ELASTOMERIC MATERIALS IN DENTISTRY: PROPERTIES, FUNDAMENTALS AND APPLICATIONS

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ABSTRACT

Dental treatments aim to restore the individual's oral health, so that there is an adequate return of form, function, aesthetics and phonetics. In many treatments, it is necessary to obtain a record of the structures of the oral cavity, through impression materials for the purpose of diagnosis, planning, execution of part of the treatment and patient guidance. Elastomeric materials are a group of polymeric and rubbery molding materials that have cross-links of chemical or physical origin. Due to their elastic characteristics, they have the ability to easily recover their original dimensions after the removal of a force, as well as have great potential to reproduce oral structures in detail. These characteristics are decisive for the accuracy and reliability of dental impressions and indispensable in the manufacture of precise prosthetic parts. Among them are polysulfide, polyether, condensed silicone and addition silicone. These have mechanical, physical and rheological properties that provide them with the ability to obtain excellent performance. Each material has unique characteristics, and it is important that the professional has knowledge to know how to indicate and handle them properly.

Keywords: Dental Materials. Materials for Dental Impression. Oral Health. Oral Rehabilitation.

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INTRODUCTION

Dental treatments aim to restore the individual's oral health, so that there is an adequate return of form, function, aesthetics and phonetics. This readjustment of the oral environment directly influences psychosocial well-being and quality of life.

It is notorious that in many of these interventions, it is necessary to obtain a record of the structures of the oral cavity, through impression materials or digital scanning. For the purpose of diagnosis, planning, execution of part of the treatment and patient guidance. This recording of the characteristics of dental and oral structures is essential in many areas of dentistry, such as orthodontics, dental prosthesis, oral and maxillofacial prosthesis, restorative dentistry and implant dentistry (Detorre, 1992; Doubleday, 1998; Craig; Powers; Wataha, 2004; Donovan; Winston, 2004; Lyon; Thoulton, 2005; Perry, 2013).

Molding materials are used in order to perform the molding procedure, which, combined with the professional's technique, results in obtaining a mold (negative reproduction) of the structures of the oral cavity. After disinfecting the mold with the appropriate chemical substance, plaster or epoxy materials are poured onto the mold, which will culminate in the acquisition of the model (positive reproduction) of the oral tissues (Craig; Powers; Wataha, 2004; Lyon; Thoulton, 2005; Perry, 2013).

Regarding analog impressions, commonly used in dental offices and educational institutions, despite the advent of digital flow, the impression material is kept inside a tray and positioned against the oral tissues. Once the material has gone through its setting process, the tray and material are removed together from the patient's oral cavity. The impression obtained should be analyzed, and if it is adequate, it can be used to obtain the model (Perry, 2013).

The supposedly ideal molding material must have characteristics such as: precision, tear strength, dimensional stability, adequate working time, elastic recovery, biocompatibility, adequate consistency, be hydrophilic, be compatible with the pouring material, do not distort during pouring, have a vivid color, do not have a strong taste and smell, have good adhesion to the tray, and be amenable to disinfection (Valle *et al*., 2013).

The accuracy of the print will be influenced by the professional's knowledge of the technique and properties of the selected print material and its handling characteristics. There are different types of printing materials available on the market, each with different properties and indications for use. No material fully satisfies the ideal requirements of a molding material, as they all have some limitation, the professional must select the one that will best meet the technique used and desired purpose (Craig; Powers; Wataha, 2004; Donovan; Winston, 2004; Rubel, 2007; Perry, 2013; Ferro *et al.,* 2024).

Materials for this purpose can be divided into two groups: elastic materials (reversible hydrocolloid, irreversible hydrocolloid, polysulfide, polyether, condensation silicone and addition silicone) and anelastic materials (type I plaster for molding, godiva and zinc oxide and eugenol paste). Each of these materials has individual characteristics and indications. The specificities in relation to elastomers (polyether, polysulfide, silicone by condensation and addition) will be addressed later (Perry, 2013).

Elastomeric materials (elastomers) are a group of polymeric and rubbery molding materials that have cross-links of chemical or physical origin. Due to their elastic characteristics, they have the ability to easily recover their original dimensions after the removal of a force, as well as having the potential to reproduce oral structures in detail (Shen, 2003). The first elastomeric printing materials were polysulfide (mercaptan) and condensation silicone introduced in the 1950s. Soon after, polyether appeared in the late 1960s, and silicones by addition in the 1970s (Hamalian; Nasr; Chidiac, 2011; Perry, 2013).

ELASTOMERIC MATERIALS

MECHANICAL PROPERTIES

Proper mechanical properties ensure that the printing material can withstand various stresses in removal while maintaining dimensional stability and integrity. The mechanical properties of elastomeric materials can be identified by tensile and tear strength, modulus of elasticity (stiffness), dimensional stability, tear strength, and viscoelastic behavior (Bates *et al*., 2021).

The tensile and tear strength of elastic printing materials are important factors in determining the success of the impression, in which case, the use of stronger rubbers would lead to higher rates of impressions and less discomfort to the patient (Herfort *et al*., 1978). Tear strength is the resilience of the material in resisting tearing in thin interproximal areas and at the depth of the gingival sulcus. Tensile strength represents the highest level of stress that a material is capable of withstanding when subjected to tensile forces. There are no standardized test methods for measuring the tear and tensile strength of elastomeric printing materials (SNEED *et al*., 1983; HONDRUM *et al*., 2001; ASTM D624-00, 2012).

Elastic recovery is the ability of the printing material to recover after deformation. Compression deformation is a measure of the flexibility/stiffness of printing materials and regarding dimensional stability, filler silicone printing materials are preferentially accepted due to excellent deformation recovery and accurate detail reproduction (Shen, 2003; Lu *et al*., 2004; Hatamleh *et al*., 2016). To evaluate the hardness of the elastomeric material, its resistance to the application of a deforming force during a specific time interval is measured. While the stiffer elastomers show greater resistance to deformation, the softer ones show the opposite behavior (Ud *et al*., 2022).

PHYSICAL PROPERTIES

Elastomeric molding materials play a key role in dentistry due to their distinct physical properties, such as fluidity, hydrophilicity, dimensional stability, and mechanical strength. These characteristics are decisive for the accuracy and reliability of dental impressions, which are indispensable in the preparation of precise dental restorations (Re *et al*., 2015). The following are the key physical properties of these molding materials, based on the available research studies:

1. **Fluidity:** Crucial aspect for the reproduction of accurate details in dental impressions. Studies, such as those by Dudás *et al.* (2023), indicate that polysiloxane and polyether vinyl materials have a superior fluidity when compared to condensation silicone.
2. **Hydrophilicity**: Evaluated by the contact angle (CA), it plays an essential role in the ability to wet surfaces and reproduce details in wet conditions. Polyethers have the lowest CAs, demonstrating excellent hydrophilicity. However, all materials tested are classified as hydrophilic, with CAs less than 90° (Saini *et al*., 2024).
3. **Dimensional Stability:** Essential for the printing material to preserve its shape over time. Hybrid vinylsiloxeter materials demonstrate greater dimensional accuracy compared to polyether, although they are less accurate than polyvinylsiloxane (PVS) (Singer *et al*., 2022).
4. **Detail Reproduction:** Crucial for capturing complex dental structures. In dry environments, all materials can reproduce details well, but in wet conditions, hybrid materials outperform silicone by addition while maintaining clarity and continuity of detail (Singer *et al*., 2022).

Elastomeric impression materials exhibit advantageous properties for dentistry, however, material selection must be adjusted to specific clinical needs. For example, although polyethers have excellent hydrophilicity, they may not have the same tensile strength as vinylpolysiloxanes. Hybrid materials seek to combine the positive qualities of both materials, offering a balanced solution for different dental procedures (Zheng *et al*., 2019).

RHEEOLOGICAL PROPERTY

The rheological properties of elastomers are of fundamental importance in the success of their use, especially in their ability to reproduce details. These materials are taken into the oral cavity in a pasty state (viscous liquid) with adjusted flow properties. Subsequently, the prey reaction resulting from the polymerization process converts them into a viscoelastic solid. The way the material behaves during flow into solid form is crucial, as the ultimate goal is precise molding. In addition, the viscosity and flow of the unmixed constituents (pastes) are essential, because these properties influence the handling process (Shen, 2003).

Viscoelasticity describes the dependence of the molding material's response on the removal speed (strain rate). Viscoelastic behavior is intermediate between an elastic solid and a viscous liquid. Elastomeric printing materials are found in different viscosities: from low to high. The main difference between the different viscosities is the amount of inert filler in the material. The low viscosity provides better reproduction of details, as it flows more easily, however, it has greater polymerization contraction (Donovan; Winston, 2004; Hamalian; Nasr; Chidiac, 2011).

ELASTOMERS

POLYSULFETUS (MERCAPTAN)

Polysulfides, also called "rubber base" or "mercaptan", emerged in the 1950s, being one of the first elastomers available on the market (Hamalian; Nasr; Chidiac, 2011).

Individual Characteristics

It is a material that has good dimensional stability, high tear strength, good detail reproduction, good working time, and low cost (Valle, 2009).

Chemical Composition

These are presented to the consumer in two pastes: base paste and catalyst paste in various consistencies (heavy, regular and light), where each one is indicated for different techniques. The base paste (terminal chain/side chain-SH groups) has in its composition a polymer of polysulfide, fillers (titanium dioxide and silica) and plasticizers, which help in the management of its viscosity. On the other hand, the catalyst paste is composed of lead dioxide, sulfur, and castor oil. They can be classified as a toxic substance, due to the presence of heavy metal oxides (lead). The viscosity is altered by the addition of different amounts of titanium dioxide powder to the base paste (Spranley; Gettleman; Zimmerman, 1983; Giordano, 2000; Craig, 2001; Hamalian; Nasr; Chidiac, 2011).

Working Time

The working time is advantageous and allows the professional to work without haste, as its polymerization occurs in about 9 minutes. They can be supplied in cartridges or printing guns in a self-mixing system and tubes or containers for manual handling. Manual handling of the dough depends on the proper ratio, technical capacity of the operator and the initial temperature of the pastes. The high initial temperature reduces the working time. Automixing products do not require mixing boards or spatulas, and are less time-consuming, so they are more practical. In addition, they can generate less waste of materials compared to mechanical mixing systems, because they are loaded with a device that deposits directly on the tray. This technique promotes greater homogeneity and less inclusion of bubbles, with fewer inherent voids, which results in more accurate molds. There is no risk of the polymerization of the material being affected by handling with gloves, so they can be used (Craig, 1985; Keck, 1985; Soh; Chong, 1991; Di Felice; Scotti; Belser, 2002; Hamalian; Nasr; Chidiac, 2011).

This is not an extremely rigid material and the mold is easier to remove from the retentive areas of the oral cavity compared to polyether or silicone by addition. Care should be taken during disinfection of the mold to avoid swelling of the print, it is recommended that it is not kept for more than 10 minutes in the chemical substance (Nayyar *et al*, 1979; Hamalian; Nasr; Chidiac, 2011).

Arrest Process

This material has condensation polymerization, which results in the formation of water as a by-product at the end of the reaction. It takes prey by oxidation of the SH Groups, which cause the chain to elongate and crosslink, which gives it elastomeric properties. The polymerization reaction generates an increase in viscosity, when this material gains thixotropic properties. Its packaging usually includes an adhesive composed of butyl rubber or styrene diluted in acetone, which promotes the bond between the material and the tray, to prevent the molding material from changing when removed from the oral cavity (Giordano, 2000; Craig, 2001; Hamalian; Nasr; Chidiac, 2011; Valle, 2009).

Dimensional Stability

They produce surface details accurately (25 µm), are moderately hydrophilic, and are more resistant to tearing compared to hydrocolloids. However, they experience contraction of 0.3-0.4% during the first 24 hours. Therefore, it is recommended that it be poured immediately, but it is recommended to observe the package insert with the manufacturer's recommendation. They have the ability to generate an accurate impression even in the presence of saliva or blood. They reproduce details with excellent results, but their dimensional stability is only reasonable (Ciesco *et al*., 1981; Williams; Jackson; Bergman, 1984; Derrien *et al.*, 1995; Giordano, 2000; Shen, 2003; Craig, 2004; Hamalian; Nasr; Chidiac, 2011).

Elastic Recovery

Compared to polyethers and silicones, they do not have a good elastic recovery. After clinically observed hardening, cross-linking continues. During this continuous reaction process, elasticity and elastic recovery increase considerably. Impressions made with polysulfide should therefore be left in the oral cavity for an additional 5 minutes beyond the indicated working time (Nayyar *et al*, 1979; Hamalian; Nasr; Chidiac, 2011).

Indications

1. Impressions of total and partial preparations for the reception of fixed prostheses, molding of single prostheses and multiple cavities.
2. Secondary molding of total edentulous edges intended for the reception of total dentures.

They have the advantage of being able to capture the subgingival margin without tearing during the removal act. However, it is first necessary to make an individual tray based on a plaster model to be able to use the material properly (Todescan; Bernardes-Silva; José-Silva, 2009; Telles *et al*., 2011).

Advantages and Disadvantages

ADVANTAGES	DISADVANTAGES
Low cost	Unpleasant odor (sulfur)
High tear strength	Unpleasant taste
Good working time	Staining
Good detail reproduction	Poor elastic memory.

Source: Valle, 2009.

POLIETER

In the late 1960s, polyether, a hydrophilic product cured by the cationic ring opening polymerization reaction, was introduced to the market (Hamalian; Nasr; Chidiac, 2011). Polyether is an elastomeric material widely used in clinical practice for high-precision impressions, as they have excellent characteristics and properties such as precision and dimensional stability, which are essential for obtaining detailed reproductions (Singer *et al.,* 2022).

Individual Characteristics

Polyether is an elastic material that stands out for its ability to deform and return to its original shape without compromising its properties, which makes it particularly suitable for moldings that require precise details and with high adaptation. Its elasticity allows the material to stretch during the mold removal process, without suffering major distortions. This is characterized by good resistance to permanent deformation and its dimensional stability, which results in superior quality prints (Singer *et al.,* 2022).

Chemical Composition

Its composition is derived from the reaction of polyether polymers, which consists mainly of epoxy resins. Its chemical composition involves the combination of a base resin with specific catalysts, which allow the material to cure. The chemical reaction that occurs during curing is highly controlled to ensure that a resistant and high-precision material is obtained. During handling, polyether is mixed with catalysts, which results in a transition from a fluid state to a rigid and highly elastic form (Accetta; Poubel, 2010).

Working Time

Polyethers have a relatively short working time, as their polymerization occurs in about 4 to 5 minutes. These are presented in a similar way to polysulfide: a base paste and a catalyst paste, which can be supplied as two tubes, automatic cartridge and mixing tip, or automatic mixer. They have viscosities available in different forms (light, medium and heavy). As the reactive ring of the polyether is opened by the catalyst, it then acts as a catalyst itself, initiating a chain reaction (the process of polymerization by addition). They have moderate hydrophilicity with a low wetting angle and should be stored in a dry environment to avoid distortion. Polyether prints allow for late pouring, it is important to check the manufacturer's guidance (Wiggs; Lobprise; Hefferren, 1997; Craig, 2004; Donovan; Winston, 2004; Rubel, 2007; Perry, 2013).

Arrest Process

The polymer fastening process occurs through a reaction involving the amine terminal groups. This curing reaction does not generate by-products, which contributes to the good dimensional stability of the material. However, the polymer has a tendency to absorb water during storage, which requires it to be kept in a dry environment. For this reason, it should never be stored together with moldings made of irreversible hydrocolloids, to avoid interference with its quality and performance (Van Noort., 2007).

Dimensional Stability

One of the most notable features of polyether is its dimensional stability. Unlike other elastomeric materials, polyether retains its shape and does not suffer significant distortion over time, which is essential for accurate impressions. After curing, the impression can be stored for an extended period without significant loss of accuracy, which makes it ideal for situations that require the elaboration of prostheses and crowns (Vann Noort., 2007).

Indications

1. Secondary molding of total edentulous ridges intended for the reception of total dentures, especially those with bone defects or that are very retentive (Telles *et al*., 2011).
2. Impressions of total and partial preparations for the reception of fixed prostheses (Valle, 2009).
3. Partially edentulous arch impressions intended for the reception of removable partial dentures (Todescan; Bernardes-Silva; José-Silva, 2009).

Advantages and Disadvantages

ADVANTAGES	DISADVANTAGES
High tear strength	Excessive stiffness (causes difficulty in removing the mold from the oral cavity)
Allows late vacancy	Short working time (4 to 5 minutes)
Good dimensional stability	Unpleasant taste
Excellent detail reproduction	Ability to absorb moisture present in the environment (may generate distortion)

Source: Hembree; Nunez, 1974; Giordano, 2000; Craig, 2001; Donovan; Winston, 2004; Hamalian; Nasr; Chidiac, 2011.

CONDENSATION SILICONE

Condensation silicone is a molding material that is widely used in professional practice, known for its elasticity and dimensional stability. Recent advances have focused on enhancing its properties, such as hydrophilicity and antibacterial characteristics, which are crucial for clinical applications (Naumovski; Kapushevska., 2017).

Individual Characteristics

Condensation silicone is used as a molding material in dentistry, it has several characteristics that influence its performance. Among these characteristics, the low viscosity stands out, which facilitates the flow of the material and allows a good adaptation and reproduction of details during molding. In addition, condensation silicone undergoes the process of curing by reaction with the moisture present in the environment, releasing a by-product such as alcohol or ether, which can affect the working time and stability of the material. Although it has a good ability to adapt to wet surfaces, it is not as effective as other more hydrophilic materials, such as polyethers. These characteristics make condensate silicone suitable for certain types of dental impressions, although other materials, such as filler silicones and polyethers, are preferred in some situations due to their better properties in terms of dimensional stability and accuracy (Chen *et al*., 2004; Rubel, 2007; Gonçalves *et al*., 2011).

Image 1: Final appearance of the silicone mold by condensation of a total edentulous lower arch after disinfection.

Source: Authors, 2024.

Chemical Composition

Condensation silicon is obtained by cross-linking polycondensation reaction of hydroxyl-terminated polysiloxane prepolymers with tetra alkoxy silanes catalyzed by dibutyl-tin dibaurate (DBTD) (Islamova *et al*., 2012).

The main chemical components are:

1. **Polysiloxane (base):** Polysiloxane, or silicone, is the main chain of the material's structure. The basic unit of polysiloxane is silicon (Si) bonded to oxygen atoms (O) and organic groups, such as methyl ($–CH_3$), ethyl ($–C_2H_5$), or vinyl ($–CH=CH_2$).
2. **Condensation agents:** These are responsible for the healing reaction, such as sillileters. During the curing process, silil groups react with moisture or other siloxane groups to form the characteristic three-dimensional network of cured silicone.
3. **Catalysts:** Catalysts, usually metal compounds such as organoaluminum acid, are used to accelerate the condensation reaction between silyl groups. Organoaluminum acid can be used to facilitate the curing of silicone by condensation.
4. **Byproducts of the condensation reaction:** During curing, the condensation reaction between the silyl groups and the humidity of the environment releases byproducts such as alcohol or ethers. These by-products can affect the working time and stability of the material.
5. **Additives:** Various other components such as plasticizers, inorganic fillers (such as silicon dioxide), dyes, stabilizers, and antimicrobial agents can be added to improve material properties such as viscosity, strength, and stability.

Working Time

Working time is the time of material handling, being the period in which the material remains moldable after being mixed with the catalyst. This time varies depending on the type and brand of silicone, it is between 2 and 3 minutes. After mixing, the material must be placed on the tray, positioned in the oral cavity and pressed to obtain the impression. The time for final hardening, that is, the time it takes for the material to reach its maximum strength, is usually between 6 and 10 minutes (Rocha; Russi, 2015).

Arrest Process

The constriction of silicone by condensation occurs through a polymerization reaction. This reaction occurs when the material is mixed with a catalyst, which activates the cure and leads to the formation of a network of polymers. During the reaction, alcohol is released as a byproduct, which can cause a slight decrease in the volume of the material. The setting time is dependent on environmental conditions, such as temperature and humidity, but in general, the curing process occurs in two phases: the initial gelling phase (where the material begins to harden) and the final hardening phase (Carr, 2012).

Dimensional Stability

Condensation silicones produce ethyl alcohol as a byproduct of the prey reaction (condensation polymerization), which evaporates after prey, contributing to shrinkage. This affects the dimensional stability of the material, therefore, it must be poured immediately, among elastomeric materials, this is the one that generates the greatest distortion if not worked properly (Craig 2001; Donovan; Winston, 2004; Perry, 2013).

Indications

1. Impressions of total and partial preparations for the reception of fixed prostheses (Valle, 2009)
2. Partially edentulous arch impressions intended for the reception of removable partial dentures (Todescan; Bernardes-Silva; José-Silva, 2009)
3. Anatomical and secondary molding of total edentulous ridges intended for the reception of total dentures, especially those with bone defects or that are very retentive (Telles *et al*., 2011).
4. Impressions for dental implants and as impression dies for double-mold techniques or in the wax molding process for prosthetics (Hamalian; Nasr; Chidiac, 2011).
5. Ability to make multiple accurate diagnostic molds from one print.

Advantages and Disadvantages

ADVANTAGES	DISADVANTAGES
High accuracy when poured immediately	Hydrophobic nature
Good elasticity	Print distortion over time
Pleasant odor	Possibility of allergic reaction
Pleasant taste	Dimensional stability affected as a result of polymerization generating by-products

Source: Caputi; Varvara, 2008; Gupta; Brizuela, 2023

SILICONE BY ADDITION

When they were introduced in the mid-1970s, the printing materials of addition silicone, polyvinylsiloxane (PVS) or polysiloxane vinyl (VPS) captured the majority of the contemporary market (Donovan; Winston, 2004; Madanshetty *et al*., 2023). This printing material demonstrates superior precision in the execution of impressions. In addition, it is available in various viscosities, allowing its application in single-phase or two-phase printing techniques (Caputi *et al*., 2008; Varvara *et al*., 2015; Jafari *et al*., 2024).

Individual Characteristics

Due to their favorable characteristics such as high usability, excellent elastic recoverability, accuracy in reproducing details, superior dimensional stability, adequate tear strength, ability to produce multiple precise molds from a single impression, and high acceptance by patients, these materials have played a revolutionary role in advancing the field of dentistry (Yeh *et al*., 1980; Rubel, 2007; Madanshetty *et al*., 2023).

Image 2: Final appearance of the silicone mold by addition after disinfection.

Source: Authors, 2024.

Chemical Composition

Polydimethylsiloxane (PDMS) is one of the most promising elastomers, exhibiting a set of remarkable properties that make it highly functional in various applications. Among these characteristics, high thermal stability, biocompatibility, corrosion resistance, flexibility, low cost, ease of handling, chemical inertness, hyperplastic properties and gas permeability stand out. These properties give PDMS significant versatility, allowing it to be used in fields such as medicine, materials engineering, and the chemical industry (Ariati *et al*., 2021).

This material is a polymer classified as silicon elastomer, characterized by the presence of inorganic chains that exhibit high surface energy, associated with silicates and methyl groups, as well as inorganic components that have low surface energy. In the chemical structure of PDMS, methyl groups are predominant and play a crucial role in conferring hydrophobic properties to the material, resulting in a surface tension approximately equal to 20.4 mN/m. These characteristics contribute to the versatility of

PDMS in various applications in materials engineering, medicine and surface technology (Colas; Curtis, 2013).

The chemical structure of polydimethylsiloxane (PDMS) consists of a siloxane matrix (Si-O) and repetitive siloxane units (Si $(CH_3)_2$ O), which can be represented by the formula CH_3[Si $(CH_3)_2$ O]n Si $(CH_3)_3$, where n indicates the number of repetitive units. The number of repetitions defines the molecular weight of the material, influencing properties such as viscoelasticity. The methyl group (CH_3) is responsible for imparting hydrophobic characteristics to the PDMS, while the siloxan bonds (Si–O) provide chemical and thermal stability. In addition, the cross-linking reaction, which can involve functional groups such as phenyl and vinyl, allows significant modifications in the properties of the material, making it adaptable for various applications in areas such as medicine, materials engineering, and nanotechnology (Sai *et al*., 2003; Seethapathy; Tadeusz, 2012; Wolf *et al*., 2018; Ariati *et al*., 2021).

Working Time

Silicone by addition is available in a wide range of viscosities, ranging from very low viscosity, indicated for use with syringes or cartridges (automixing system), to medium, high and very high viscosities, allowing appropriate selection according to specific clinical needs (Donovan; Winston, 2004; Hamalian; Nasr; Chidiac, 2011).

The proportion of manipulation should be done based on the manufacturer's guidelines. This elastomeric material has a significant disadvantage: its susceptibility to contamination. Contamination of polysiloxane vinyl (PVS) usually stems from the presence of sulfur or sulfurous compounds (Craig, 2001; Donovan; Winston, 2004; Hamalian; Nasr; Chidiac, 2011), often found in latex gloves or rubber (Noonan, 1986). Importantly, any contact of the non-polymerized PVS with latex will result in direct inhibition of the material's polymerization process. In addition, this inhibition can occur if the bulk material is handled while wearing gloves or if latex gloves are employed prior to mixing the material.

Arrest process

The process of attaching silicone to addition, also known as addition polymerization, occurs through a chemical reaction that involves functional groups present in the structure of the material. Filler silicon is based on the addition polymerization between divinylpolysiloxane and polymethylhydrosiloxane with a platinum salt as the catalyst (Shen, 2023).

Main components: Filler silicone is typically composed of two parts:

1. **Base**: Contains poly(siloxane) with vinyl groups (–CH=CH_2) and hydrosilanes (–Si–OH).
2. **Catalyst**: Generally, it is a compound that contains platinum or another transition metal, which acts as a catalyst for the polymerization reaction.
3. **Addition reaction**: Polymerization occurs when vinyl groups react with hydrosilane groups, resulting in the formation of siloxan (Si–O) bonds and the creation of a three-dimensional network.

Dimensional Stability

Ideally, the dimensional stability of a printing material reflects its ability to preserve impression accuracy over time, which is critical to ensuring compliance with the desired anatomical features and the functional effectiveness of the restorative or prosthetic device. This property is influenced by a number of factors, including the chemical composition of the material, environmental conditions, and the curing process, all of which play crucial roles in minimizing deformations and maintaining dimensional integrity (Craig, 2001). In this way, the opportunity to pour it is provided at the operator's convenience. In reality, this process is typically time-dependent, with maximum dimensional accuracy being achieved immediately after polymerization is complete. However, this accuracy tends to decline as the print is stored for prolonged periods. This phenomenon can be attributed to factors such as the relaxation of internal stresses, moisture absorption, and variations in environmental conditions, which can compromise the dimensional integrity of the material over time. (Williams *et al*., 1984; Craig *et al*., 1990; Shen, 2003; Donovan; 2004; Hamalian; Nasr; Chidiac, 2011).

For this reason, it is crucial that these materials exhibit low shrinkage after polymerization and maintain dimensional stability. Polyvinylsiloxane-based materials demonstrate near-optimal dimensional stability, allowing them to be poured 1 to 2 weeks after printing. This characteristic is essential to ensure the accuracy and effectiveness of the result, minimizing the distortions that can occur due to changes in environmental conditions and storage time (Derrien; Le Menn, 1995; Craig, 2001; Shen, 2003; Donovan; Winston, 2004; Hamalian; Nasr; Chidiac, 2011).

Indications

1. Ability to make multiple accurate diagnostic molds from one print (Shen, 2003).
2. Precise impressions for implant abutments and structures, contributing to optimal prosthetic results (Shen, 2003).

3. Anatomical and secondary molding of total edentulous ridges intended for the reception of total dentures, especially those with bone defects or that are very retentive (Telles *et al*., 2011).
4. Impressions of total and partial preparations for the reception of fixed prostheses (Valle, 2009)
5. Partially edentulous arch impressions intended for the reception of removable partial dentures (Todescan; Bernardes-Silva; José-Silva, 2009).
6. Ideal for patients with multiple pillars or complex intraoral topographies, where detail and fidelity are essential (Shen, 2003).

Advantages and Disadvantages

ADVANTAGES	DISADVANTAGES
Easily visible margins	Hydrophobic nature
Excellent elastic recovery	Low tear strength
Pleasant odor	Susceptible to contamination by the components of the latex gloves
Pleasant taste	Heavy and hard material
Allows late vacancy	Heavy material can displace the light
Allows you to vask repeatedly	

Source: Noonan, 1986; Craig, 2001; Donovan; Winston, 2004; Hamalian; Nasr; Chidiac, 2011.

DISINFECTION METHODS

Contamination of dental impression materials by saliva and blood from the oral cavity is frequent in dental clinics, and as a result, potentially contaminated with pathogens (e.g., *streptococci*, *staphylococci*, *Escherichia coli*, *Mycobacterium tuberculosis*, Hepatitis C Virus and Herpes Simplex Virus, *Candida albicans*). The direct interaction between dental clinics and prosthetic laboratories implies that these impressions, when contaminated, represent a significant challenge for the control of cross-infection, requiring strict disinfection and biosafety protocols (Amin *et al*., 2009; Valle, 2009; Azevedo *et al*., 2019; Al Mortadi *et al*., 2019; Mantena *et al*., 2019). Until 1991, the recommended practice consisted of rinsing the impressions under running water (Fabiani, 2006). Guidelines for infection control in dental settings state that all dentures and prosthetic devices must undergo strict cleaning, disinfection, and rinsing protocols prior to handling in the laboratory, using hospital-acquired disinfectants with proven antimicrobial efficacy (American Dental Association, 1996; Kohn *et al*., 2003; Amin *et al*., 2009)

The disinfectant used in the disinfection of molds and models should ideally serve a dual purpose: to act as an effective antimicrobial agent, ensuring the elimination of pathogenic microorganisms, while preserving the dimensional properties and surface integrity of the molding material and the resulting plaster model. This compatibility is essential to ensure the accuracy of the impressions and the quality of the prosthetic devices, avoiding interference in the physical characteristics that may compromise the fit and functionality of prosthetic specimens (Taylor *et al*., 2002).

Among the disinfectants used for the decontamination of molding materials, 2% glutaraldehyde and sodium hypochlorite in concentrations of 0.5% and 1.0% stand out. When selecting an appropriate disinfectant, it is critical to consider its compatibility with the molding material in order to avoid potential adverse effects on the detail reproduction, dimensional stability, and degree of wetting of the molding materials. Careful evaluation of the interaction between the disinfectant and the material is crucial to ensure the effectiveness of the disinfection process without compromising the physicochemical properties of the material used (Valle, 2009; Melo Neto *et al*., 2023)

The following protocol describes a disinfection procedure for impression molds, which can be adjusted according to the type of impression material used:

1. Wash the mold in running water for the prior removal of blood and saliva, ensuring the elimination of contaminants;
2. Place the disinfectant in a glass or plastic tub with a lid, ensuring the adequacy of the container to the product used;
3. Immerse or spray the disinfectant solution on the mold for a period of 10 minutes or spray it to ensure effective disinfection;
4. After soaking, rinse the mold again under running water to remove any disinfectant residue;
5. Proceed to dry the mold, ensuring that it is completely free of moisture before storage or subsequent use.

Glutaraldehyde is widely used for the disinfection of molds made of polysulfide and silicone. In contrast, sodium hypochlorite is recommended for disinfecting a variety of molding materials, including polysulfide, silicone, and polyether. For the disinfection of alginate and polyether, it is recommended that sodium hypochlorite be sprayed on the surface of the mold, which should be covered with paper towels previously moistened in the same disinfectant solution. The mold should be kept in a plastic bag for a period of 10 minutes to ensure the effectiveness of disinfection. After this interval, the mold should be washed under running water, followed by proper drying and pouring (Valle, 2009).

The following is a summary table of elastomeric materials and their respective disinfectant methods:

MATERIAL	DISINFECTION METHODS	OBSERVATIONS
POLYSULFETUS (MERCAPTAN)	1. Initial cleaning: Rinse under running water to remove residue; 2. Disinfection: Immerse in 0.5% or 1.0% sodium hypochlorite solution for 10 minutes or 1% peracetic acid; 3. Rinse: Rinse under running water to remove disinfectant residues; 4. Drying: Dry in the open air or with a disposable towel.	Initial cleaning should be performed immediately after removal of the mold to prevent material degradation.
POLIETER	1. Initial cleaning: Rinse under running water to remove residue; 2. Disinfection: Immerse in 2% glutaraldehyde solution for 10 minutes; 3. Rinse: Rinse under running water to remove disinfectant residues; 4. Drying: Air dry or with disposable towel	Initial cleaning should be carried out immediately after molding; 2% glutaraldehyde solution is compatible with polyether and effective against microorganisms.
CONDENSATION SILICONE	1. Initial cleaning: Rinse under running water to remove residue; 2. Disinfection: Immerse in 0.5% or 1.0% sodium hypochlorite solution for 10 minutes or 1% peracetic acid; 3. Rinse: Rinse under running water to remove disinfectant residues; 4. Drying: Dry in the open air or with a disposable towel.	Avoid using hot water, as it can affect dimensionality.
SILICONE BY ADDITION	1. Initial cleaning: Rinse under running water to remove residue; 2. Disinfection: Immerse in 0.5% or 1.0% sodium hypochlorite solution for 10 minutes or 1% peracetic acid; 3. Rinse: Rinse under running water to remove disinfectant residues; 4. Drying: Air dry or with disposable towel	Silicone by addition is sensitive to alcohol-based disinfectants.

Source: Authors, 2024.

FINAL CONSIDERATIONS AND CLINICAL RELEVANCE

It is indisputable that the use of elastomeric materials is part of the routine of many professionals, due to their characteristics and properties, in addition to which, in many treatments, it is necessary to obtain an impression of the structures of the oral cavity. These materials can be applied in several areas, however, in order to be successful in their application, it is important that the professional has knowledge about their indications and aspects.

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