Application of Bioroot Sealing Cement as An Innovative Method in Patients.

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Abstract

Introduction: Sealant cements are essential to obtain a successful root canal treatment, it is vitally important that they have biocompatible, antimicrobial properties that do not allow microfiltration and that they are not toxic to avoid irritating the periapical tissues. Objective: To evaluate the available scientific evidence regarding the efficacy of BioRoot sealant cement. Methods: To carry out this scientific bibliographic review article, it was through duly verified scientific articles similar to the main topic. Results: BioRoot sealant cement belongs to the bioceramic cements that are recently launched products on the market, which have been proven to have properties that help the periapical tissues to have good healing, adhesion and mineralization at the time of endodontics. It also contributes to bone regeneration. Conclusions: BioRoot cement is a material with high purity, which is why several authors recommend this product, which has a bioactive technology for tissues and, thanks to it, excellent results have been obtained.

Keywords: Sealant cement, Bioroot, Endodontics

1. Introduction

The sealant cements in endodontic treatment are of utmost importance, since they are responsible for preventing the micro filtration of fluids from the root canal to the periapical region. These materials must have a good biocompatibility with the walls of the duct so; The success or failure of the treatment will depend on that, taking into account that the composition of the material to be used must also be considered. (1)

For a root canal to work it is important to know what; In the sealing a cement with properties that allow the correct adhesion is used together with the gutta-percha in the duct and in case of needing a secondary treatment, it can be removed in its entirety and without difficulty. It should be noted that the BioRoot sealing cement makes the work viable since; It is accepted by the periradicular tissues without causing any irritation. (2)

BioRoot sealant cement is a bioceramic material that has optimal biocompatibility, thanks to its main component tricalcium silicate, favoring adhesion and resistance, as well as long-term improvement with optimal periapical healing and mineralization of dental structures. Thanks to several studies it has been established that its pH has antibacterial activity in addition to not being a cytotoxic material for the patient. (3)

It is a cement of high purity which in its presentation comes in a fine powder that must be mixed with a liquid solution, uses the moisture of the dentinal tubules to be able to set, consequently a calcium silicate hydrate gel is obtained resulting in a perfect conditioning with dentin. Therefore, several authors recommend using this bioceramic material to perform endodontic work guaranteeing our patients a quality treatment. (4)

Compared to other types of sealant cements, authors suggest that, this type of material closely resembles an ideal cement, since; There are many materials used to plug a duct such as zinc oxide eugenol, calcium hydroxide, resin sealants among others; that, it has been verified that they have components that in one way or another harm and do not allow to obtain 1 a quality treatment. (5)

That is why it has been introduced innovative materials in order to improve all these shortcomings already mentioned above and therefore it has been found that; Bioceramic cement provides multiple benefits for all dental structures. (6) It is important to know that, this material is not contracted; rather it

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expands after setting, however; It usually relates favorably to surrounding tissues. It does not allow bacterial adhesion or staining of the dental organ after treatment, as well as suitable for various clinical uses such as root canal perforations, lateral perforations, external and internal root resorptions and pulp coatings. (7)

In a comparison between Endofill and BioRoot sealants it was observed that; The two materials possess properties that benefit duct sealing, however; this indicates that there was less micro filtration with BioRoot cement due to its ease of work and speed of handling. (8)

It is clear that all sealant cement can present filtration to a greater or lesser degree, but it must be taken into account that; As long as the microfiltration is less or null it will lead us to endodontic success. (9) This cement was introduced to the market in February 2015, in vitro studies angiogenic and osteogenic growth factors have been observed by periodontal ligament cells, in addition; It has bioactive properties that contribute to periapical healing and bone regeneration. (10)

Compared to the other sealant cements it is known what; BioRoot has the lowest degree of toxicity. (11)

Bioceramic sealant cements play a fundamental role in the inflammatory response because the layers contained in the material make it possible to; Its tissue regenerative action allows an improvement in inflammation. (12)

Its anti-inflammatory action has been shown to be efficient and must be taken into account for the clinical improvement of a root canal, avoiding causing secondary work (Retreatment) by contamination. (13)

The bio toctivity of this material allows the production of hydroxyapatite that consequently has a fundamental contribution for a good remineralization thus returning a functional stability to the tissues; in addition, it has a high radiopacity and its working time is approximately 15 minutes with a setting of less than four hours and does not produce contraction, benefiting from an adequate sealing for the root canal. (14)

By hermetic sealing of the channel between the dentinal wall and the gutta-percha, the passage of bacteria from the oral environment to the periapical tissues is hindered. This sealant to be optimal must offer specific properties such as: absence of staining, solubility in solvents, insolubility in oral and tissue fluids. Being that, to have a guarantee about the success of this procedure it is essential to have a good insolubility since the results will depend on it. (15).

The objective of carrying out a bibliographic review of this cement; is to evaluate the available scientific evidence regarding the effectiveness of BioRoot sealant cement, in addition; to provide concrete and clear information about this new material that came on the market in 2015, in order to provide the dentist with a safer and more effective procedure when performing a root canal. It is essential to know the excellent properties that this material has for the filling of ducts, and; the benefits that it gives us with the adjacent structures.

2. Materials and Methods

Research line

Study and development of materials and technologies applicable in Dentistry.

Type of research according to the approach

The focus of this work will be qualitative, since; it will allow us to collect data and information that will contribute to the realization of an authentic study on the evolution and benefit of this sealant material as an innovative product introduced in the market from 2015.

Type of research according to the Objective or purpose

It is an applied research since; Thanks to the properties of this product allows us to guarantee the success of endodontic treatment in patients in the long term, due to the advantages it offers to dental structures; and, will allow the dental professional a better manipulation for its effectiveness.

This method allows us to observe how the patient evolves over time and evaluate if there has been an alteration with the treatment performed; as well as, also comparing with results of other sealant materials in order to analyze which is the appropriate sealant cement to use in endodontic treatment.

Population and Sample

In the present work, information has been collected from the following journals: Journal Endodontics 1 article, Pudmed 1 article, Scielo 9 articles, Postgraduate thesis 8 publications and Google academic 8 works, which in turn was subdivided by the year of publication, these being in 2015: 1 publication, in 2016: 3 publications, in 2017: 3 publications, in 2018: 4 publications, in 2019: 7 publications, in the
2020: 4 publications and in 2021: 3 publications.

Inclusion criteria

The information to be included in this paper; It will be of indexed database scientific articles, master's theses and / or specialties that allow obtaining a relevant and current study of data from 2015 to the present. Research was obtained from these websites due to their veracity and reliability, which helped in the preparation of this registered study.

Exclusion criteria

Other databases with articles that are not within the last 6 years, undergraduate theses and articles that do not have enough information to contribute to this review will be excluded.

Methods to be used.

It is a documentary analysis in which all the scientifically proven information will be compiled that will serve to emphasize, analyze, interpret our

research topic and thus be able to contribute with a complete study and with current data made by several authors, from journals such as Journal Endodontics, Pubmed, Scielo, postgraduate thesis and Google academic.

3. Results

Endodontics is a science of dentistry that; It is responsible for the study of the morphology, structure, pathology of the pulp and adjacent tissues. It is aspecialty recognized in 1963 by the American dental association, this treatment allows us to preserve theteeth and thus avoid future exodontias. (16) Endodontics allows us to solve several problems related to pulp dentine complex conditions, avulsions, teeth whitening with color alteration, retreatments and treatments involving bolts and residual limbs.

Root canal filling is necessary to fill the dead space left when pulp is lost. Root canal treatment methodologies have changed very little over the years. The filling of the duct is usually done with a solid cone and a sealant. Initially used as a single cone along with root canal sealant, then techniques evolved towards lateral condensation to improve the three-dimensional quality of duct filling.

It is important to determine what; The sealant has the ideal properties since it comes into contact with dentin and periodontal tissues.

The three main functions of a root filler are: sealing against the growth of bacteria from the oral cavity, burial of the remaining microorganisms, and complete filling at the microscopic level to prevent stagnant fluid from accumulating and serving as nutrients for bacteria from any source. (17)

The sealant cements in the treatment of endodontics are considered a fundamental part in the success of the treatment since; They are responsible for filling the ducts and preventing the passage of bacteria into the peri-root tissues.

This material must meet several requirements such as Easily enter the duct, do not contract after being applied, do not pigment the tooth structure, not be toxic and do not irritate the tissue, be bacteriostatic. (17)

In the market we can find cements based on zinc-eugenol oxide, calcium hydroxide, glass ionomer, epoxy resin based on MTA and tricalcium silicate, this being The most suitable for sealing root canals thanks to its various benefits that it offers. (18)

Bioceramic cements are materials that do not cause inflammation in the periapical tissues, the same as; They are able to produce hydroxyapatite during their setting, since; They form a bond between the material and the dentin. Its pH is alkaline, which makes it so, A material with high antibacterial activity. (19)

They are easy to manipulate in the duct due to the size of its particle that is approximately 2 um, bioceramics do not usually contract, on the contrary, they have the ability to expand and not reabsorb.

Bioceramic cements are divided into three basic groups.

1. Bioinert cements of high resistance.
2. Bioactive cements that form chemical bonds with mineralized tissue.
3. Biodegradable materials that are actively integrated with the metabolic processes of the body.

Due to their high stability and sealing properties, bioceramic cements can be used in combination with gutta-percha as part of a single cone technique; or directly inside the root canal to seal its entire length. Although bioceramic cement can also function as a sealing material.

Bioroot is a cement that has antimicrobial properties, has high biocompatibility and is easy to handle. This hydraulic cement contains powder and liquid, where powder is tricalcium silicate containing povidone and zirconium oxide, the liquid is an aqueous solution of calcium chloride and polycarboxylate. (20) Tricalcium silicate is a bioactive material that allows the restoration of pulp and dental tissue, it is ideal for direct or indirect pulp protection causing a hermetic seal in deep caries that are close to the pulp. (21)

Zirconium oxide and povidone is a high radiopacifier and a biocompatible polymer that allow this material to offer great adhesion. (22)

One of the great benefits that this cement has is that; It stimulates bone growth, in addition to being an excellent hermetic material, radiopaque and easy to handle. According to studies, Bioroot can be administered safely in women who are pregnant.

The bioroot has active biosilicate technology, this means that it does not contain monomers. A great advantage of this material is that it favors periapical healing due to its bioactive properties, thus preventing a bacterial environment from developing in the duct and leading to a failure of the procedure. (23)

In the application of this material must be taken into account its working time which is 15 minutes and its setting time which is less than 4 hours.

For its placement we have two lateral condensation techniques is the most used, where a master cone is occupied in the form of the duct covered by the sealant cement and placed laterally in the duct with the help of the spacers to be able to place the accessory cones until obtaining a seal.

The single cone seal technique is worked with a single cone without the need to occupy the accessory cones, this technique is faster, but it must be worked with precision and depends a lot on the type of sealant that is occupied, since it must be left well adjusted especially in the apical part.

BioRoot sealant cement mixture

1) Place a tablespoon of BioRoot in a mixing block.
2) Add 5 drops of liquid.
3) Mix for 60 seconds.

Placement of cement in the duct:

1) It begins with the disinfection of the duct to be

treated.
2) The gutta-percha cone must fit perfectly into the duct with the appropriate length of work.
3) Check that the duct is very dry.
4) Use the sealant cement in a gutta-percha cone and cover all the walls of the duct.
5) Proceed to the sealing either with the single cone technique or lateral condensation.
6) Assess the quality of the filling using a periapical x-ray.
7) Cut excess gutta-percha with a hot condenser. (24)

According to studies the BioRoot has a disadvantage at the time of sealing, it is recommended that a cold gutta-percha filling should be performed since, with the hot gutta-percha technique, it produces alterations in its microstructure negatively influencing the percentage of the mass, increase in viscosity and thickness of the sealing cement film in the sealing, decreased fluidity and decreased setting time. These changes in the chemistry of sealant cement are due to the evaporation of water, which occurs at high temperatures. (25)

This bioceramic cement achieves excellent hermeticism due to its adhesion to the dentin of the root canals, due to the tubular diffusion of its particles; the infiltration of the mineral content of cement, and the reaction of calcium silicates with dentin moisture, resulting in the formation of hydroxyapatite along the mineral infiltration zone.

That's why; They are indicated as sealing cements in root canal filling, in perforation repair, in retro-fillings, in pulpotomy, in resorptions, in apexifications, and in regenerative endodontics. (26)

BioRoot is effective in killing microorganisms even when water is used as the final irrigation solution and its activity increases when using an irrigation solution such as EDTA.

The paste of this cement is of smooth consistency with good flow and adequate adhesion to the instruments to allow optimal placement in the root canal.

Thanks to the use of Active BioSilicate technology that does not contain monomers, there is no shrinkage of this material during setting to allow a hermetic sealing of the root canal.

BioRoot has become increasingly popular since its introduction on the market and has become one of the materials of choice in cases of open apices and extensive periapical lesions; its effectiveness has allowed its popularity to grow due to its excellent biocompatibility, remarkable sealing properties, hydrophilicity and its ability to promote both healing and tissue mineralization together, these properties make BioRoot a very interesting option when choosing a filling technique. (27)

4. Discussion

It is very important to know the biological, mechanical, physical and chemical characteristics of dental materials in order to use them correctly and obtain benefits in the medium and long term. The treatment of the root canal is performed in order to avoid periradicular injuries and promote a suitable environment so that the body can heal the injury or pathology that exists.

The use of cements to seal the interface between the tooth and gutta-percha is of crucial importance to achieve endodontic success.

BioRoot, being a hydrophilic material, can be set in a humid environment, such as dentin, which; It is composed of almost 20% water and due to its wettability, bioceramics have a decreased viscosity and a higher quality seal compared to all sealants currently marketed. (10)

Bioceramic sealants can be considered as an interesting solution to make sealing steps reliable and easier to achieve, potentially replacing zinc-eugenol oxide-based sealants. The same that provides a hermetic and durable 3D seal along the entire length of the root canal, without the need for any compaction procedure. It is used in combination with a tight gutta-percha point and due to its excellent wettability and viscosity, bioceramic could extend to any irregularity of the root canal and non-instrumented space.

This new class of materials could finally simplify the shuttering stage, making it reproducible in the hands of all professionals with a reduced learning curve. Above all, this technique could provide equivalent, if not better, clinical outcomes; compared to gold standards.

Bioroot cement, being a sealing material, has excellent properties that make it a bioactive, antimicrobial cement and ideal to be applied in a duct. These cements function as resorbable regenerative scaffolds that eventually dissolve as the body rebuilds the tissue.

The quality of adhesion of cement to dentin can be compromised due to the high percentage of irregularities in the cement interface and root canal wall.

The most accepted explanation for this failure is related to the volumetric shrinkage of the sealant cement during setting. (27)

According to the literature investigated in comparison with other sealant cements such as AH Plus cement that is based on epoxy resin, a very important comparison was found in which they highlight that; the two cements have very similar properties, but at the time of microscopic research, results were obtained where the BioRoot has a higher percentage of adhesion at the level of the middle and apical third. Consequently, avoiding future leakage of bacteria to the apex. (5) In 2015 Camps, Jeanneau, Laurent designed a study in which they determined the interrelationship between newly developed Bioroot cement and apical tissue, comparing it with zinc-eugenol oxide. As results it was obtained that; Bioroot has fewer toxic effects on periodontal ligament cells. This bioceramic cement induced a greater secretion of angiogenic and osteogenic growth factors than zinc-eugenol oxide, resulting in that; Bioroot calcium silicate cement has

a higher bioactivity than, the sealant of zinc oxide and eugenol in periodontal ligament cells.

Compared to a cement based on calcium hydroxide such as Sealapex, which has antimicrobial properties due to the release of calcium ions, the same ones that fit perfectly with the periapical tissues, but at the time of filling cause spaces that produce a defective apical seal. (6)

On the other hand, the BioRoot, being a high purity product, has a low contraction which causes a three-dimensional seal in the duct, thus avoiding leaks.

In short, as technology passes, materials and instruments evolve and gradually update, improving and avoiding fewer failures in root canal treatment, allowing dental professionals to perform a safe and effective work for patients(28-31).

5. Conclusions

The BioRoot is a hydraulic sealant that allows a simple and effective filling of the root canal, this material is non-toxic and easy to use. The success of the seal lies in the antimicrobial activity and biological seal, rather than; in the hermetic seal reported by classic sealants. In addition, thanks to its components it produces the regeneration of dentin and its application also helps all periapical tissues to recover from an infection that has arisen in the dental organ, which is very helpful for the professional, thus being able to offer the patient an adequate and safe treatment.

BioRoot is a highly effective cement, proven by different scientific studies that verify that; This material has properties which allows an adequate filling in the endodontic process; Despite being a new cement on the market, it has been able to meet all the needs required in the seal in order to avoid the entry of bacteria and future endodontic failures.

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