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Original Research

Dental impression materials: A Comprehensive review

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ABSTRACT:
Dental impression making is the process of creating a negative form of the teeth and oral tissues, into which gypsum or other die materials can be processed to create working analogues. Contemporary dentistry generates new information every year and digital dentistry is becoming established and influential. Although dentists should stay abreast of new technologies, some of the conventional materials and time-tested techniques remain widely used. It is important to review the impression-making process to ensure that practitioners have up-to-date information about how to safely and effectively capture the exact form of the oral tissues to provide optimal patient management.
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INTRODUCTION

An impression material must be capable of accurately recording dimensional characteristics of oral tissues in order to precisely transfer the impression to the model. Irreversible hydrocolloid impressions are a common part of daily practice. Alginate is one of the most frequently used dental materials; the alginate impression is usually performed at the first dental visit and its results are fundamental to forming a first "idea" about the patient's oral health status. For many years, alginate impression material has been a staple of most dental practice and impression materials are an important consideration for dental clinics even today. Therefore, it is important to understand the material and follow certain fundamental guidelines in order to achieve flawless, predictable impressions and hence avoid repeat impression/restorations. The Food and Drug Administration (FDA) issued a document in 1998, defining a Dental Impression Material as a class II device composed of materials such as alginate or polysulfide intended to be placed on a preformed impression tray and used to reproduce the structure of a patient's teeth and gums.[1- 3]

HISTORICAL PERSPECTIVE

In the mid–seventeenth century, early references to making impressions in wax to reproduce parts of jaws and teeth were recorded by a German military surgeon, Gottfried Purman. Then, in the eighteenth century, there were reports of an impression technique that involved pressing a piece of bone or ivory on the oral tissues that were painted with a coloring material and then carving out the fitting surface at the chairside. Philip Pfaff in 1756 was the first to make an impression of an edentulous jaw with 2 pieces of wax and then join them and making a cast using plaster of Paris. Other impression materials used were zinc oxide eugenol impression paste and compound, although their applications were limited by their inability to surpass undercuts without distorting or fracturing. Reversible hydrocolloids were introduced in 1925, followed by the irreversible hydrocolloids becoming available in 1941. The disadvantage of the hydrocolloids is shrinkage caused by the loss of water, leading to inaccuracy. In 1953, polysulfide was used as an impression material

along with condensation reaction silicones, but they both show significant shrinkage over a period of several hours, mainly because of the evaporation of low-molecular-weight by-products. In the late 1960s, polyether was proposed as an alternative polymer because of its improved mechanical properties and low shrinkage. In the 1970s, polyvinyl siloxane (PVS) appeared on the market and became very popular, in part because of its high dimensional stability.[4, 5]
According to international standards, the impression material should record a line of 0.02 mm width or less, which is less than the width of a human hair.

Classification
Impression materials can be classified as follow:

- **Based on Use**

For primary impressions, e.g., alginate, impression compound, elastomeric putty.
For secondary impressions, e.g., light body elastomers and zinc oxide eugenol.

- **Based on Setting Reaction**

Reversible (physical): impression compound, impression waxes, agar.
Irreversible (chemical): alginate, impression plaster, elastomeric impression materials.

- **Based on the State of the Impression Material After Setting in the Oral Cavity**

Rigid: impression compound, zinc oxide eugenol, impression plaster, impression waxes.
Elastic: alginate, agar, polysulfides, addition and condensation silicones, polyether.

- **Based on Compression of Underlying Tissues**

Mucostatic: impression plaster, light body elastomers.
Mucocompressive: impression compound, putty elastomers.

- **Based on Consistencies**
  - Light body
  - Medium body
  - Heavy body
  - Putty[5- 7]

GENERAL PROPERTIES OF IMPRESSION MATERIALS

ACCURACY

An impression material must not only accurately record the surface detail of oral tissues, but also transfer this detail to the model, cast, or die. The American Dental Association specifies the level of detail that must be recorded by different impression materials. For instance, specification #19 requires the elastomeric materials to reproduce fine detail of 25-µm or less. Polyvinyl siloxane (PVS) materials are best in this regard, and reversible hydrocolloids are the least effective. However, the limiting factor is the subsequent ability of the gypsum material to transfer this detail on to the model. Gypsum materials do not reproduce fine detail as well as impression materials. Viscosity also affects the ability to record fine detail. Heavy viscosity materials (also known as putty or heavy-body) do not record as fine detail as low viscosity materials (known as wash or light-body) and are only required to record detail at the 75- µm level.[7-9]

ELASTIC RECOVERY

When an undercut exists in a preparation, only the elastic impression materials can be successfully removed over it. The material must flow into these areas, set, and return to the correct shape once removed. This ability to return to the correct shape is termed elastic recovery, but no impression material is 100 % efficient.[10]

DIMENSIONAL STABILITY

This term describes the ability of an impression material to maintain accurate dimensions over time. Changes in dimension result in loss of accuracy when the gypsum material is subsequently poured into the impression. The PVS materials have no by-product in the chemical setting reaction, and therefore possess ideal dimensional stability. If the impression is sent to the laboratory for model pouring, the PVS materials would therefore be ideal to use. They can be poured immediately after removal from the mouth or weeks later with no change in accuracy. Conversely, the alginates are subject to both syneresis (evaporation of water) and imbibition (absorption of water) which means they should ideally be poured soon after removal from the mouth. Although the practice of wrapping alginate impressions in damp gauze or towels is common place, the time wrapped should be < 1-hour since water absorption may still occur and contribute to distortion.[10, 11]

HYDROPHILICITY/WETTABILITY

The wettability of a substance is a measure of the affinity of a liquid for a solid, and its ability to maintain contact with the solid surface. Hydrophilicity describes a material's attraction to water. These characteristics can be measured by observing the shape of a liquid drop on a solid surface, and calculating the contact angle (θ). The contact angle is defined as the angle between the solid surface and the line through the periphery of the drop, tangential to the surface. A low contact angle shows the solid being readily wetted by the liquid (hydrophilic if the liquid is water). A high contact angle (> 90°) shows poor wetting (hydrophobicity if the liquid is water). Two features of wettability should be distinguished. The first concerns the ability of the viscous material to flow into and adapt to moist oral tissues. Hydrophilic materials are more likely to be able to flow well into moist oral cavity spaces. The second concerns subsequent pouring of gypsum materials into the impression. Poor wettability may lead to void/bubble formation in the cast.[11- 13]

SUMMARY

Summary Dentists have relied on impression materials for various uses, including fabricating dental

prostheses, serving as temporary liners, and serving as bite registration materials. The materials that have received a lot of attention because of their physical and handling properties include the irreversible hydrocolloids, polyethers, polyvinyls, and polysulfides. The polyvinyls (addition silicones) and the polyethers account for a major portion of the market used as impression materials in fabricating fixed partial dentures, removable appliances, and implant prostheses. The hydrophilic addition silicones and polyethers flow easily, result in fewer retakes, and produce more bubble-free casts when used under appropriate guidelines. The polyvinyl siloxane materials are intrinsically hydrophobic (water repellent) by nature, so they must be made hydrophilic by adding surfactants. When these surfactants come into contact with moisture, it has to migrate to the surface, which prevents the hydrophilicity from fully developing during working and setting times and can result in voids and inaccurate impressions. A dry field is critical for their use. Polyether is hydrophilic by nature of its chemical makeup, and moisture does not interfere as much with achieving void-free impressions. The condensation silicones, polysulfides, and irreversible hydrocolloids have qualities that make them more sensitive with respect to handling considerations and mix-and-pour techniques because they exhibit more changes over time after setting, which may affect accuracy in detail reproduction. The polyvinyls and polyethers are more stable to deformation after setting has occurred. All have specific protocols for disinfecting that must be followed to prevent distortion of the material before pouring casts; however, the polyvinyls seem to be most impervious to different disinfection protocols.

REFERENCES

1. Anusavice K.J., Kenneth J. Phillips' Science of Dental Materials. 11th ed. Elsevier; Amsterdam, The Netherlands: 2003. pp. 210–230.
2. Giordano R. Impression materials: Basic properties. Gen. Dent. 2000;48:510–516.
3. Craig R.G., Robert G. Restorative Dental Materials. 11th ed. Elsevier; Amsterdam, The Netherlands: 2002.
4. Brunton PA, Christensen GJ, et al. Contemporary dental practice in the UK: indirect restorations and fixed prosthodontics. Br Dent J 2005;198:99-103.
5. Thongthammachat S, Moore BK, et al. Dimensional accuracy of dental casts: influence of tray material, impression material, and time. J Prosthod 2002; 2: 98-108.
6. Simos S. Three Impression Material Classifications: A Comparison. Dent Today. 2017 Mar;36(3):76,78, 80-1.
7. Al-Ansari A. Which final impression technique and material is best for complete and removable partial dentures? Evid Based Dent. 2019 Sep;20(3):70-71
8. Pratten DH, Covey DA, Sheats RD. Effect of disinfectant solutions on the wettability of elastomeric impression materials. J Prosthet Dent 1990;63(2):223–7.
9. Leung RL, Schonfeld SE. Gypsum casts as a potential source of microbial cross-contamination. J Prosthet Dent 1983;49:210.
10. Combe EC, Burke FJT, Douglas WH. Dental biomaterials. Boston: Kluwer; 1999:294.
11. Miller MW. Syneresis in alginate impression materials. Br Dent J 1975;139:425–30.
12. Osborne J, Lammie GA. The manipulation of alginate impression material. Br Dent J 1954; 96:51–8.
13. Rudd KD, Morrow RM, Rhodes JE. Dental laboratory procedures. Vol. 3: Removable partial dentures. St. Louis (MO): Mosby; 1986. p. 6.