Ministry of Higher Educati on

& Scientific Research

University of Baghdad

College of Dentistry

Impression materials and techniques used for complete dentures

A project

Submitted to the council of College of Dentistry, University of Baghdad at Department of Prosthodontics in partial fulfillment of the requirement for B.D.S degree

Prepared by:

Aya Ali Raheef

5 th Grade

Supervised by:

Dr. Yagthan Mohammed Haider

B.D.S, M.Sc Dental Materials

2021م

Certification of the Supervisor

I certify that this project entitled “**Impression techniques for completely edentulous patient** “ Was prepared by **Aya Ali** under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the Bachelor degree in dentistry

Supervisor’s name**: Dr**. **Yagthan Mohammed Haider**

بسم هللا الرحمن الرحيم

وقل رب زدني علما

صدق هللا العظيم

سورة ط- 114

Dedication

Now I'm standing in front of 18 years from my life as a hard working student getting

knowledge and be effective in my way, by the end of the first journey

I dedicate this graduation project to my dear mother and father who supported me in

every step of my life and be my backbone in my joys and sorrows, my companions on the path.

My sisters and my brother, thank you to be there always by my side, in my dark days and moments even

before happy days.

My friends, i will remember you always as my people who never let me alone, as a

wonderful journey partners

We finished These steps together, Always remember our days that pass heavily on us

But by the end, we did it together! wishing God to protect them and protect everyone from all evil.

ACKNOWLEDGEMENTS

In the beginning, I thank “God” who gave me opportunity, ability, energy, spirit and patience to complete this project work . I would like to express my heartfelt thanks to Dr. Raghad Abdul-Razzaq Al-Hashemi, Dean of the College of Dentistry, University of Baghdad for his support of the student's research program. I would like to thank Dr. Ghassan Abdel Hamid Al-Taie, Head of the Prosthetics. Department, for his scientific support, encouragement and advice. It gives me great pleasure to express my deepest gratitude to my supervisor,
Dr Yagthan Mohammed Haider, Department of Prosthodontics,
College of Dentistry, University of Baghdad, for his constructive academic advice and guidance, constant encouragement and valuable suggestions,
and everything else. Support throughout the life of this project and successfully prepares this project report.
I really benefited from his excellent supervision. I would like to thank all our family members, friends and those who helped ,inspired us and gave us mental support at different stages at different times of our project.

ABSTRACT

Background: Edentulism is relatively common and is often treated with the provision of complete or partial removable dentures. Prosthodontists make final impressions of complete dentures (CD) using different techniques and materials. There are several factors that contribute in successful impression making such as technique used, type of the material, and patient situation.

Aim of the study: To identify the type of materials and technique used by Prosthodontist in their clinics to construct conventional complete dentures.

Conclusion: This review study shows the dominance of use of irreversible hydrocolloid (Alginate) in primary impressions making. Zinc oxide eugenol paste, polyvinylsiloxane and polyether were used as final impression material in construction of complete denture. Prosthodontists prefer to use border molding procedure in their practice during taken an impression for complete denture. It takes between 10 and 20 minutes for each arch, but this procedure is not waste of time for them.

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

An impression is a record, a duplicate of mouth tissues taken at an unstrained rest position or in various positions of displacement **(Devan, 2005).** In the case of an edentulous arch, this requires a unique combination of managing movable soft tissue commensurate with integrating different materials and a technique for accurate reproduction **(Kois and Fan, 1997; Petrie *et al*., 2005).**

The history of complete denture impression procedures has been influenced largely by the development of impression materials from which new ideas and techniques arose. Some impression materials have been developed to accomplish specific goals and, at the time at least, were considered desirable for the purpose **(Zarb et al., 1985).**

The materials available for impression tray construction are as varied as are the materials for border molding and the final impression. Selection of material is left to the discretion of the dentist, who makes choices based on personal preference and experience. More important than selection of material is the dentist's complete understanding of the concepts and principles in impression making **(Boucher, 2004; Petropoulos and Rashedi, 2005; Al-Ahmad *et al.,* 2006).**

The manner in which the impression was made may be more important than the material. In the last decade, several investigators have recommended using newer elastomeric materials such as polyvinylsiloxane and polyether for final impressions to replace the older and more traditional materials **(Chee and Donovan, 1992; Ivanhoe *et al.;* 2002McCord*et al*., 2005; Petrie *et al.,* 2005)** .

Four basic types of elastomer impression materials are currently in use in the dental profession:

(1) Silicone rubbers which polymerize by a condensation reaction,

(2) Polysulfide (Mercaptan) rubbers

(3) Polyether

(4) Silicones which polymerize an addition reaction.

The latter have been introduced relatively recently and are also called polyvinylsiloxanes **(Lacy *et al*., 1981).**

AIMS OF THE STUDY

The study aim is to review the selections concerning impression techniques and materials used for making complete denture.

CHAPTER ONE
REVIEW OF LITERATURE

1.1. The History of impression materials used for Complete Denture

Dental impression making was developed ever since humans realized that the basic prerequisite for successful tooth replacement required capturing of the tooth morphology, along with the patient's functional characteristics. However up to mid-1800s, no official source had been identified indicating the presence of an impression material for tooth and/or dental alveolar processes. Up to 18th century, the prosthetic restorations consisted of ox's teeth and bone, hippopotamus and sea cow ivory tusks and human cadaver's teeth **(Hoffmann 1981).**

The first officially registered impression technique along with the fabrication of dental casts in the history of dentistry is dated back in 1756, at Berlin and was performed by Philip Pfaff, a German dentist of King Frederick II of Prussia Bees wax was the material applied in that first impression making process. The introduction of wax in dentistry has been ascribed to a German surgeon name Matthias Gottfried Purmann **(Zinner& Sherm an, 1981; Hoffmann, 1981).**

Pfaff's technique involved smoothing the sealing wax via immersion in warm water so as to facilitate the impression making procedure and to ensure a detailed capturing of soft oral tissues characteristics. With regard to the fabrication of stone dental cast, almond oil was used as separating agent applied on the surface of the impression before pouring stone into the impression with a spoon **(Starcke, 1975; Glenner, 1997).**

In 1842 Montgomery discovered gutta-percha, which belongs to the Sapotaceae, a family of flowering plants in Malaysia. Colburn and Blake, two American dentists, were the first who used gutta-percha as impression material in 1848. This material did not gain wide acceptance as impression material due to the rigidity and the high temperature involved in softening for its application.The introduction of Plaster of Paris as impression material in the field of dentistry first occurred in 1844 **(Starcke, 1975; Glenner, 1 997;Wilson & Gelbier, 2014).**

In 1925, the Austrian physicist Alphons Poller was invented the first elastomeric impression material composed of reversible hydrocolloid agar-agar with the trade name “Nogacall”. During the 1930s, Ward and Kelly introduced the zinc oxide eugenol sealer (ZOE). In 1935, William Wilding invented a new type of hydrocolloid based on sodium alginate that had replaced agar-agar hydrocolloid up to 19 In 1955, Pearson in the university of Liverpool invented the first polymeric

elastomeric of mercaptan that was released in the market with the trade name “Thiokol”. In 1975, addition - cured silicones were generated because of Apollo space program. Armstrong’s boots were composed of addition silicone exhibiting high dimensional stability (Jorgensen, 1982;Glenner, 1997).

The first light cured impression material composed of polyether urethane dimethacrylate was commercially introduced in 1988(Smith39**(Jorgensen, 1978;Smith, 1998)**

In 1955, Pearson in the university of Liverpool invented the first polymeric elastomeric of mercaptan that was released in the market with the trade name “Thiokol”. In 1975, addition - cured silicones were generated because of Apollo space program. Armstrong’s boots were composed of addition silicone exhibiting high dimensional stability **(Jorgensen, 1982;Glenner, 1997).**

The first light cured impression material composed of polyether urethane dimethacrylate was commercially introduced in 1988**(Smith, 1998).**

In 2009, EXAlence launched into the market a vinyl polyether silicone product (VPS) and which is composed of a combination of (VPS) vinyl polysiloxane and (PE) polyether and is promoted as a hydrophilic material that apparently exhibited the dimensional stability of the parent products **(Nassar et al.,,2013).**

Table 1.1 showed the developing of dental impression materials that used for construction of complete denture

Table (1): The chronological development of dental impression materials

Year	Type of material
1756	Bees wax
1842	gutta-percha
1844	Plaster of Paris
1857	thermoplastic synthetic resins
1925	agar-agar
1930	zinc oxide eugenol sealer (ZnOE),
1935	sodium alginate
1955	Mercaptan
1965	polyethers
1975	addition - cured silicones
1985	CAD-CAM
1988	polyether urethane dimethacrylate(Light cured)
2009	vinyl polyether silicone

1.2. Classification of Impression Materials

1.1 Impression materials used for complete denture are shown on Figure

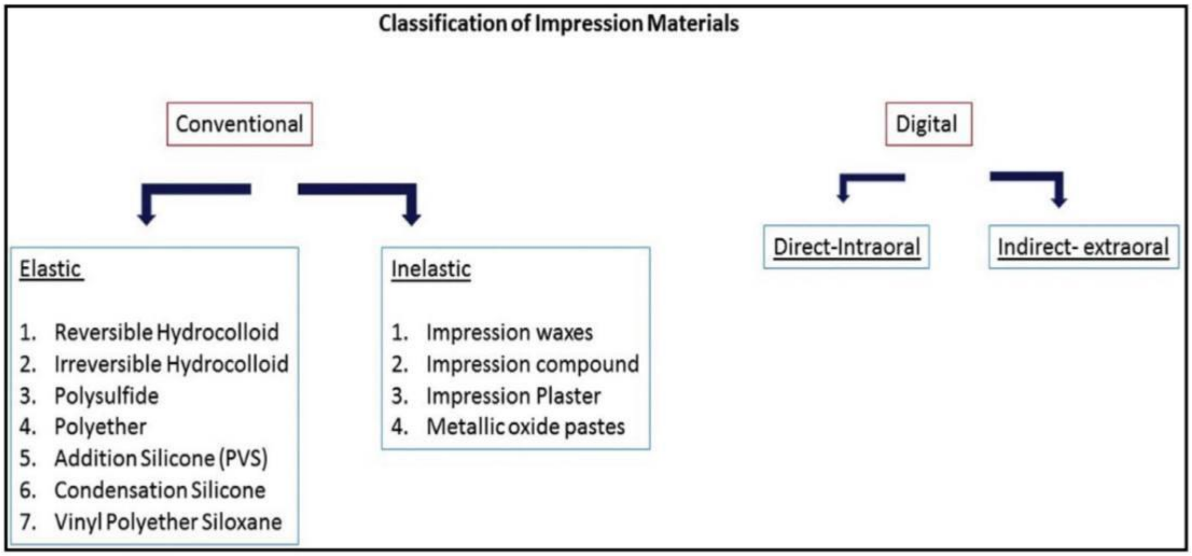

Figure 1.1: Classification of impression materials

1.2.1. Rigid Impression Material

I. Impression Compound

Impression compound is a thermoplastic material with a glass transition temperature of about 55–60°C. Above its glass transition temperature it becomes soft and will take up a new form. On cooling to mouth temperature, it hardens and can be removed, retaining an impression of the oral cavity. Thus, no chemical reaction is involved in the use of this material.

The composition of impression compounds tends to vary from product to product and is usually a trade secret. They consist of a combination of resins and waxes, plasticizers and fillers, each having a specific function:

•Resins and waxes. Resins are amorphous organic substances that are insoluble in water. Typical naturally occurring resins used in impression compound are shellac, dammar, rosin or sandarac to give greater control and consistency of the composition. Waxes are straight-chain hydrocarbons of the general formula CH3 (CH2) n CH3, where n is between 15 and42. They are characteristically tasteless, odourless, colourless and greasy to the touch. Waxes used in impression compound include beeswax and colophony.

•Plasticizers. The waxes and resin, if used on their own, would tend to produce a brittle material with a tendency toward stickiness. The brittleness is overcome by the addition of plasticizers, such as gutta percha and now, more commonly, stearic acid.

•Fillers. To overcome the tackiness, control the degree of flow and minimize shrinkage due to thermal contraction, a filler is added. Commonly used fillers are calcium carbonate and limestone. The fillers also improve the rigidity of this impression material.

Impression compound is muco-compressive, as it is the most viscous of the impression materials used. This can present particular problems in those patients who have a flabby mandibular ridge. The material has poor dimensional stability and the model must be poured as soon as possible after the impression is taken; this should take place within 1 hour **(Van Noort & Barbour, 2014)**

The application of dental impression compound has decreased with the increased use of rubber impression materials **(CRAIG, 1988).**

Figure 1.2: Maxillary and mandibular primary impression made in impression compound

II. Zinc oxide–eugenol paste

Whereas there are many zinc oxide–eugenol products that are presented as powder–liquid systems, the impression material is in the form of two pastes. There is typically a base paste consisting of zinc oxide, olive oil, linseed oil, zinc acetate and a trace of water, and a reactor paste, consisting of eugenol and fillers, such as kaolin and talc.

The liquid is very fluid, i.e. mucostatic, and, being a water-based system, readily adapts to the soft tissues. It therefore provides a detailed reproduction of the soft tissues without causing displacement of the soft tissues, but is rigid once set and is thus unable to record undercuts. This limits its application to the edentulous mouth, where it is used with a special tray.

It has the advantage of being dimensionally stable and shows little shrinkage on setting. However, as it is used with a special tray, the tray may impose limitations on the dimensional stability of the whole impression.

Although the material is non-toxic, eugenol can cause a burning sensation in the patient's mouth and leave a persistent taste that the patient may find unpleasant. The paste tends to adhere to skin, so the skin around the lips should be protected with petroleum jelly **(Van Noort & Barbour, 2014).**

Although zinc oxide-eugenols are excellent materials for wash impressions of edentulous areas, they have been replaced to a large extent by light-bodied rubber impression materials. As a result of the diminished use, research papers on zinc oxide-eugenol impression pastes have been nearly non-existent **(CRAIG, 1988).**

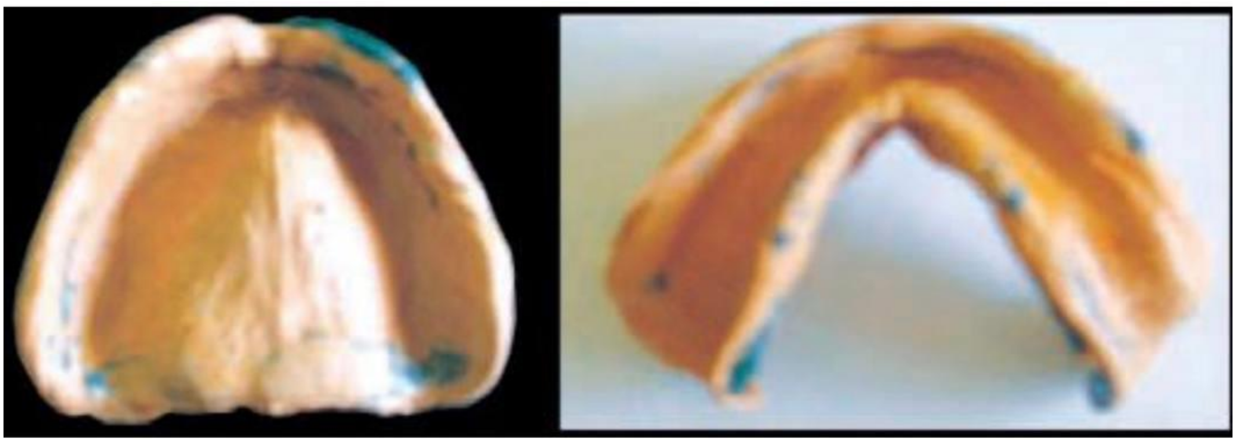

Figure 1.3: Final impression made in zinc oxide eugenol impression paste.

III. Impression plaster

Impression plaster consists of a powder to which water is added to produce a smooth paste. The impression material consists typically of calcium sulphate β-dihydrate $(CaSO4)2\cdot H2O$, potassium sulphate to reduce the expansion, borax to reduce the rate of setting, and starch to help disintegration of the impression on separation from the plaster/stone model.

The impression plaster is easy to mix, but great care must be taken to avoid trapping air bubbles, as these will give rise to surface inaccuracies. The material has well-controlled working and setting characteristics, which are governed by the relative amounts of borax and potassium sulphate.

The mixed material has a very low viscosity, and so is mucostatic. It is hydrophilic and thus adapts readily to the soft tissues, recording their surface detail with great accuracy. The material is best used in a special tray, made of acrylic or shellac, to a thickness of 1.0–1.5 mm. Alternatively, it can be used as a wash with a compo special tray.

The dimensional stability of impression plaster is very good, so a time delay in pouring the model is of no consequence, although extremes of temperature should be avoided**.**

A separating medium (usually a solution of sodium alginate) must be used between the model plaster and the impression plaster.

The material is rigid once set and thus unable to record undercuts .This limits its application to the edentulous patient **(Van Noort & Barbour, 2014).**

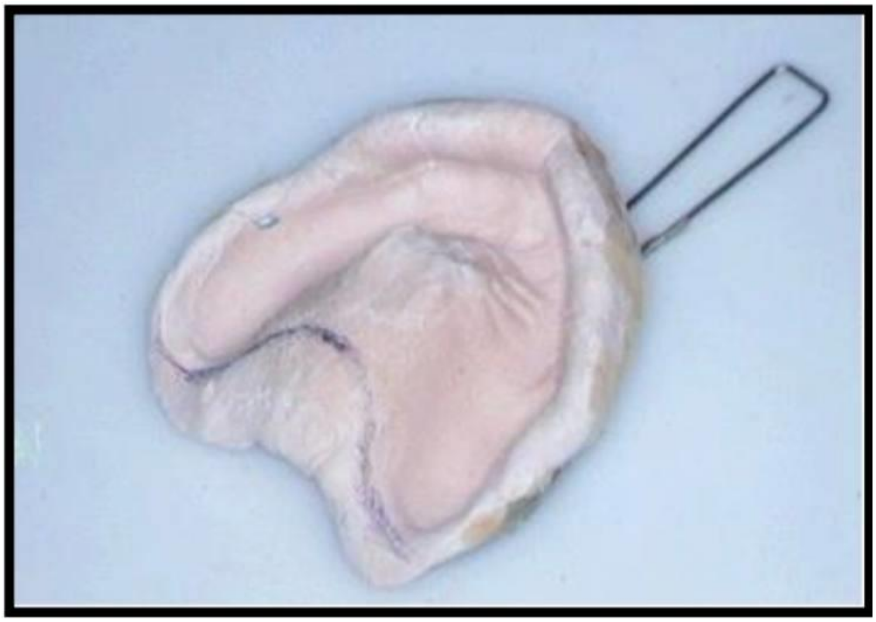

Figure 1.4: Final impression by impression plaster.

1.2.2. Elastic Impression Materials

I. Irreversible Hydrocolloids (Alginate)

Alginate impression materials are used for full-arch impressions because of their low-cost and good wetting properties making them a popular choice to fabricate primary impression and produced diagnostic casts. The hydrophilic nature of the material allows it to be used in the presence of saliva and blood with a moderate ability to reproduce details. Its poor dimensional stability caused by loss of water creates distortion and shrinkage if it is not poured within 10 minutes and it can be poured only once because of distortion and low tear strength **(Rubel, 2007).**

This material is flexible and easy to remove from the mouth compared with other materials if they flow into undercuts (Figure 1.5). They are easy to use and easy to mix with sufficient setting time to be handled and placed in the oral cavity **(Combe et al., 1999; Donovan & Chee,2004).**

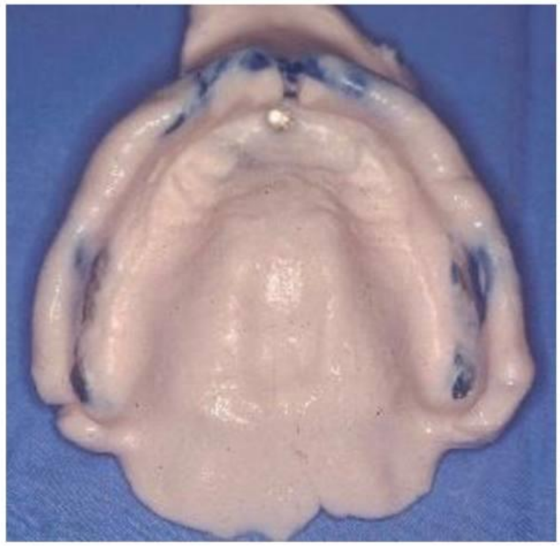

Figure 1.5: primary impression by Irreversible hydrocolloid (Alginate)

II. Reversible Hydrocolloids (Agar)

Agar is a galactose sulphate, which forms a colloid with water. It liquefies between 71°C and 100°C and sets to gel again between 30°C and 50°C.

These materials are analogous to thermoplastics and have the advantage that they can be used repeatedly.

The agar is heated in a water bath until it becomes fluid. It is placed in a special metal tray through which water can be passed when it is placed in the patient's mouth. The water cools the agar, whereupon it resolidifies as a gel, having taken up the shape of the oral tissues.

As it is a highly fluid liquid when placed in the mouth and adapts readily to the contours of the hard and soft tissues because of its hydrophilic nature, this material provides very accurate reproduction of surface detail. In addition, the material closest to the water-cooled tray gels first, while the material in contact with the tissues stays liquid longest and can compensate for any inaccuracies due to shrinkage or unintentional movement of the tray

The model should be poured from the impression immediately, and should this not be possible, the impression material should be kept at a relative humidity of 100% by wrapping it in a wet towel. In any case, the model needs to be poured within 1 hour as the material suffers from two potential problems:

1-Syneresis. This is a process whereby water is forced out on to the surface of the impression as the gel molecules are drawn closer together, with the main driving force being the relief of internal stresses. The water evaporates from the surface and causes the impression material to shrink.

2-Imbibition. This is the uptake of water that occurs if the material has become dry, possibly due to inadequate storage technique. Distortion of the impression will result if this occurs, as the internal stresses that are always present are relieved during this process.

The material is highly viscoelastic, so it is important that the tray is removed by a rapid snap action so that a near-elastic response results. This applies equally for many of the other polymer-based impression materials. It is necessary to have a reasonable thickness of the impression material to limit the extent of the deformation arising on the removal from an undercut.

There are some disadvantages with the agar impression materials, in that one needs special equipment such as water-cooled trays and a temperature controlled bath, and there is an initial cost in providing this equipment. Also,

the water-cooled tray is very bulky, which may cause some discomfort to the patient. Whilst the material can, in principle, be recycled, in these days of crossinfection concerns this is no longer viable. Also, great care must be exercised that the water baths are not contaminated. For these reasons, this impression material is now relatively little used **(Van Noort & Barbour, 2014).**

III. Polyethers

These material are hydrophilic which allowing them to be used in a moist environment. Their good wetting properties also allow gypsum casts to be made more easily **(Sakaguchi & Powers, 2012).**

Figure 1.6: Polyether impression material

Newer polyether impression materials are slightly more flexible than the older products, making them easier to remove from the mouth. Because of the nature of the material absorbing water, the impression should not be submerged in water for a period of time because it could lead to distortion **(Powers &Wataha 2017).**

IV. Polyvinyl Siloxanes (Addition Silicone)

Polyvinyl Siloxanes (PVS) impression material is one of the most favored impression materials in dentistry because of excellent properties and availability in different viscosities ranging from extra light body to putty. Impressions made from this material produce great detail reproduction and can be poured multiple times because of their high tear strength and high elastic recovery. Caution should be taken to avoid contact of the material with latex rubber dams or latex gloves, which may leave a sulfur or sulfur compound that inhibits polymerization of the material **(Reitz &Clark, 1988; Noonan et al., 1985).** Moreover, gingival retraction soaked cords containing sulfur may also contribute to the inhibition **(Boening et al., 1998).**

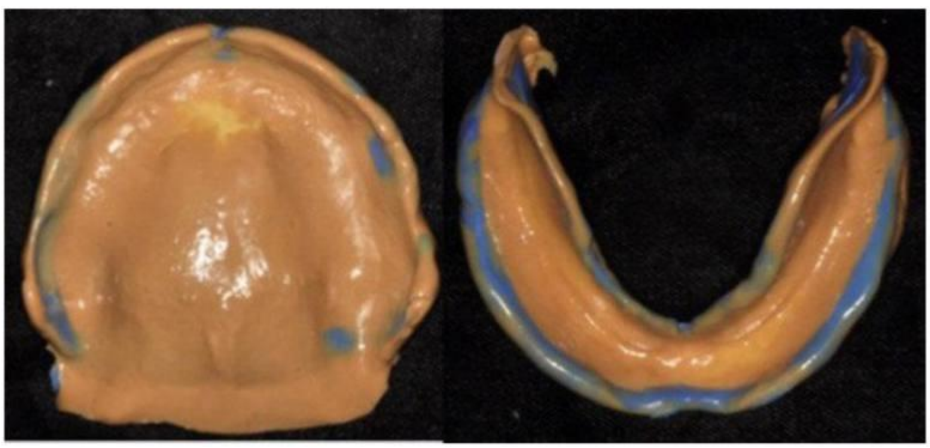

Figure 1.7: Final impression taking using light body Addition Silicone.

V. Vinyl Polyether Siloxane

This material has been reported to combine the ease of removal of PVS with the hydrophilicity (wetting properties) of polyether making it a promising material for difficult situations in which moisture control issues are present, such as narrow, deep gingival crevices **(Walker et al.,2013).**

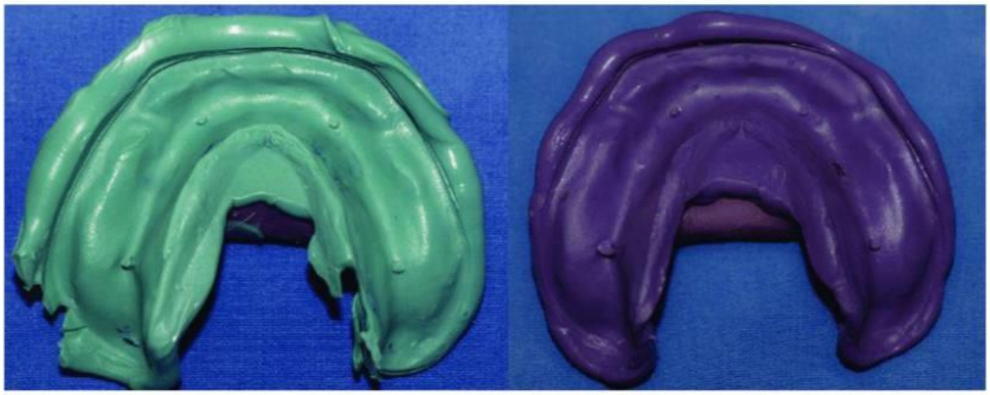

Figure 1.8: Impressions of polyether and vinyl polyether siloxane.

VI. Polysulfides

Polysulfide impression materials are supplied as two paste systems. The base consists of a polysulfide polymer, the accelerator (catalyst) has primarily lead dioxide with other substances. The viscosity is altered by adding different amounts of titanium dioxide powder to the base (Craig & Robert, 2002; Giordano, 2000).

Polysulfide impression materials are generally low to moderately hydrophilic and make an accurate impression in the presence of some saliva or blood. Because the material has a low wetting angle it makes a full arch impression easier than with polyvinyl siloxanes or polyethers. It reproduces detail with excellent results but its dimensional stability is only fair (Shen, 2003).

It has a terribly bitter taste and is relatively inexpensive. It is not affected by latex gloves. Unfortunately, it does not adhere to itself, which makes it unavailable for border molding or correctable impression techniques.

Figure 1.9: Polysulfide impression material.

1.2.3. Digital Impression

The intraoral scanners are highly accurate and even better than conventional impressions for manufacturing indirect restorations. There is still insufficient data in the literature about complete-arch scans. Ender and colleagues reported that conventional impression materials were more precise than digital systems for complete-arch impressions **(Ender et al., 2016; Chochlidakis et al., 2016).**
In another study, Cho and colleagues reported that the accuracy of the entire cast area of a conventional cast was significantly better than a printed stereolithographic model **(Cho et al., 2015).**

Arguably, the learning curve for digital impression techniques can be steeper for some dentists; however, there is a study that reports that it was the preferred technique for dental students **(Lee et al., 2013).**

An in vitro study reported that digital impression making was less time consuming and more efficient than the conventional method and that patients preferred it **(Patzelt et al., 2014; Schepke et al., 2015).**

The advantages and disadvantages of digital impression are summarized below.

Advantages

1. Real-time visualization and evaluation

2. Easy to correct, manipulate, or recapture images

3. Segmental image capture

4. Archival digitally, therefore no need to store physical casts

5. No wastage of impression material and therefore environmentally friendly

6. Economical, considering no use of impression trays, adhesives, or gypsum

7. Do not need to disinfect before sending information to the laboratory

8. No damage or wear and tear of the stone casts

9. Swift communication with the laboratory via the Internet

10. Self-assessment for tooth preparations

11. File transfer capabilities to merge with other files like DICOM (Digital Imaging and Communications in Medicine) images using sophisticated software

12. Increased patient satisfaction

13. Some systems have color scanning, shade selection, and still photograph image-taking Capabilities

Disadvantages

1. Initial cost of equipment and software maintenance fees

2. Learning curve can be difficult for some individuals

3. Scan bodies needed for implant systems that are compatible with the design software

4. Difficult to capture occlusion information for complex prosthodontics Treatment.

5. Closed systems restrict options for transferring STL (standard tessellation language) files

6. Cannot capture subgingival margins if obscured with blood, saliva, or tissue

7. Unable to accurately capture images of the edentulous arches

8. Scanning patterns need to be followed manufacturer's recommendation

1.3. Clinical Implications of Elastomers

1.3.1. Mixing

Despite all the advantages that elastomeric materials possess, a thorough understanding of the composition, physical properties, and manipulative variables of these materials is essential to achieve predictable success **(Chee and Donovan, 1992).** They are well suited for making complete denture impressions and have simplified restorative procedures compared to inelastic materials **(Burton, 2000; Johnson et al., 2003).**

The material is available in automatic mixing systems, so it can be easily and evenly applied on the tray borders, with one insertion of the tray **(Phoenix DeFreest, 1997).**

Good results are obtained with less expenditure of time as well as less discomfort and inconvenience for the patient, even in the hands of an inexperienced operator **(Duncan and Taylor, 2001).**

Compared to hand mixing, both automixing and electronic mixing techniques enhance the quality of a definitive impression. Also, auto mixing was considered to be more economical than hand mixing because it wastes one third less volume of material as compared to hand mixing (**Hayakawa & Watanabe, 2003; Nam et al., 2007).**

1.3.2. Dimensional Change

In the dental practice, pouring of the impression is often delayed due to time constraints, and the majority of impressions are sent to a commercial laboratory for pouring. It has been shown that dental practitioners may delay pouring impressions up to 72 h. Therefore, practitioners should be aware of the tolerable time delay for which the selected impression material will remain dimensionally accurate **(Petrie et al., 2005).**

With these materials, the dimensional accuracy is usually time dependent, i.e. the material may display great dimensional accuracy soon after its polymerization is complete, but is dependent on the material, and varying degrees of accuracy have been reported after the impressions have been stored for a period of time **(Petrie et al., 2005).**

In general, polyether and polyvinylsiloxane impression materials remain dimensionally accurate for a prolonged period of time (up to 1 week) **(Chee and Donovan, 1992; Petrie et al., 2005).**

The condensation-silicone systems should be poured as soon as possible after making the impression. VPS impression materials demonstrate excellent accuracy, and the fewest dimensional changes after multiple pours. Polysulfide impression materials have acceptable dimensional accuracy only if poured immediately or within approximately1–2 h after the impression is made **(Nissan et al., 2000; Nam et al., 2007).**

1.3.3. Hydrophilic behavior

There are also definite differences in the hydrophilic behavior of the most popular elastomeric materials that are used for final impressions for complete dentures. The original disadvantage of using VPS impression materials was their hydrophobic characteristics, producing an adverse effect on the surface quality of the polymerized impressions **(Utz et al., 2004; Wright, 2004).**

The presence of moisture has been reported to result in impressions with voided and/or pitted surfaces and inferior detail reproduction even with the newer ‘‘hydrophilic’ ’polyvinylsiloxane presently available on the market. Surfactants applied to the impression material, like polyether carbosilane (PCS), significantly reduced the number of voids in artificial stone casts, as did the modified elastomers designated by the manufacturers hydrophilic **(Butta et al., 2005; Nam et al., 2007).** This allows the material to be in more intimate contact with tissues with the aim of capturing better surface detail and fewer defects. Since oral mucosal tissues contain both the major and minor salivary glands, it is very difficult to attain or maintain a dry field when making impressions to capture the mucosal details of the edentulous arches **(Petrie et al., 2005).**When using polyvinylsiloxanes, moisture control remains a critical factor for the predictable success of the clinical impression. However, polysulfide and polyether impression materials, because of their more hydrophilic nature, should be more compatible with the inherent moisture of the edentulous arch mucosal tissues **(Petrie et al., 2005).**

Even though here is a need to control the salivary secretions when making impressions with polysulfide rubber. Polyether produced the best detail under moist conditions **(Walker et al., 2005; Allen et al., 2006).**

1.3.4. Soft tissue detail

Surface detail reproduction has also improved with the evolution from reversible hydrocolloid (agar) to polysulfide, then condensation silicone, and finally to polyether and vinyl polysiloxane materials **(Johnson et al., 2003).** Polyether and hydrophilic addition silicone produced casts with more soft tissue detail than low-viscosity polysulfide or ZOE, even though ZOE records accurate surface detail. This disparity is difficult to explain because the wettability of the materials is similar. The difference could be explained by one or more of the following: shear thinning effects, amount and size of filler particles, extent of initial cross-linking, and compatibility of gypsum and impression material **(Pratten and Novetsky, 1991; Petrie et al., 2005).** The correct amount of flow necessary to obtain an impression is not known. A thin material is more easily placed, but is more difficult to contain. The flow of polysulfide rubber may increase the detail, but some authors question the need for precise surface detail for retention of mandibular denture. Close adaptation to the tissue is usually considered necessary to increase retention and stability, but there may be a fine line where optimum adaptation ends and the pressure begins. The degree of detail that needs to be recorded by an impression for a complete denture has never been established. However, since viscosity is controlled and an adequate flow is maintained during seating in the mouth, mucosal detail is superior **(Hayakawa and Watanabe, 2003).**

1.3.5. Viscosity

Viscosity is one of the factors that influence surface detail reproduction. There appears to be a direct relationship between the viscosity of the impression material and the amount of pressure placed on the mandibular ridge during impression making.

The tested materials can be categorized into two groups: a group that produced high pressure, which included irreversible hydrocolloid and medium body vinyl polysiloxane, and a group that produced low pressure, which included light body polysulfide and light body vinyl polysiloxane.

As the viscosity of the material increased, the pressure exerted upon the mandible increased as well. A tray that had 2 mm relief or holes, or both, produced less pressure than one with no relief and no holes, especially for high pressure impression materials **(Komiyama et al., 2004; Al-Ahmad et al., 2006).**

The use of light body polysulfide or light body vinyl polysiloxane is recommended for making edentulous impressions

However, it has been found that statistically significant differences in the flange form measurement distances among the different materials and method of application of the materials **(Masri et al., 2002; Al-Ahmad et al., 2006).**

The fact that they produce the lowest pressure is important in the production of accurate impressions of minimally displaced mucosa. This will help in the fabrication of dentures that have proper retention, stability, and support.

It is important to emphasize on the notion that medium and high-viscosity impression materials, though containing more filler particles, can function as low-viscosity materials when mixed mechanically **(Al-Ahmad et al., 2006)**

For some authors, however, zinc oxide paste is still the final impression material of choice in most instances **(Weng&Khlevnoy, 1995).**

1.4. Theories of Impression Technique

Depending on the pressure exerted on the tissues during the registration of the impression, the theories of impression techniques can be classified into:

1.4.1. Mucocompressive theory

Greene Brothers advocated it. They considered it essential for the denture to contact the tissues during function. They preferred the closed-mouth technique so as to record the tissues in function, especially under masticatory load.

In this technique, impression is recorded in trays that have occlusal rims attached on the polished surface. Maxillary and mandibular trays, loaded with the impression material, are inserted into the mouth and the patient is instructed to close the mouth applying pressure on the occlusal rims as the material sets. During the procedure, the patient is instructed to swallow, grin and purse the lips while the material flows **(Inoue et al., 2017).**

Thus in this technique, the mucosa is compressed while the patient does the functional movements and under masticatory force.

Advantage

• Good retention during function.

Disadvantages

1. The pressure applied during the procedure may overstress the tissues and eventually cause bone resorption.

2. The gradual resorption of the bone will hinder retention of the denture over a period of time.

3. The closed-mouth technique will not enable accurate recording of the border tissues.

4. Tissues held under pressure rebound to their original form at rest.

5. This technique does not respect the principle of tissue biology.

1.4.2. Mucostatic Theory

Harry L Page advocated it in 1938. This theory is claimed to be based on Pascal's law, which states, "The pressure applied on the confined liquid will be equally transmitted undiminished throughout the liquid in all directions." This law is applied here because the denture-bearing mucosa, which is made of 80 percent water, is confined between the firm denture base and the hard bone of the denture bearing area. In this technique, the spacer is adapted on the entire tissue surface with four stops to enable orientation and stabilization of the tray. It is not practically possible to make an impression with absolutely no pressure on the supporting ridge. Hence, it is called the minimal pressure technique, which is used in cases of medically compromised conditions and excessively resorbed ridges **(Tripathi et al., 2019).**

Advantage

• Tissue health is preserved and maintained.

Limitations:

1. Since the borders of the impression are not extended to the functional depth of the sulcus, the tissue fluid can easily escape through the borders of the denture and thus Pascal's law is not applicable.

2. Mucosal topography is not stable over 24-hour period and hence the stress on the mucosa will vary.

3. This technique considers interfacial surface tension as the only retentive mechanism and is not optimal.

4. Presence of short flanges of the denture affects the retention and stability.

1.4.3. Selective Pressure Technique

Carl O Boucher, in 1950, combined the principles of both mucocompressive and mucostatic theories and adopted the mucoselective theory. Here, the pressure is applied to the stress bearing areas and the areas that cannot bear the stress are relieved. The stress relief areas in the maxillary foundation are the mid palatine raphe and the incisive papilla. In the mandibular foundation, it is the crest of the alveolar ridge. These areas are relieved in the diagnostic casts while fabricating the custom tray. Border molding is done with low fusing impression compound and a wash impression is made with zinc oxide eugenol impression paste or Impression plaster. This technique is used in patients with well-formed healthy ridges **(Tripathi et al., 2019)**

CHAPTER TWO

DISCUSSION

MEDLINE, Elsevier, and hand searches were conducted for articles on selected aspects of impression materials and techniques for complete dentures with a focus on the best available evidence. If publications of the highest levels, i.e. clinical randomized controlled trials (RCT) and systematic reviews of RCTs, were not available, other studies were considered.

Most textbooks advocate a two-stage procedure: (1) preliminary impression, often with an irreversible hydrocolloid (alginate) in a stock tray; and (2) final impression in a custom tray usually made of acrylic resin. There are many materials for the final impression, such as gypsum, zinc oxide and eugenol (ZOE) paste, polysulfide rubber, polyether, polyvinyl siloxane, and alginate. Preferences vary much among dentists. However, there is no evidence that one technique or material produces better long term results than another.

Many general practitioners use a single alginate impressions the definitive impression for the construction of complete dentures, which conflicts with the teaching in practically all dental schools.

It is, therefore, of interest that an RCT found neither patient-assessed nor dentist-evaluated differences between dentures fabricated according to a traditional nor a simplified method.

The simple technique used alginate in a standard tray for the definitive impression, whereas the traditional technique included an individual tray with border molding and polyether for the final impression **(Kawai et al., 2005).**

Although impression materials differ in many aspects and variety of techniques exist in taking the impressions, there is no evidence to conclude that the clinical long-term outcome of dentures fabricated using varying materials and methods would differ significantly **(Tripathi et al., 2019).**

These and other aspects of variation in methods and techniques are discussed in a review of an evidence base for complete dentures **(Carlsson, 2006).**

We should recognize that a variety of dental impression materials are still currently being used. The majority of which originated for use in non-dentalrelated fields.

The elastomers were developed as an alternative to natural rubber during World War II. These materials have since been modified chemically and physically for use in dentistry.

Initially, this group consisted exclusively of polysulfide impression materials. Subsequently, condensation-cured silicones were developed.

Today, two of the most popular elastomers used in dental practice are the polyethers and addition-reaction silicones, or vinylpolysiloxane **(Wadhwani et al., 2005).**

The popularity of the elastomer materials is understandable, given the combination of excellent physical properties, handling characteristics, and unlimited dimensional stability.

Polyvinylsiloxane putty and light-body impression material are well suited for making complete denture impressions. Obviously, good results are obtained with less expenditure of time as well as less discomfort and inconvenience for the patient, especially in the hands of an inexperienced operator (**Lu et al., 2004).**

In addition, the odor, taste, and color of the polysiloxane materials give them good patient acceptability. The dentist appreciates the ease with which they can be used **(Komiyama et al., 2004).**

CHAPTER THREE

CONCLUSIONS

(1) Distinct trends for increasing use of polyvinylsiloxane and polyether for border molding procedures and impressions of edentulous arches were observed. They are well suited for making complete denture impressions.

(2) The manner in which the impression was made may be more important than the material.

(3) Greater accuracy was obtained in custom trays than with impressions made in stock trays.

(4) The material can be easily and evenly applied on the tray borders with one insertion of the tray. They demonstrate excellent accuracy, and the fewest dimensional changes after multiple pours.

(5) Polyether and hydrophilic addition silicone produced casts with more soft tissue details than low-viscosity polysulfide or ZOE

References

(A)

Al-Ahmad, A., Masri, R., Driscoll, C.F., von Fraunhofer, J., Romberg, E., 2006. Pressure generated on a simulated mandibular oral analog by impression materials in custom trays of different design. J. Prosthodont. 15, 95–101.

Allen, E., Brodine, A., Burgess, J., Cronin Jr., R., Summit, J., 2006. Annual review of selected dental literature: report of the committee on scientific investigation of the American academy of restorative dentistry. J. Prosthet. Dent. 96, 174–199.

(B)

Boucher, Carl O., 2004. Complete denture prosthodontics – the state of the art. J. Prosthet. Dent. 92, 309–315.

Boening KW, Walter MH, Schuette U. Clinical significance of surface activation of silicone impression materials. J Dent 1998;26(5–6):447–52.

Burton, M., 2000. Current trends in removable prosthodontics. JADA 131.

Butta, R., Tredwin, C., Nesbit, M., Moles, D.R., 2005. Type IV gypsum compatibility with five addition-reaction silicone impression materials. J. Prosthet. Dent. 93, 540–544.

(C)

Chee, D.T., Donovan, T., 1992. Polyvinylsiloxane impression materials: a review of properties and techniques. J. Prosthet. Dent. 68, 728–732.

Combe EC, Burke FJ, Douglas WH. Dental biomaterials, 1st edition. Boston:

Craig RG, Robert G. Restorative dental materials. 11th edition. Elsevier 2002. p. 12.

Chochlidakis KM, Papaspyridakos P, Geminiani A, et al. Digital versus conventional impressions for fixed prosthodontics: a systematic review and meta-analysis. J Prosthet Dent 2016;116(2):184–90.e12.

Cho S-H, Schaefer O, Thompson GA, et al. Comparison of accuracy and reproducibility of casts made by digital and conventional methods. J Prosthet Dent 2015;113(4):310–5

Carlsson, G.E., 2006. Facts and fallacies: an evidence base for complete dentures. J. Prosthodont. 12, 280–287.

Craig RG.REVIEW OF DENTAL IMPRESSION MATERIALS.Adv Dent Res 2(l):51-64, August, 1988

(D)

Donovan TE, Chee WW. A review of contemporary impression materials and techniques. Dent Clin North Am 2004;48(2):vi–vii, 445-470.

Duncan, J.P., Taylor, T.D., 2001. Teaching an abbreviated impression technique for complete dentures in an undergraduate dental curriculum. J. Prosthet. Dent. 85, 121–125.

(E)

Ender A, Zimmermann M, Attin T, et al. In vivo precision of conventional and digital methods for obtaining quadrant dental impressions. Clin Oral Investig 2016; 20(7):1495–504.

(G)

Glenner RA. Dental impressions. J Hist Dent. 1997;45(3):127-130.

Giordano R. Impression materials: basic properties. Gen Dent 2000;48:510–6.

(H)

Hoffmann-Axthelm W. History of Dentistry. Chicago: Quintessence Pub.Co. 1981 .Hayakawa, I., Watanabe, I., 2003. Impressions for complete dentures using new silicone impression materials. Quintessence Int. 34 (3), 177–180.

(I)

Inoue, S., Kawara, M., Iida, T., Iwasaki, M., Komiyama, O. (2017). Influences of differences in tray design and impression material on impression pressure at edentulous mandible. Journal of oral science, 59(4), 505-510.

Ivanhoe, J.R., Cibirka, R.M., Parr, G.R., 2002. Treating the modern complete denture patient: a review of the literature. J. Prosthet. Dent. 88, 631–635

(J)

Jorgensen KD. Indlaegog kroner. OdontologiskaBoghandelsForlag Copenhagen 1978 p. 46.

Jorgensen KD. Thermal expansion of addition polymerization (Type II) silicon impressions materials. Australian Dent J. 1982;27(6):377-381.

Johnson, G.H., Lepc, X., Chee, A.W.T., 2003. The effect of surface moisture on detail reproduction of elastomeric impressions. J. Prosthet. Dent. 90, 354–364.

(K)

Kois, J.C., Fan, P., 1997. Complete denture impression technique. Compend. Educ. Dent. 18 (7), 699–704, 706–8.

Komiyama, O., Saeki, H., Kawara, M., Kobayashi, K., Otake, S., 2004. Effects of relief space and escape holes on pressure characteristics of maxillary edentulous impressions. J. Prosthet. Dent. 91, 570–576.

Kawai, Y., Murakami, H., Shariati, B., Klemetti, E., Blomfield, J.V., Billette, L., et al., 2005. Do traditional techniques produce better conventional dentures than simplified techniques? J. Dent. 33, 659– 668.

(L)

Lacy, A.M., Fukui, H., Bellman, T., Jendersen, M.D., 1981b. Time dependant accuracy of elastomer impression materials. Part II: polyether, polysulfides, and polyvinylsiloxane. J. Prosthet. Dent. 45 (3), 329–333.

Lee SJ, MacArthur RX, Gallucci GO. An evaluation of student and clinician

Lu, H., Nguyen, B., Powers, J.M., 2004. Mechanical properties of 3 hydrophilic addition silicone and polyether elastomeric impression materials. J. Prosthet. Dent. 92 (2), 151–154.

(M)

McCord, J.F., McNally, L., Smith, P.W., Grey, N.J., 2005. Does the nature of the definitive impression material influence the outcome of (mandibular) complete dentures? Eur. J. Prosthodont. Restor. Dent. 13 (3), 105–108.

Masri, R., Driscoll, C., Burkhadt, J., et al., 2002. Pressure generated on a simulated oral analog by impression materials in custom trays of different designs. J. Prosthodont. 11, 155–160

Nassar U, Oko A, Adeeb S, El-Rich M, Flores- Mir C. An in vitro study on the dimensional stability of a vinyl polyether silicone impression material over a prolonged storage period. J Prosthet Dent. 2013;109(3):172-178.

(N)

Noonan JE, Goldfogel MH, Lambert RL. Inhibited set of the surface of addition silicones in contact with rubber dam. Oper Dent 1985;10(2):46–8.

Nam, J., Raigrodski, A., Townsend, J., Lepe, X., Mancl, L.A., 2007. Assessment of preference of mixing techniques and duration of mixing and tray loading for two viscosities of vinyl polysiloxane material. J. Prosthet. Dent. 97, 12–17.

Nissan, J., Laufer, B.-Z., Brosh, T., Assif, D., 2000. Accuracy of three polyvinylsiloxane putty-wash impression techniques. J. Prosthet. Dent. 83 (2), 161–165.

(P)

Petrie, C.S., Walker, M.P., Williams, K., 2005. A surveys of US prosthodontists and dental schools on the current materials and methods for final impressions for complete denture prosthodontics. J. Prosthodont. 14 (4), 253–262.

Petropoulos, V.C., Rashedi, B., 2005. Complete denture education in US dental schools. J. Prosthodont. 14, 191–197.

Pearson SL. A New Elastic Impression Material: A Preliminary report. Br Dent J. 1955; 99:72-76.

Powers J, Wataha J. Dental materials foundations and applications. 11th edition. St. Louis (MO): Elsevier; 2017.

Patzelt SB, Lamprinos C, Stampf S, et al. The time efficiency of intraoral scanners: an in vitro comparative study. J Am Dent Assoc 2014;145(6):542-51.

Phoenix, R., DeFreest, C., 1997. An effective technique for denture border evaluation. J. Prosthodont. 6, 215–217.

Pratten, D.H., Novetsky, M., 1991. Detail reproduction of soft tissue: a comparison of impression materials. J. Prosthet. Dent. 65 (2), 188–191.

(R)

Rubel BS. Impression materials: a comparative review of impression materials most commonly used in restorative dentistry. Dent Clin North Am 2007;51(3): 629–42, vi.

Reitz CD, Clark NP. The setting of vinyl polysiloxane and condensationsilicone putties when mixed with gloved hands. J Am Dent Assoc 1988;116(3):371–5.

(S)

Smith DC. Development of glass-ionomer cement systems. Biomaterials. 1998;19(6):467–478.

Starcke, E.J., 1975. A historical review of complete denture impression materials. J. Am. Dent. Assoc. 91 (5), 1037–1041.

Sakaguchi RL, Powers JM. Craig's restorative dental materials. Philadelphia (PA): Elsevier Health Sciences; 2012.

Shen C. Impression materials. In: Anusavice KJ, editor. Phillip's science of dental materials. 11th edition. Philadelphia: Saunders; 2003. p. 210–30.

Schepke U, Meijer HJ, Kerdijk W, et al. Digital versus analog complete-arch impressions for single-unit premolar implant crowns: operating time and patient preference. J Prosthet Dent 2015;114(3):403–6.e1.

(T)

Tripathi, A., Singh, S. V., Aggarwal, H., Gupta, A. (2019). Effect of mucostatic and selective pressure impression techniques on residual ridge resorption in individuals with different bone mineral densities: A prospective clinical pilot study. The Journal of prosthetic dentistry, 121(1), 90-94.

(U)

1. Utz, K.-H., Mu¨ller, F., Kettner, N., Reppert, G., Koeck, B., 2004. Functional impression and jaw registration: a single session procedure for the construction of complete dentures. J. Oral. Rehabil. 31, 554–561.

(V)

2. Van Noort, R., Barbour, M. (2014). Introduction to Dental Materials-EBook: Elsevier Health Sciences.

(W)

Wilson N and Gelbier S. The history and impact of development in dental biomaterials over the last 60 years. Brit Dent Assoc 2014. pp. 72-73.

Walker MP, Alderman N, Petrie CS, et al. Correlation of impression removal force with elastomeric impression material rigidity and hardness. J Prosthodont 2013; 22(5):362–6.

Wright, C.R., 2004. Evaluation of the factor necessary to develop stability in mandibular dentures. J. Prosthet. Dent. 92, 509–518.

Walker, M.P., Petrie, C., Haj-Ali, R., Spencer, P., Dumas, C., Williams, K., 2005. Moisture effect on polyether and polyvinylsiloxane dimensional accuracy and detail reproduction. J. Prosthodont. 14, 158–163.

Weng, B.X., Khlevnoy, V., 1995. Pressure control for complete denture impressions. Oral Health 85 (11), 21–3, 24, 27.

Wadhwani, G.H.J., Lepe, Xavier, Raigrodski, Ariel J., 2005. Accuracy of newly formulated fast-setting elastomeric impression materials. J. Prosthet. Dent. 93 (6), 530–539.

(Z)

Zarb, G.A., Bolender, C., Hickey, C., 1985. Boucher's prosthodontic treatment for edentulous patients. Mosby, St. Louis, MO.

Zinner, I.D., Sherman, H., 1981. An analysis of the development of complete denture impression techniques. J. Prosthet. Dent. 46 (3) 242–249