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Uses of TheraCal: An Applied Study

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Abstract

EL TheraCal is a new base and lining material filled with light-curing resin-modified calcium silicate, thus achieving control of hardening time, designed as direct and indirect pulp capping, with approximately 45% by weight of mineral material, 10% of radiopaque component, 5% hydrophilic thickening substance and approximately 45% resin.The release of these components, especially that of tricalcium silicate, stimulates the formation of a secondary dentin bridge, hydroxyapatite. Furthermore, when released, they are in the concentration range for the possible stimulating activity of the dental pulp and odontoblasts. They are used in resin, amalgam and cement restorations, as well as being a sensitizer. It addresses certain advantages such as allowing a seal and a strong adherence, apart from the fact that its use considerably reduces pulpal death.Pulp capping attempts to maintain the vitality of the pulp, which can be based mainly on applying medication directly to the exposed pulp, calling this procedure direct pulp capping, or choosing to apply a sealer or choosing to apply used under restorative materials, cements. or other residual base materials being called indirect pulp capping.Comparative studies have been conducted between SCMR and other materials used in pulp capping, where it has been determined that TheraCal has the ability to release more calcium ions. Another characteristic attributed to TheraCal is that it forms an alkaline pH of 10-11, but returns to neutral pH within a short period of 3 days. This type of indirect pulp capping has a specific clinical behavior for the procedure of acute and strong caries wounds, mainly in adolescent patients, with symptoms that correspond to a pulp with a potentially reversible state, without visibly exposing the pulp.

Keywords: *TheraCal, calcium silicate, MTA, pulp protection.*

1. Introduction

TheraCal is a new base material and coating filled with resin modified calcium silicate (SCMR) photopolymerizable thus achieving control of the hardening time, designed as a direct and indirect pulp coating, with approximately 45% by weight of mineral material, 10% radiopaque component, 5% thickening hydrophilic substance and approximately 45% resin (Gandolfi, 2012a). The release of

these components, especially tricalcium silicate, stimulates the formation of a secondary dentin bridge, hydroxyapatite, In addition released are in the concentration range for the possible stimulating activity of dental pulp and odontoblasts (Giani et al., 2017a). They are used in restorations of resins, amalgams and cements, as well as being a desensitizer. It addresses certain advantages such as allowing a seal and strong adhesion, apart from its use considerably reduces pulp death (Hilton, 2009). The pulp coating tries to maintain the vitality of the pulp, it is mainly based on applying medication directly on the exposed pulp calling this procedure direct pulp coating, or choose to apply used under restorative materials, cements or other base materials residual being called indirect pulp coating (Gandolfi et al., 2012b).

Comparative studies have been conducted between SCMR and other materials used in pulp coating (calcium hydroxide and MTA), where it has been determined that the TheraCal It has the ability to release more ions (calcium). Another characteristic attributed to the TheraCal is to form an alkaline pH of 10 to 11, but returns to neutral pH within a short period of 3 days Camilleri, 2014). It is very easy to handle with a good slide of the product since it is presented in a syringe similar to a Flow resin, although it requires some methods so that its properties are not altered. Being a very radiopaque material, layers greater than 1 mm thick should not be loaded, if a layer greater than that thickness is necessary, an incremental loading must be made so that the photopolymerization is carried out correctly (Arandi & Rabi, 2018). TheraCal used in a precise way, can be used in all deep cavitary preparations. It is important to note that the exclusive formulation allows a setting controlled by a visible polymerization unit, being a photopolymerizable material will facilitate the placement due to its thixotropic properties and immediate condensation, said exclusive formulation of the hydrophilic resin will provide stability and durability in the cavity base (Arandi, 2017).

This research project will provide us with enough relevant information about the properties, composition, function and most importantly focusing on the indications for use of TheraCal, so that it can be applied as a pulp protector in a certain dental organ that may present complications in its structure and function. This research is based on a bibliographic review where content from scientific sources will be analyzed and compared, thus allowing us to execute a better assimilation of the mentioned material.

2. Materials And Methods

This article is a scientific literature review, obtaining information from scientific articles, repositories of prestigious universities, final projects of international postgraduate theses and additional information that was verified by organizations that govern a standardization of quality information.

Protocol

The protocol used in the review of this study was designed according to Cochrane standards and for systematic reviews. The search criteria complied with the Preferred Reporting Items for Systematic reviews and Meta-Analysis Protocols (PRISMA) guidelines. A total review of 48 articles was carried out, of which 27 studies were excluded based on the keyword in the title (TheraCal), the information obtained meets the objective in 9 reviews based on the base topic and 5 after reading the articles in full text. Finally, 21 articles were included in the review, these articles were read and thoroughly analyzed their satisfactory results on the study material.

Inclusion and Exclusion Criteria

The inclusion criteria in this review were: studies and clinical cases published in the last 10 years, studies conducted on the use of Theracal in patients for both direct and indirect pulp coatings, comparative studies of pulp coating materials, studies conducted in Mexico were the basis of this bibliographic review, the languages of the articles in Spanish and English , studies that address the use of the Theracoral, its composition, its characteristics. The exclusion criteria were: studies older than 11 years, studies without statistical analysis or relationship with pulp coating materials, studies in a language other than Spanish, English, analytical studies that did not associate pulp coating with

Theracal or any material related to its composition such as calcium hydroxide, results of clinical cases with very limited population.

Search strategy

We searched the following databases based on years from 2012 to the present year: 1) PubMed, 2) Google Schoolar 3) Elsevier through ScienceDirect, 4) Mexican Journals, In addition information from several repositories of Universities such as the Autonomous University of Baja California was included. The search strategy used was: (pulp coating) AND (Theracal use OR composition AND (Latin America or South America). The terms used were: TheraCal, calcium silicate, MTA, direct pulp protection, indirect pulp protection.

Study Eligibility and Data Extraction

The most relevant articles, theses and complete clinical cases of studies were examined to answer the research question. A matrix was generated for data extraction from selected studies.

The matrix had the following fields: authors, year of publication, country, average age, ease of use of the Theracal, preventive measures and treatment protocols.

Analyzed result

Studies investigating the association between TheraCal and materials used in pulp coatings with comparative clinical history and the application of pulp coating materials prior to the use of Theracal

The selected studies must have analyzed the clinical parameters of pulp involvement and the filling material used. It was not predetermined how calcium hydroxide needed to be evaluated in pulp lesions since different materials are currently used in pulp coating treatments, so an analysis was performed between MTA and Theracal.

Pulp coating estimates were classified as follows:

1. Direct
2. Indirect

A review of a clinical case of TheraCal use performed in young patients attending the clinic of the Specialty of Pediatric Dentistry of the Autonomous University of Baja California was carried out where 11 indirect puparal coatings were treated that were based on an age range of the participants between 8 to 12 years, regardless of gender in permanent dental organs.

Development

At present, restorative dentistry establishes the preservation of the pulp health of the teeth that make up the stomatognathic apparatus, with the wide variety of materials, there is no master protocol of pulp protection to which dentists should rely. A direct pulp coating is where the vital pulp is exposed and proceeds to treat with a therapeutic material, then applying a base and restoration to thus guide a healing, achieving the main objective of maintaining the vitality of the pulp, protecting it from thermal, chemical and harmful stimuli (Tyas, 1998; Poggio et al., 2015).

A recognized material within pulp coatings is calcium hydroxide in permanent teeth, the effect of this pulp coater is the result of a chemical bond induced by hydroxide ions released during the hydration response in the surrounding environment, stimulating pulp defense and repair, in order to generate a repairing dentin bridge (Yamamoto et al., 2017).

Studies have revealed that there is 89% from 192 dentin bridges structured with calcium hydroxide cement in monkeys, which may not provide a permanent barrier and a long-term biological seal against bacterial infections, because tunnel defects were identified in its structure (Giani et al., 2017b) Additionally, the high solubility represents the main disadvantage in calcium hydroxide, which leads to the disappearance of the material, thus forming inconsistencies in the repair dentin below the coating material, which provides a seal against bacterial invasion permanently.

This solubility characteristic of TheraCal helps promote better biosealing by chemically binding to dentin, this strong binding to dentin allows the release of calcium and hydroxyl ions to form calcium apatite. Several studies have shown that this material has lower solubility and better sealability than Biodentine, ProRoot MTA, Angelus MTA and hard calcium hydroxide (paste-paste). Another characteristic of Theracal is its alkaline pH of 10.6, which remains stable after 3 hours of use and 24 hours without statistically significant changes in either case. The high alkalinity of the medium gives the material good antibacterial properties; They also have excellent biological properties, which is due to the formation or precipitation of calcium and phosphate at the dentin-material interface, which leads to their sealing.

Direct pulp protection is based on placing a medication directly on the pulp exposure or a liner in order to preserve the vitality of the pulp. It is the method in which the dental pulp is exposed by accident, during the cavity preparation or by some type of fracture, is coated with a material defending additional injuries and at the same time, stimulates the formation of a barrier or bridge of repairing dentin. The TheraCal can be placed directly on pulp exposures once hemostasis has been achieved where it includes certain exposures (Table 1.1)

Table 1.1 (Baños.K.A, Patiño.K.J)

Direct pulp coating
Exhibitions
Mechanical exhibitions
Exposures due to trauma

This type of indirect pulp coating has a specific clinical behavior for the procedure of acute and strong caries wounds, mainly in adolescent patients, with symptoms that correspond to a pulp with a potentially reversible state, without visibly exposing the pulp. The pulp is in a potentially reversible state once there is no record of spontaneous pain and once it responds to tactile and thermal stimuli, especially cold. (16) TheraCal is indicated as a coating agent in this type of coating in deep preparations, as a protective lining in extensive preparations, and as a base or sealant for use (Table 1.2).

Table 1.2 (Baños.K.A, Patiño.K.J)

Indirect pulp coating
Below amalgam restorations
Below restorations of class I and class II compounds
Under base materials
Under cements
As an alternative to calcium hydroxide
As an alternative to glass ionomer/RMGI
As an alternative to cavity sealant varnish
As an alternative to zinc phosphate
As an alternative to MRI/ZOE (intermediate restorative material)

In these types of pulp coatings, application techniques will be used as follows

Indirect pulp coating technique

Isolate the tooth and perform a conventional preparation of the cavity. Remove all infected decayed tooth structure and proceed to apply the TheraCal directly to the bottom of the cavity in incremental layers. The depth of each layer should not be more than 1 mm. Manipulate the product to form a smooth surface covering all deep dentinal areas and photopolymerize between layers. Photopolymerize each incremental layer for 20 seconds**.** Place the desired adhesive, base or restoration following the manufacturer's instructions. Continue with tooth restoration.

Technique in direct pulp coating

Finish cavity preparation in a field using rubber dam insulation. achieving hemostasis by placing a piece of cotton moistened with sterile physiological solution. Gently dry the preparation with cotton swabs. Apply TheraCal directly to exposed pulp in incremental layers. The depth of each layer should not be more than 1 mm. Cover all exposed areas and spread TheraCal at least 1 mm over the healthy dentin surrounding the exposure area. Photopolymerize between layers, each incremental layer for 20 seconds. Place the desired adhesive, base or restoration according to the manufacturer's instructions. Continue with the restoration of the tooth.

3. Results and Discussion

TheraCal should be studied in greater depth both in vitro and in vivo studies prior to its clinical application as a direct pulp coating material, since it should be better evaluated whether the release of calcium ions in union with the cytotoxic effect they present with the non-polymerizable resin monomers of which TheraCal is composed, They directly influence clinical and biological performance. On the other hand, the use of the TheraCal In indirect pulp coating treatments yielded extremely favorable results with percentages of 90.09% effectiveness in both clinical and radiographic evaluations, thus recommending that its use is excellent in indirect treatments in young permanent teeth. In a case reviewed with TheraCal Sample as results 9% had sensitivity to heat, no sensitivity to cold and no pain. 81% had no sensitivity to cold or heat, nor pain.

The direct pulp coating is considered a conservative treatment to maintain the vitality of the pulp when it has been exposed, therefore this procedure is considered a controversial procedure, since, the research regarding the use of this technique is scarce and was developed on the basis of empirical knowledge and as a result there is distrust on the part of professionals towards these conservative procedures, Despite the advances in the practice of direct coating, at this time, there has not yet been evidence of an ideal protocol for restorative dentists to follow to preserve pulp vitality.

To establish the success or failure of the direct pulp coating the tooth must be monitored with a follow-up of 21 months with the possibility of performing the definitive restoration, it must always be taken into account that the pulp should not present an irreversible injury, since it will not respond to the stimuli for the formation of tertiary dentin nor will it have the capacity to regenerate. Therefore, the probability of success will also depend on finding a hemostatic, antibacterial and inducer of dentinogenesis material, accompanied by an aseptic, hemostatic and minimally invasive technique. TheraCal, (calcium silicate modified with resin), is a direct and indirect pulp protector, this material serves as a barrier and protector of the dentin-pulp complex. which is characterized by being photocurable, which saves time, in turn has a great capacity to form the dental bridge. The precise placement of TheraCal allows it to be used in all deep cavity preparations. The success of good pulp coating does not depend solely on the material, there are more factors to consider. However, it has been shown that certain materials favor greater success in this process. The goal of any pulp protection procedure should be to control bacteria, stimulate cells to form new dentin, and provide a biocompatible, long-lasting seal.

4. Conclusion

Pulp protectors based on calcium silicate have shown superiority compared to calcium hydroxide, they have a greater capacity to release calcium ions and hydroxyls, which allows an optimal formation of the dentin bridge. Among the materials based on calcium silicate, the TheraCal this material is easy to apply because it comes in a direct dispenser and does not have to perform some type of previous mixing or the need for a mixing device such as the amalgamator. TheraCal, trade name of calcium silicate modified with resin, is a direct and indirect pulp protector that is characterized by being

photocurable, which saves time. To be successful, a hermetic and permanent seal must be achieved, to prevent the entry of microorganisms and reinfection since the diffusion of toxins through the walls of the restoration to the pulp causes pulp damage and not the material it self.

Conflict of interest:
The authors declare no conflict of interest.

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