughout the shipping stage, or it can be done after manufacturing by creating a depression that is 1 mm deep and broader than the label's dimensions. After that, the label can be sanded and covered with a thin coating of auto-polymerised resin. (Figures 8 and 9).

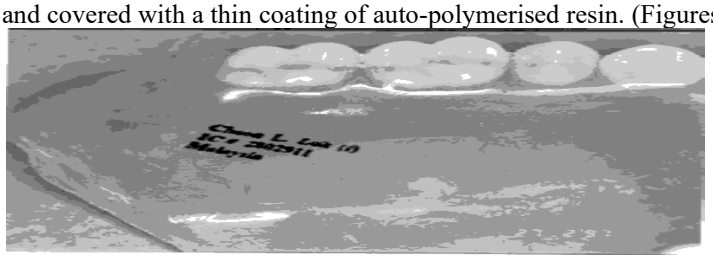


Figure 8: Customer personal data appears on white aircraft material at the top, and specifics are duplicated on 50% reduced translucent film at the bottom.

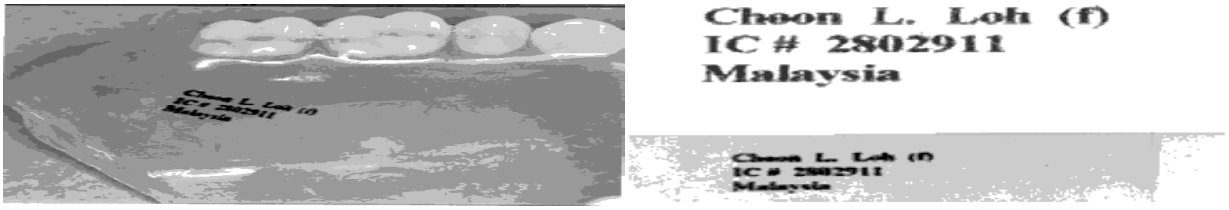


Fig. 9: Completed mandibular dentures with labeling attached.

6) Bar code denture marker

A method for identifying dentures employing accessible to machines code consisting of a sequence of gaps and bars inscribed in predetermined quantities was presented by Aglouglu S. et al. (2010). the Crown corporation and bridge repairs can be utilized with prosthetic identification about the patient's name, age, sex, address, and other details may be contained in the bar code. Prosthesis bar coding is simple and inexpensive, and because cellphones have become more widely used, particular gear is no longer required to read the bar code.

Fig(10 & 11):The denture's coding system and the bar software readers

7) Q-R code

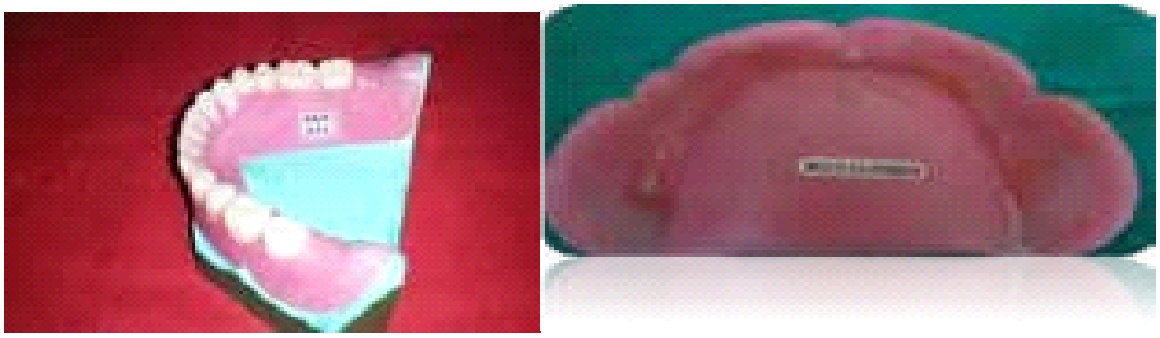
Using a code power source, Venkateshwara Rajendran et al. (2011) explained a method that involved using a two-dimensional bar code containing information like name, age, gender, addresses, telephone number, and social insurance number. order to stop the ink from spreading when it comes into touch with the polymerization through the prosthetic

production process, a 10x10 mm QR code has been generated and coated. Place the laminating label in a gingival depression that has been made 1 mm shallow. Repair and polish the false teeth after filling the recessed area with clear au-to polymerized resins (fig.12). Holding a mobile camera with a code decoding activated up towards the label allows the code to be decoded (fig13).

Fig(12 & 13): The prosthetic tooth has a 2-D coding system built into it, and a mobile device can be utilized to decipher it.

8) The printing panel technique

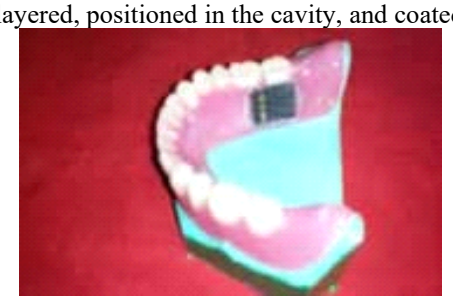
The technique reported by Thomas CJ et al.12 involved incorporating medical data, such as name, age, sex, and location, into a rectangle of paper that measured 10 x 5 mm. Following the trial conclusion, the strip above was inserted into the tissue side of a prosthesis. The gap between the palate's ridge and centre in the upper jaw, and in the mandible's distolingual area that houses this surface, a written newspaper strip is placed, and the chemical monomer is used to give moisture to the paper. Whenever the false teeth flask is finally closed, transparent cement is applied over the paper (figs 14 and 15).



Fig(14 & 15): The false teeth flask is finally closed, and transparent cement is applied over the paper

9) Integrated storage media or semiconductors

A technique for downloading health information onto a chip or card with memory was disclosed by Hampton et al. (2013). On the posterior-lateral aspect of the mandibular dentition and the distolingual area of the lower jaw, a depression was made that was marginally bigger than the size of a semiconductor or recording card. The prosthetic appliance was finalised and finished after these chips were layered, positioned in the cavity, and coated with self-curing polymer (Fig. 16).



Fig(16): The prosthetic appliance was finalised and finished after these chips were layered, positioned in the cavity, and coated with self-curing polymer

10) RFID, or electromagnetic identification

Carlos Madrid and others, 14 The contributors of this work explained how to identify prostheses employing devices that recognise radio frequencies (RFID). The system consists of a tag or transponder, a device for reading it, and a data carrier. Inside the teeth is a microprocessor with a helical antenna that makes up the tag.

A significant issue with medical facilities and long-term care homes is the challenge in determining who owns misplaced dentition. This issue may be resolved by using bands or transmitters that store patient information, such as surname and birthdate. The tiny (2.12 x 8 mm) tags were employed, put at the mouthpiece following manufacture, and topped with self-curing acrylic resin. The primary drawbacks of this identifying method are its high cost and lack of fire resistance. (Figs. 17 and 18)

Fig(17&18):This identifying method's primary drawbacks are its high cost and lack of fire resistance.

11) Images

A method that used epoxy resin to insert copyright photos in the prosthesis was presented by Alehouse GV et al.15. In nations with low reading rates, when an image is the most straightforward means of verification, the marking is very helpful. Thermal testing, nonetheless, showed that photography markers were simply resilient to temperatures between 200 and 3000C.

(12) Adjacent Uroscopy

A attached rugae, which arrangement is one of the distinctive and reasonably accessible structural characteristics found in testimony obtained from a toothless. victimized following an occurrence, catastrophic event, or terrorist attack. The arrangement can be obtained from the mucous membrane of the prosthetic teeth as well as straight from the enamel of the palate.[3]

Palatal rugae's distinctiveness and general reliability were discussed by Ines Morais Caldas et al.16, who also recommended using them for forensic purposes. In addition to their uniqueness and the environment, maxillary rugae are utilized for individual identifying for additional reasons, such as their inexpensive cost of use.

The Carrea categorization, which divides pharyngeal rugae, or into four categories or merely classifies them based on their morphology, is among the most widely used categorization.

TYPE 1 Rugae oriented posteriorly-anteriorly.

TYPE 2 Rugae of that are transverse to the raphae

TYPE 3: Horizontal rugae from the frontal to the backside. Ruge type 4 is directed in multiple locations.

Teeth casts, outdated prosthetic devices (such as CD or RPD), and intraoral radiographs (fig. 19&20) can all be used to identify palatal rugae. However, the most commonly used approach is the analysis of mandibular dental impressions due to their affordability, ease of use, and dependability.

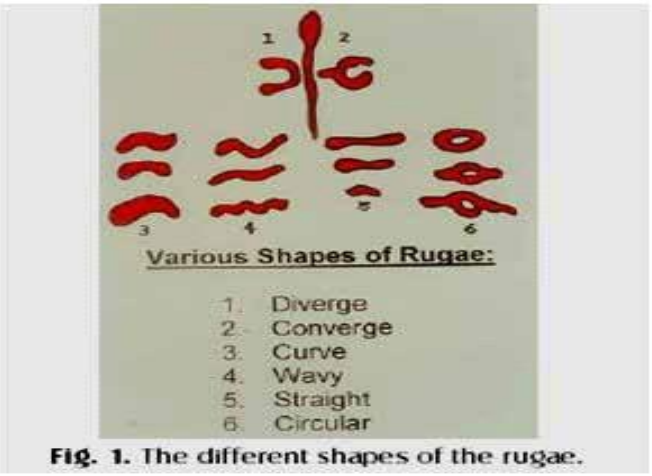


Figure (19 and 20): Teeth casts, outdated prosthetic devices (such as CD or RPD), and intraoral radiographs

4. DISCUSSION

The surface procedure and the integration procedure are the two most often used techniques for identifying dental restorations. Topical techniques appear to be simple to use and reasonably priced, but they require follow-up since they are readily removed, discoloured, or exhibit shifts in colour. Few surface techniques often employ stamped or engraved signatures with the aid of diamond burs or other tools.

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