Use of Addition Silicones in the Final Impression of A Fixed Prosthesis

Granda Macías, Luz Amelia[1], Quishpe Cóndor, Odalys Belén[2], López Torres Rómulo Guillermo[3], Salame Ortiz Verónica Alejandra[4]

[1]Universidad Regional Autónoma de los Andes UNIANDES, Ambato, Ecuador.
Email: ua.luzgranda@uniandes.edu.ec
https://orcid.org/0000-0001-5611-2819
Email: oa.odalysbqc15@uniandes.edu.ec
https://orcid.org/0000-0002-4096-1370

[2]Universidad Regional Autónoma de los Andes UNIANDES, Ambato, Ecuador.
Email: ua.romulolopez@uniandes.edu.ec
https://orcid.org/0000-0001-9315-3388

[3]Universidad Regional Autónoma de los Andes UNIANDES, Ambato, Ecuador.
Email: ua.veritosalame@uniandes.edu.ec
https://orcid.org/0000-0002-7103-5804

[4]Universidad Regional Autónoma de los Andes UNIANDES, Ambato, Ecuador.

Abstract

Background: Addition silicones were introduced in 1970, and since then, they have not ceased to undergo improvements and changes for which they occupy an important place as the impression material of choice in fixed prostheses. **Introduction:** Nowadays, additional silicones are cataloged as the most used materials for dental treatments since they can capture minimum details and offer a variety of viscosities to be used in dental practice. **Objective:** To determine the main theoretical bases available on using addition silicones as the material of choice for taking definitive impressions for elaborating fixed prostheses. **Methods:** Scientific research articles, review articles, and clinical case studies published in journals indexed in Latindex, Scielo, Google Scholar, West Indian Med, Pubmed, and Dialnet were considered. **Results:** Addition silicones represent the essential impression material for the successful development of a fixed prosthesis, a therapeutic alternative to reduce dental extractions, bone resorption caused by partial edentulism and the use of conventional partial prostheses, improving the lifestyle of patients with fixed prostheses. **Conclusions:** According to several authors, silicone is the material with the best reproduction of details, which guarantees success in our treatments in fixed prosthodontics.

Keywords: Addition Silicones, Fixed prosthesis, Oral Rehabilitation.

Resumen

Antecedentes: Las siliconas de adición se introdujeron en el año de 1970 y desde esos años no han dejado de experimentar mejoras y cambios por lo cual ocupan un lugar importante como material de impresión de elección en prótesis fija. **Introducción:** En la actualidad, las siliconas de adición se catalogan como los materiales más empleados para los tratamientos odontológicos, ya que son capaces de captar mínimos detalles además de que ofrecen una variedad de viscosidades para ser empleados en la práctica odontológica. **Objetivo:** Determinar los principales sustentos teóricos disponibles acerca del uso de las siliconas de adición como material de elección para la toma de impresiones definitivas destinadas a la elaboración de prótesis fija. **Métodos:** Se tomaron en cuenta artículos científicos de investigación, artículos de revisión, estudios de casos clínicos publicados en revistas indexadas en Latindex, Scielo, Google académico, West Indian Med, Pubmed, Dialnet. **Resultados:** Las siliconas de adición representan el material de impresión esencial para el desarrollo exitoso de una prótesis fija, alternativa terapéutica para disminuir las exodoncias dentales, reabsorción ósea causada por edentulismo parcial y el uso de prótesis parciales convencionales, mejorando el estilo de vida de los pacientes portadores de prótesis fija. **Conclusiones:** Según varios autores la silicona de adición es el material con mejor reproducción de detalles lo que garantiza el éxito en nuestros tratamientos en prostodoncia fija.

Palabras clave: Siliconas de Adición, Prótesis fija, Rehabilitación Oral.

1. Introduction

In dental practice, obtaining a faithful copy of the hard and soft tissues to be rehabilitated is essential to achieve adequate functional and esthetic results (1). Furthermore, a dental impression is required as a duplicate to faithful detail of all the bucco-dental structures, which to achieve it is necessary to use certain materials dedicated to the area of dentistry being applied in the oral cavity using instruments determined to take the impression; these materials

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should be in its most appropriate state to fulfill its purpose (2).

The first impression material available was agar, a reversible hydrocolloid obtained from various species of algae, first introduced in dentistry in 1937 for the registration of crown impressions; however, its use was not convenient due to the discomfort it caused during handling and the need for expensive equipment. Its substitute was the irreversible hydrocolloids or alginate, which today are still an economical option and a material that is easy to handle (3).

Printing materials are selected according to their characteristics and physical, biological and mechanical properties. The choice of the adequate material in each case is given by the accuracy in the details that it reproduces, easy handling, thixotropy, compatibility with other materials, dimensional stability, and adequate resistance so that when it is removed from the mouth, it does not present local complications (4).

The material for reproducing details for a fixed prosthesis is the elastomers and rubbers, whose main peculiarity is maintaining its design to the deformation by pressure, humidity or heat superior to its composition (5).

This family, in turn, is divided into 2 groups: condensation silicones, which must be limited to moisture to be manufactured because they are hydrophobic materials; on the other hand, there are additional silicones, which must be used in a dry field of action to avoid deformations in the impression (6).

When taking the definitive impression of a fixed prosthesis, the material of the first choice is additional silicone because it has the ideal characteristics to achieve optimal results (7). These silicones, also called polyvinyl siloxane or vinyl poly siloxane, have a great detail reproduction capacity, the best dimensional stability among impression materials, resistance to tearing and elastic recovery of 99.5% (8).

The composition of this printing material is the base composed of polymers ending in vinyl groups: hydrogen siloxane or polymethyl siloxane, siloxane prepolymers, siloxane oligomer and filler particles. In addition, its catalyst contains platinum salts (activator) and chloropentatinic acid (accelerator). The vinyl-based end groups mean no release of by-products, which helps reduce printing shrinkage (9).

Nowadays, additional silicones are cataloged as the most used materials for dental treatments since they can capture the smallest details and offer a variety of viscosities to be used in dental practice. For this reason, to carry out correct handling and dosage, the manufacturer's instructions should be respected in each case since there is a variety of commercial brands and origins and therefore their handling is not the same (10).

Addition silicones generally have two types of consistency: heavy silicone or putty and light or fluid silicone, which should be used together when printing (1).

For the definitive impression in a fixed prosthesis, there are two main techniques: the one-step or one-time technique in which the heavy consistency silicone is placed in the tray and the light consistency silicone in the part where the prosthesis will be placed, and the dental impression is taken. And the two-step or two-stage technique is in which, first, the impression is taken in the mouth with the heavy consistency silicone removed and the light consistency silicone is applied on the dental surface where the prosthesis is placed the impression is taken again. These two techniques have similar accuracy regarding detail reproduction (11).

In addition, silicones were introduced in 1970, and since then, they have not ceased to undergo improvements and changes, which is why they occupy an important place as the impression material of choice in fixed prostheses (12).

2. Materials and Methods

Types Of Research

Documentary Review: Since there is no collection of information on this topic, it provides the undergraduate student with updated and effective concepts for a better understanding of the precise impression material for the successful development of a fixed prosthesis.

Applied: A bibliographic review is developed to solve a problem: the lack of knowledge in students studying semesters at the UAO.

Descriptive: This type of research will help clear up doubts and concerns about how to adequately develop the definitive impression from the correct use of the material of choice, such as additional silicones, to effectively realize a fixed prosthesis. This type of review is of great importance and a wide utility in the daily practice of the oral health professional.

3. Population And Sample

This literature review article uses information obtained from databases such as Latindex, Redalyc, Scielo, Medigraphic, and Pubmed from the last 5 years, from 2017. The information collected is from reports of scientific articles that frame and relate to our topic to be highlighted.

4. Methods To Be Used

Document Analysis

Scientific research articles, review articles, and clinical case studies published in journals indexed in Latindex, Scielo, Google Academic, West Indian Med, Pubmed, Dialnet were taken into account; this study will be conducted with publications from 2017 to 2021.

Selection Criteria

In this bibliographic review, both inclusion and exclusion criteria will be considered to select the

information that will support this research adequately.

Inclusion criteria

- Publications from 2017 onwards.
- Scientific basis mentioned above.
- Dental esthetics.
- Fixed prosthesis.
- Impression materials in fixed prosthesis.
- Partial oral rehabilitation.
- Adjuvant treatments for fixed prostheses

Exclusion criteria

- Publications from 2015 backward.
- Bases with little scientific enhancement and without indexing, such as Gaceta Dental.
- Conventional partial oral rehabilitation.

5. Results

From the bibliographic review implemented in the present research, whose subject is based on the use of addition silicones in the definitive impression of a fixed prosthesis, a total of 28 scientific articles were obtained. A fact to be highlighted is that in prosthodontics, more dental impressions are made, being the definitive material to be used, additional silicones play a fundamental role (13).

Of the 28 scientific articles, around 13 discuss the definition of dental impression; in addition to identifying a clear concept of impression materials, they highlight their properties and characteristics, which are of great importance when selecting the most suitable impression material to achieve the desired objectives.

15 scientific articles mention the addition of silicone as the material of choice for definitive impressions in elaborating a fixed prosthesis and agree that it presents properties such as the definition of detail, elastic recovery and dimensional stability superior to other impression materials. Additionally, 8 scientific papers talk about the impression techniques, which is the two-stage technique most recommended for taking impressions in the fixed prosthesis because better and more predictable results are obtained once the technique is mastered.

Dental impression

According to López (2) a dental impression is a detailed copy of all the bucco-dental structures. To obtain it, specific materials for stomatological use are required that will be applied in the buccal cavity by means of instruments determined for taking the impression; these materials should be in their most suitable state to fulfill their purpose.

Printing materials

Espinoza (9) in his research mentions that the impression materials are those used to make an impression. They are of great importance in the success of the treatment since, according to the material chosen to obtain a faithful record of the hard and soft tissues of the oral cavity, an optimal adaptation of the prosthesis in the mouth will be achieved. The first impression material used to register crown impressions was agar, a reversible hydrocolloid; however, it was later replaced by irreversible hydrocolloids or alginate.

Importance

According to Villavicencio (14), the professional needs to understand the materials to be used in their work area; the impression materials should be selected according to the type of procedure to be performed. These should present characteristics and properties that improve the probabilities of success of the treatments, in addition to the fact that the impression-taking should be fair and not spoil the material.

Properties and characteristics

On the other hand, Diaz (20) mentions that a series of properties that printing materials must comply with must be considered when selecting the adequate material to achieve the desired objectives and results. These are detail definition, dimensional stability, thixotropy, fluidity, and elastic recovery. In addition, as they are in intimate contact with the tissues of the oral cavity, they must have the appropriate characteristics for their use, such as pleasant smell and taste, they should not be toxic or irritating, adequate working time, and compatible with casting materials, easy to provide, dispense and mix.

Ranking

Printing materials are classified as follows:

-Rigid impression materials: they have no application in fixed prostheses.

-Elastic impression materials: reversible hydrocolloids (in disuse), irreversible hydrocolloids (alginate) important in fixed prosthesis for antagonist models. Elastomers: condensation silicones, addition silicones, polyethers and polysulfides (in disuse).

According to Garaicoa et al. (18), the impression materials currently most used for fixed prosthesis impressions are addition silicones and polyethers. The material of choice has been condensation silicones; however, they are being replaced by addition silicones since they present substantial improvements.

Addition silicone

Composition

Anaya (16) mentions that the composition of this printing material is silica as the load material and its catalyst or activator the platinum salt, resulting in an ionic polymerization reaction between vinyl and hydrogen groups originating a three-dimensional composition without generating any collateral by-product, therefore, a great fidelity in printing. In addition, surfactants are added, making them slightly hydrophilic, which leads to fewer casting problems. However, this material releases hydrogen when set and can produce pores and bubbles if poured before

the recommended time (1 hour).

Properties

According to Macchi (15), addition silicones surpass other printing materials admired by many as the one that generates the best reproduction of details and accuracy, have great dimensional stability and a greater elastic recovery, better fulfilling the required properties and therefore are the most used materials nowadays.

Presentation and handling

Peregrina et al. (17) mention that addition silicones are found in different viscosities: heavy in the form of putty with its dispenser, and light and medium consistency in combined cartridges through a gun with dosing termination.

Each commercial company presents specific instructions for the use, working time and handling of the material, so it is advisable to comply with the indications and to know the material with which you are going to work to avoid making mistakes in the handling of the product.

Utilities

Cova (19) writes in his book that the uses of addition silicones in stomatology are several, ranging from the realization of working models, operative design (Inlay, Onlay, Overlay) to recognize areas of adjustment in Inlay, for bite registrations, gaps or partial dentures. The addition silicones can be used for all dental impressions, if necessary, from anatomical, diagnostic or definitive impressions; according to the professional, for anatomical or diagnostic impressions the, irreversible hydrocolloids are more used due to their low cost.

Advantages and disadvantages

According to Villamarin (8)the main advantages of adding silicones are clear reproduction of details, pleasant smell and flavor, easy handling, and presentation in auto-mixing devices, which allows to avoid bubbles and obtain exact proportions, good dimensional stability and resistance to tearing. It has few disadvantages, such as high cost, cannot be handled with latex gloves, and release hydrogen, so they must be emptied up to one hour later to avoid deformation.

Printing techniques

On the other hand, Gupta et al. (21) mention that polyvinyl siloxanes for the development of an impression in fixed prosthesis can be applied using two techniques: the one-time technique, which is performed by applying the two types of consistency, the heavy consistency silicone is placed in the tray and the light consistency silicone is placed on the dies to be reproduced and the dental impression is taken. The advantage of this technique is that the impression is taken with a single intention and requires less work.

The other impression technique is known as the two-step technique, double execution, which consists of the first step of placing the additional silicone of heavy consistency in the tray and taking the impression of the die; in this way, it manages to individualize the tray leaving a uniform space for the subsequent placement of the light consistency silicone, once the first impression is removed, place the light consistency silicone on it and take the second impression fitting on the same dental organs to limit distortions. As a result, the light consistency silicone will register with greater detail the dental preparations. This technique is the most recommended to achieve precision in taking definitive impressions in fixed prosthesis.

6. Discussion

The different impression materials will be used by the professional depending on the case or the treatment to be indicated; taking into account this, an impression made of alginate will not serve as a definitive impression for a fixed partial rehabilitation. This is due to the fact that the quality of reproduction of details of this impression material is much lower (22).

The success in a prosthetic rehabilitation is in the fidelity of the impression; this will be the guarantee for the prolonged life of the prosthesis made; in the esthetic management in fixed prosthesis, the gingival tissues play a fundamental role in achieving an esthetic ecosystem between the replaced dental organ and the gingival contour. To keep the periodontium healthy, it is necessary to avoid invading the width of the junction epithelium, otherwise, it can start papillary gingivitis, causing discomfort such as pain due to friction, evident bleeding, inflammation and even possible periodontitis, therefore, future failure of the fixed prosthesis (10).

The good separation of gingival tissues is related to the success of the fixed partial restoration, for which the edges of the abutment teeth must be well defined in the impression. For this reason, the addition silicones are the material of choice due to their great reproduction of finer details and acceptance of gingival tissues (23).

In the definitive impression, it will be possible to visualize the invasion of the material for which it is recommended to use the two-step technique by means of the use of addition silicones, so the well-defined edges will be noticed during the first step and will continue with the second impression if the edges are well defined (24). Guzman writes in his book that the addition silicones are the most optimal impression material to develop the definitive impression in fixed prosthesis because its distortional change is the smallest of all the other impression materials, only from 0.05 to 0.16%, which marks its great dimensional stability (25).

On the other hand, Gomez compared the dimensional stability of three addition silicones poured in one hour, one day and one week. The different times in which the impressions taken with the addition silicone were poured did not reflect significant differences in the models obtained.

Therefore, it can be deduced that this impression material presents satisfactory dimensional stability and minimum polymerization deformation (27).

The main advantage of addition silicones over condensation silicones is that the latter do not generate collateral products or impurities that cause distorting changes in the final impression (26). Among their advantages are their great resistance to tearing when removed from the oral cavity, support such force, achieve great elastic recovery, well perceived by patients regarding their taste and odor, are not toxic and are very easy to handle. In addition, they have good dimensional stability before and after setting, recover after deformation and are accurate in reproducing details, which is why they have been widely accepted and are currently the most widely used (28).

The fixed prosthesis is a great alternative to restore the patient's confidence after the loss of dental organs, it generates greater acceptance by society, and in order for it to be carried out in the best way, parameters established by each commercial company should be taken into account in relation to the variety of products in the dental market. It is clear that this impression material should be used to a greater extent by the students who carry out their daily work at the UNIANDES Dental Care Unit in order to learn about its benefits and master its use in the area of oral rehabilitation.

7. Conclusions

This research shows the importance of knowing about addition silicones as the impression material of choice in taking the definitive impression in fixed prosthesis. It is of great importance for the professional to understand the materials to be used in their work area; the impression materials should be selected according to the type of treatment to be performed. According to several authors, addition silicone is the material with the best capacity to reproduce details and accuracy, which guarantees success in our treatments in fixed prosthodontics.

This impression material can be applied by means of two techniques, the one-time and the two-time. These are similar in terms of the quality of reproduction of details, in spite of this, they will be applicable according to the criteria of each professional. There are different commercial companies in the dental market, so it is important to follow the indications of each manufacturer, each one presenting specific indications for use, working time and handling of the material. This way, it will avoid mistakes and inconveniences in handling the product.

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