EAS Journal of Dentistry and Oral Medicine
Abbreviated key title: EAS J Dent Oral Med
ISSN: 2663-1849 (Print) ISSN: 2663-7324 (Online)
Published By East African Scholars Publisher, Kenya
Volume-1 | Issue-5| Sept-Oct-2019 |

OPEN ACCESS

Review Article

Recent Advances in Elastomeric Impression Materials

Sweta Pisulkar, M.D.S, M.Phil, Ph.D[1*], Sharayu Nimonkar, M.D.S[2], Anjali Borle M.D.S[3], Yogita Dhage, B.D.S[4]

[1]Asso. Professor, Department of Prosthodontics SPDC, DMIMS (DU), India
[2]Asst. Professors, Department of Prosthodontics SPDC, DMIMS (DU), India
[3]Professor and Head of Department, Department of Prosthodontics SPDC, DMIMS (DU), India
[4]Tutor, Department of Prosthodontics SPDC, DMIMS (DU), India

*Corresponding Author
Sweta Pisulkar, M.D.S, M.Phil, Ph.D

Abstract: For accurate fit of indirect restoration a precise impression is important. In restorative dentistry, for many clinician ,for fixed prosthesis is one of the challenging aspects . a new generation of impression materials are discovered from Advances in elastomeric chemistries. Since last decade there are major advances in impression materials and their application with more importance on rubber impression materials than rigid materials. The qualities of impressions and the biocompatibility of impression materials shows effect of disinfection solution is the major issue. Polyvinyl siloxane shows the feature of polyether and vinyl siloxane. This involves accuracy, elastic recovery, dimensional stability, flow, flexibility, workability, hydrophilicity, a long shelf-life, patient comfort, and economy. Impression materials vary considerably in relation to ideal properties such as accuracy, elastic recovery, dimensional stability, flow, flexibility, workability, hydrophilicity, a long shelf-life, patient comfort, and economy. An accurate impression is an important step for accurate restoration. Viscosity is also important for perfect impression.

Keywords: Fixed prosthesis, Elastomeric impression material, Physical property.

INTRODUCTION

Impression is the negative likeness or copy in reverse of the surface of an object (GPT :Grossary of prosthodontic term 9). Impression material is any substance or combination of substances used for making an impression or negative reproduction. It is made by placing an appropriate material in a stock or custom dental impression tray which is designed to roughly fit over the dental arches. An accurate impression is the most important step in the procedure of obtaining a perfect restoration (Yaqoob, A. *et al.*, 2018). It is the aim of the impression to produce a dimensionally stable 'negative' which can serve as a mold for a cast. It is long foregone that almost every impression material meets all the basic requirements for an impression material. The recording of tissues in oral cavity is difficult due to factors, such as salivation, blood flow and sulcular fluid (Punj, A. *et al.*, 2017). This becomes critical especially in recording finish lines for fixed restorations, especially where margins lay intrasulcularly. Hence, most dental surveys conducted correctly rate hydrophilicity as the most important criteria to choose an impression material where more can these materials improve. Not just hydrophilicity, immediate hydrophilicity is the need of the hour. This has led to the dawn of a new elastomeric impression material, i.e. vinyl polyether siloxane. Elastomers refer to a group of rubbery polymers, which are either chemically or physically cross-linked. There are four kinds of Elastomers used as impression materials viz., polysulfide, condensation silicone, addition silicone and polyether. Of these, addition silicone and polyether are most commonly used (Daou, E. 2010). Traditional additional silicones were hydrophobic; due to which accuracy of impressions was questionable. The newer ones have added surfactants to counteract this. Polyether, on the other hand, is hydrophilic and records good detail, but it is the stiffest among all Elastomers. This newer elastomers that has been developed is called as vinyl polyether siloxane (VPES) combining features of both addition silicone and polyether. This new Elastomers boasts of immediate hydrophilicity, at the same time combining favorable characteristics of both polyether and vinyl

Quick Response Code

Journal homepage:
http://www.easpublisher.com/easjdom/

Article History
Received: 05.09.2019
Accepted: 11.09.2019
Published: 26.09.2019

DOI: 10.36349/easjdom.2019.v01i05.001

polysiloxane. A number of ideal properties for impression materials can be identified. These include accuracy, elastic recovery, dimensional stability, flow, flexibility, workability, hydrophilicity, a long shelf-life, patient comfort, and economy. Impression materials vary considerably in relation to these ideal properties, and these differences may provide a basis for the selection of specific materials in specific clinical situations (Donovan, T.E., & Chee, W.W.L. 2004). To improve the working time, viscosity, and flexibility of the polyether ; polyether and silicone impression materials have been modified (Craig R.G. 1988).

PROPERTIES OF IMPRESSION MATERIALS:

Accuracy:

According to American Dental Association specification number 19, to create exact castings, elastomeric impression materials must be able to reproduce fine detail of 25 μm or less. PVS impression materials can make details of even 1 to 2μm. Viscosity is also an important property of a material for the precise impression in a cast. It is found that to record fine detail viscosity should be lower. Putty materials fail to produce fine detail at the 25 μm level and are required only to record details of 75μm (Donovan, T.E., & Chee, W.W.L. 2004). Putty material not record fine detail that is it poorly record critical areas such as cervical margin. Dimensional accuracy is another aspect of the accuracy of an impression material. It is evaluated by measuring tooth-to-tooth distances within the same quadrant and cross arch. If they are manipulated correctly impression material shows superb accuracy. Although PVS materials are likely to be more exact than other materials (Donovan, T.E., & Chee, W.W.L. 2004).

Elastic Recovery:

When we use a material to take an impression, the material should to be able to flow readily into undercut areas in the mouth and set in that position. And again it is needed to ‘‘rebound’’ back to its original shape when the set impression is removed from the mouth. This intrinsic process is called elastic recovery (Donovan, T.E., & Chee, W.W.L. 2004). There is no 100% elastic recovery of any impression material. The greater in the permanent distortion of the impression material if greater the depth of the undercut, for all impression materials. Thus, the minimum thickness of the material in the tray should be three to four times more than the largest undercut (Hamalian, T. A. *et al.*, 2011). Though there are limitations about the behavior of various impression materials, but with a specific test undercut, PVS impression materials have the best elastic recovery at over 99% elastic recovery (Donovan, T.E., & Chee, W.W.L. 2004). Along with this they have excellent dimensional stability due to 99% of elastic recovery. So this material can be poured second time also. By eliminating or blocking out any undercuts in the tooth preparation before making the impression will maximize the elastic recovery of an impression material. This can be accomplished with any of the modified or resin modified glass ionomer products on the market (Donovan, T.E., & Chee, W.W.L. 2004).

Flow and Rheological properties:

The ability of a material to flow into small areas and reproduce minute details defines wettability or flowability of an impression material. This type of material provides more accurate impression as this material produce impression with fewer voids and less entrapment of oral fluids. A light-body material, tends to flow off the preparation and possesses excellent flow characteristics (Hamalian, T. A. *et al.*, 2011). The ability of an impression material to reproduce minute detail in the area of 20 to 70 mm is necessary in the area of fixed partial dentures. When the heavier body tray materials are placed over the top of them most of the newer PVS products and polyether are thixotropic and stay where they are syringed but flow readily (Donovan, T.E., & Chee, W.W.L. 2004).

Flexibility:

As the name suggests, this property is very important with regards to take proper impressions and ease of doing the procedure on a patient. Materials with regard to flexibility vary from one another. When flexible impression material set it is easier to remove from the mouth. Enough flexibility of materials will overcome the undercuts in the adjacent teeth and other intraoral structures. Among the various impression materials, polyether tends to be more rigid than the other materials. But this can be a troublesome when dealing with long, thin preparations of periodontally involved teeth. Also Fracture of delicate gypsum dies is a common occurrence due to the rigidity of polyether materials. It is advantageous to use a very rigid impression material, with certain impressions, such as dual arch impressions. A rigid impression material can compensate for the flexibility of double bite trays. In this case polyether material work well as this is thixotropic. To provide the essential rigidity many of the new PVS material have specific components (Donovan, T.E., & Chee, W.W.L. 2004). PVS is fairly stiff, and depending on the viscosity of the material, flows readily to capture areas of detail (Hamalian, T. A. *et al.*, 2011). Clinical studies have shown that the viscosity of the impression material is one of the most important factor in producing impressions and dies with minimal bubbles and maximum detail (Rubel, B. S. 2007). Polyethers would be considered the least flexible among the impression materials than the alginates which are considered to be the most (Rubel, B. S. 2007).

Ease of Handling:

Various manufacturers prepared working time with respect to standard set vrs quick set impression material (Rubel, B. S. 2007).

Tear Strength:

Resistance of particular material to tearing after setting is the tear strength of an impression material. It is expected that high tear energy and appropriate elastic recovery shown by that performing material. Tearing is required to initiate and prorogate expenditure of large amount of energy. Polyethers are considered to have the highest tear strengths, whereas hydrocolloids have relatively low tear strengths (Rubel, B. S. 2007). According to Chai *et al.*,, yield strength, the strain at yield point, and the tear energy are the three mechanical properties of elastomeric impression materials are clinically relevant. PVS and polyethers are considered to have the highest tear strengths, as it tear before the limit of permanent deformation. They will deform in the range of their yield strength so, their clinical use is more suitable (Hamalian, T. A. *et al.*, 2011).

Shelf Life:

We always should know about the life of an impression material so as to avoid the technical difficulties while using it. It is not well advised to use material beyond the expiry date display by the manufacturers, the accurate shelf life of impression material is not known. But for practical purposes impression material should not be used more than 6 months, it is arbitrarily suggested (Donovan, T.E., & Chee, W.W.L. 2004).

Clinical implication:

1. **Mixing:** Understanding of the composition, physical properties and manipulative variables of elastomers is necessary to get predictable success. elastomers are useful for complete denture impression and for fixed prosthesis. These materials are obtainable in auto mixing system so it can be easily and evenly applied on tray border. Auto mixing and electronic mixing technique improve the quality of impression as compare to hand mixing. And auto mixing technique waste one third of material less than hand mixing so it was considered in a low budget and more cost effective (Daou, E. 2010).

2 **Custom tray:** Accurate impression was made in custom tray more precisely than stock trays. size of undercuts and volume of impression material are the major significance. Use of custom tray and adhesive to retained polyvinyl siloxanes maintained precision and consistency. Polyether is the material used to record functional periphery seal in maxillary arch (Daou, E. 2010).

3 **Dimensional Changes:**

In the dental practice, for pouring most of the dental practitioner sent impression to the commercial lab which causes delay. For pouring impressions, practitioners may delay up to 72 h. But the material may display great dimensional accuracy soon after its polymerization is complete as the dimensional accuracy is usually time dependent, but after the impressions have been stored for a period of time ,this is dependent on the material, and varying degrees of accuracy. The selected impression material will remain dimensionally accurate so, practitioners should be aware of the tolerable time delays. Hydrogen gas released after setting from early generations of VPS. So to avoid bubbles we have to delay the pouring of casts. Then by adding platinum or palladium which scavenge the gas, this problem has been resolved. With this improvement the immediate pouring of casts without bubbles or voids can be done successfully. The materials like polyether and polyvinylsiloxane remain dimensionally accurate for a prolonged period of time (up to 1 week). And about VPS impression materials, have excellent accuracy and the fewest dimensional changes after multiple pours. When compared with the polysulfides and the condensation- curing silicones the polysiloxane materials shows small dimensional changes with time. If polysulfide impression materials poured instantaneously have sufficient dimensional accuracy (Daou, E. 2010).

4. Hydrophilic Behavior*:*

The hydrophobic characteristics was unique difficulty of using VPS impression materials. The Quality of surface of the polymerized impression has the undesirable effect due to hydrophobic characteristic. But in case of hydrophilic impression materials which are recently added in the list like polyvinylsiloxane, there is presence of moisture in the cast has been reported. It was resulted in impressions with voided and or rough surfaces and substandard detail reproduction even with. While these ‘‘hydrophilic’’ polyvinylsiloxane impression materials are coupled with superior wettability of the polymerized impression with dental gypsum slurries, these materials produce impressions with clinically satisfactory surface characteristics only under dry conditions. About the Polyethers, it was found that they have produced the best details under moist conditions. Moisture control remains a significant factor for the expected achievement of the clinical impression with using polyvinylsiloxanes. So it is concluded that there are uneven results among the investigators. But for the practical purpose, the increasing hydrophilicity for elastomeric impression materials is the desired characteristics; polyethers have highest hydrophilicity than polysulphide than silicone (Daou, E. 2010).

4. Viscocity:

One of the factors that determine the surface details of a cast is Viscosity. The tested materials can be categorized into two groups: 1.irreversible hydrocolloid and medium body vinyl polysiloxane this group produces high pressure 2. Light body polysulphide and light body vinyl polysiloxane this group produce low pressure (Daou, E. 2010).

5. Disinfection:

Destruction of all infective organisms from a surface is known as disinfection. Continuous researches and technique effectiveness throughout the years these procedure recommendations have changed. Accuracy of both polyether and VPS should be altered after long term immersion in disinfection solution. So this material be only spray disinfected to avoid imbibitions and dimensional change. Immersion disinfection is useful if the recommended time of disinfection is used and impression material accuracy will be unaffected. Reliability of addition silicon and polyether material remains acceptable (Daou, E. 2010).

DISCUSSION:

In FPD, diagnostic impression is important as diagnostic cast gives idea about occlusocervical dimension of edentulous spaces, relative alignment and angulations of proposed abutment teeth, occlusal plane and occlusion's detailed analysis . Due to low cost and easy to use as compare to other material, alginate is most commonly used in diagnostic impression (Jankar, A. *et al.,* 2016). To maintain normal appearance of healthy gingival is the difficult procedure in FPD[7]. In FPD, agar will record the prepared tooth correctly and alginate record remaining arch so, combine agar alginate technique is good than separate agar and alginate. Polysulphides have a long working time, tear strength is good, before setting flow is good, surface detailed shows good reproduction, easier removal around undercuts is due to high flexibility and as compare to silicon and polyether it is with lower cost. And drawback is that cannot be repoured (Jankar, A. *et al.,* 2016). Polyvinyl siloxane also known as addition siloxane is dimensionally stable and record fine detail and can be poured at the comfort of the operator. PVS has excellent physical properties and handling characteristic and has the best elastic recovery of all available impression materials. This material can be poured 1 week after impression taken and can do multiple pour. Disadvantage of PVS are that the material is more rigid and to much costly practitioner use irreversible hydrocolloid mostly (Jankar, A. *et al.,* 2016). Irreversible hydrocolloids have limitation that it tears easily and must be poured immediately after removal from mouth (Jankar, A. *et al.,* 2016). Accuracy and acceptable stability of polyether and addition silicon material after disinfection protocol are unaffected (Alqatten, W. *et al.,* 2016). Whenever impression are made by polyvinyl siloxane , vinyl gloves should be used (Eames, W.B. *et al.,* 1979).

Summary:

This review shows that vast variety of impression material is available for impression making. Technique used for making impression may be more important than material used. Custom tray gives greater accuracy for impression made than stock trays. A good impression is an exact negative replica of each prepared tooth and must include all of the prepared surfaces and an adequate amount of unprepared tooth structure adjacent to the margin. The use of vinyl glove is recommended whenever impression are made by vinyl polysiloxane as latex gloves results in inhibition of polymerization due to presence of sulfur and sulfur chloride compounds. When removed from the mouth, all impression materials should be rinsed, dried, and disinfected. Polyvinyl siloxane has good physical properties and this material can be poured by multiple times. But this material is too expensive so most of the practitioner takes impression by using irreversible hydrocolloid. Alginate is most commonly used among irreversible hydrocolloids. As it is easy to used and less expensive.

REFERENCE:

1. GPT :Grossary of prosthodontic term 9.
2. Yaqoob, A., Al Shehrani, I., Alfarsi, M., Baba, S., Kanji, M. A., & Hussain, M. W. (2018). PANORAMA OF IMPRESSION TECHNIQUES IN FIXED PARTIAL DENTURES. A SYSTEMATIC REVIEW. *International Journal of Medical Dentistry*, *22*(1).
3. Punj A., Bompolaki D., & Garaicoa J. (2017). Dental impression material and techniques. Dent clin N Am 2017 (61), 779 -796.
4. Daou, E. (2010). The elastomers for complete denture impression: a review of literature. The Saudi Dental Journal, (22), 153–160.
5. Donovan, T.E., & Chee, W.W.L. (2004). A review of contemporary impression materials and techniques. Dent Clin North Am, 48(2), vi-vii, 445-70.
6. Craig R.G. (1988). Review of dental impression materials. Dent res, 2(1), 51-64.
7. Jankar, A., Nilawar, S., Magar, S., & Mutneja, P. (2016). Impression Material and techniques used and followed for the fixed partial denture treatment by private dental practitioners in Maharashtra state: a questionnaire study. International journal of healthcare and biomedical research, 4, 83-92.
8. Hamalian, T. A., Nasr, E., & Chidiac, Jose J. (2011). Impression material in FPD influence of choice on clinical procedure. Journal of Prosthodontics, 20(2), 153–160.
9. Rubel, B. S. (2007). Impression materials: a comparative review of impression materials most commonly used in restorative dentistry. *Dental Clinics of North America*, *51*(3), 629-642.
10. Alqatten, W., Alalawi, H., & Khan, Z. (2016). Impression techniques and material for complete denture construction .Dent Health Curr Res, 2(1).
11. Eames, W.B., Sieweke, J.C., Wallace, S.W., & Rogers, L.B. (1979). Elastomeric impression materials: effect of bulk on accuracy. J Prosthet Dent, 41(3), 304-7.