Reporte de Casos
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Vital pulp therapy in young permanent teeth with the bioactive material Biodentine®. Case series.

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Abstract: Vital pulp therapy stands out among minimally invasive endodontics as an alternative treatment for young permanent teeth with reversible and irreversible pulpitis affected by caries lesions, trauma or restorative treatments, eliminating the affected portion of pulp tissue and promoting its repair. The development of bioactive materials has allowed a range of therapeutic options focused on maintaining the largest amount of vital pulp tissue by stimulating the formation of tertiary dentin, which contributes to the complete root development of these teeth, avoiding complex, expensive procedures that can generate negative experiences in pediatric patients. The objective of this study was to radiographically evaluate the root formation of young permanent teeth with irreversible pulpitis due to dental caries treated with vital pulp therapy with Biodentine®. Three cases of first permanent molars with incomplete root formation and irreversible pulpitis were presented, which were treated through vital pulp therapy with a 4-year follow-up. Complete root formation, absence of symptoms and adequate maxillofacial development were evident. It is concluded that vital pulp therapy is the treatment of choice in teeth with irreversible pulpitis and can be performed by a pediatric dentist, ensuring preservation of the pulp organ and its complete root development.

Key words: Biodentine, Vital pulp therapy, Young permanent tooth.

Terapia pulpar vital en dientes permanentes jóvenes con material bioactivo Biodentine®. Serie de casos.

Resumen: La terapia pulpar vital destaca entre la endodoncia mínimamente invasiva como alternativa de tratamiento para dientes permanentes jóvenes con pulpitis reversibles e irreversibles afectados por lesiones de caries, traumas o tratamientos restauradores, eliminando la porción de tejido pulpar afectado y favoreciendo su reparación. El desarrollo de materiales bioactivos ha permitido un abanico de opciones terapéuticas enfocadas en mantener la mayor cantidad de tejido pulpar vital estimulando la formación de dentina terciaria, lo cual contribuye con el completo desarrollo radicular de estos dientes evitando procedimientos complejos, costosos y que puedan generar experiencias negativas en pacientes pediátricos. El objetivo de este estudio fue, evaluar radiográficamente la formación radicular de dientes permanentes jóvenes con pulpitis irreversible por caries dental tratados con terapia pulpar vital con Biodentine ®. Se presentaron tres casos de primeros molares permanentes con incompleta formación radicular y pulpitis irreversible los cuales, fueron tratados a través de terapia pulpar vital con seguimiento de 4 años. Se evidenció la completa formación radicular, la ausencia de sintomatología y el adecuado desarrollo maxilofacial. Se concluye que la terapia vital pulpar es el tratamiento de elección en dientes con pulpitis irreversible pudiendo ser realizada por el especialista en Odontopediatría y garantizando la preservación del órgano pulpar y su completo desarrollo radicular.

Palabras clave: Biodentine, Terapia pulpar vital, Diente permanente joven.

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Terapia de polpa vital em dentes permanentes jovens com material bioativo Biodentine®. Série de casos.

Resumo: A terapia pulpar vital destaca-se dentre a endodontia minimamente invasiva como alternativa de tratamento para dentes permanentes jovens com pulpite reversível e irreversível acometidos por lesões de cárie, traumas ou tratamentos restauradores, eliminando a porção de tecido pulpar afetado e promovendo sua reparação. O desenvolvimento de materiais bioativos tem permitido uma gama de opções terapêuticas focadas na manutenção da maior quantidade de tecido pulpar vital, estimulando a formação de dentina terciária, o que contribui para o completo desenvolvimento radicular desses dentes, evitando procedimentos complexos e caros que podem gerar experiências. negativo em pacientes pediátricos. O objetivo deste estudo foi avaliar radiograficamente a formação radicular de dentes permanentes jovens com pulpite irreversível por cárie dentária tratados com terapia pulpar vital com Biodentine®. Foram apresentados três casos de primeiros molares permanentes com formação radicular incompleta e pulpite irreversível, os quais foram tratados através de terapia pulpar vital com acompanhamento de 4 anos. Evidenciaram-se formação radicular completa, ausência de sintomas e desenvolvimento maxilofacial adequado. Conclui-se que a terapia pulpar vital é o tratamento de escolha em dentes com pulpite irreversível, podendo ser realizada pelo especialista em Odontopediatria e garantindo a preservação do órgão pulpar e seu completo desenvolvimento radicular.

Palavras-chave: Biodentine, Terapia de polpa vital, Dente permanente jovem.

Introduction

A young permanent tooth is defined as a recently erupted tooth with incomplete root formation[1], which will achieve apical closure in approximately three years. If pulp vitality is lost during this stage, it will result in the cessation of dentin formation at the root level and, consequently, interruption of the root development process[2]. Therefore, the preservation of the maximum amount of non-inflamed pulp tissue is required to ensure apexogenesis and root dentin formation. Furthermore, the pulp tissue of immature teeth has regenerative potential due to open apices, abundant blood supply, and potentially viable apical tissues[1].

In children with immature permanent teeth, dental caries and traumatic injuries are the most common problems, leading to pulp necrosis[1]. The loss of a young permanent tooth in pediatric patients with mixed dentition may result in consequences such as malocclusion, loss of function, and inadequate maxillofacial development[3].

The presence of preoperative spontaneous or severe pain is not always indicative of an inability of the pulp to repair itself, and deep carious lesions are not always associated with irreversible patterns of pulp damage[4]. Histological studies demonstrate that the exposed vital pulp is not always completely infected, since inflammation is usually localized to the area adjacent to the carious lesion[2,5].

Preserving pulp vitality is a key factor for the long-term survival of the tooth[6,7]. Vital pulp therapy (VPT) is designed to preserve and maintain the vitality of pulp tissue in a tooth compromised by carious lesions, trauma, or restorative treatments. Its objective is to stimulate the formation of tertiary dentin to maintain the tooth as a functional unit[6]. VPT is considered a promising individualized treatment

for irreversible pulpitis by removing a certain amount of pulp tissue according to the pulp condition, in line with the trend of minimally invasive endodontics[5]. Procedures include direct and indirect pulp capping as well as more invasive ones such as partial or full pulpotomy[6]. Currently, partial pulpotomy is one of the VPT treatments that allows root development in young permanent teeth with open apices, thus avoiding conventional root canal treatments or extraction[8].

According to the American Association of Endodontists Glossary of Terms[9,4], a complete pulpotomy involves the removal of the coronal portion of the vital pulp in order to preserve the vitality of the remaining radicular pulp. It may be performed as an emergency procedure for temporary symptom relief or as a therapeutic measure, such as in Cvek pulpotomy.

In the past, calcium hydroxide was the standard material for direct pulp capping due to its ability to stimulate tertiary dentin formation. However, significant disadvantages have been reported, including long-term dissolution, formation of tunnel defects beneath the dentin bridge, and poor sealing ability. Recently, calcium silicate-based cements, including mineral trioxide aggregate (MTA) and Biodentine®, have been proposed as alternative materials for direct pulp capping and pulpotomy[6].

A bioactive material is defined as one designed to induce specific biological activities. Based on this definition, biologically active materials include those that promote tissue regeneration by stimulating migration, proliferation, and osteogenic differentiation of cells[6].

Biodentine® is a calcium silicate-based material introduced in 2009. Developed by Septodont's research group, it was designed as a new type of dental material to replace dentin, with high mechanical properties, excellent biocompatibility, and bioactive behavior[10].

It gained recognition in endodontics due to its excellent sealing ability, handling properties, biocompatibility, stability, long-term impermeability, low solubility, fast setting time, and its ability to induce hard tissue regeneration. In addition, Biodentine has been shown to have superior antimicrobial properties due to its high pH. It also eliminates the need for a separate restorative material to fill the pulp chamber[11,12].

Biodentine® is presented in two components: powder and liquid. The powder includes tricalcium silicate ($3CaOSiO_2$) as the main component, dicalcium silicate ($2CaOSiO_2$), calcium carbonate ($CaCO_3$) as filler, iron oxide as a coloring agent, and zirconium dioxide (ZrO_2) as a radiopacifier. The liquid consists of calcium chloride ($CaCl_2.2H_2O$) as a setting accelerator and a water-soluble polymer as a water-reducing agent[10].

Biodentine® promotes cell migration and activates growth factors such as TGF-B1, responsible for early cytodifferentiation, which stimulates the formation of

new odontoblast-like cells from pulp stem cells, promoting tertiary dentin formation[10]. The growth of an apatite layer on calcium silicate cements provides an ideal environment for stem cell and osteoblast differentiation and colonization, supporting new hard tissue formation. Apatite, along with epigenetic signals associated with ion release, may explain Biodentine's bioactivity. It has been shown to promote reparative dentinogenesis after pulp exposure by regulating and modulating bioactive molecules released from the dentin matrix, including TGF-B1 and other growth factors[6].

The release of TGF-B1 induces tertiary dentin formation by attracting dental pulp stem cells to the site of Biodentine application (injury), where they differentiate into odontoblast-like cells that secrete tertiary dentin beneath the material[6].

The choice of pulp irrigant in VPT requires antimicrobial effect as well as biocompatibility in order to preserve tissue vitality and stimulate pulp repair, which is the main goal of VPT. The most commonly used irrigants in endodontics are sodium hypochlorite (NaOCl), chlorhexidine (CHX), saline solution, and ethylenediaminetetraacetic acid (EDTA)[13].

VPT should be considered a first-line treatment in patients with signs and symptoms of reversible or irreversible pulpitis. It can be performed by a pediatric dentist and offers pediatric patients the possibility of effective treatment that ensures full root development of the affected tooth, preserving it within the oral cavity and favoring growth and development.

The aim of this study is to radiographically evaluate the progression of root formation in young permanent teeth diagnosed with irreversible pulpitis due to dental caries lesions treated with vital pulp therapy using Biodentine® in pediatric patients.

Materials and Methods

The cases of pediatric patients presented below attended a private dental clinic in the commune of Maipú, Santiago de Chile, during 2020–2021. The parents of all patients signed informed consent forms, which are stored in the clinic's archives, authorizing clinical procedures and their eventual publication. Clinical records were managed using Dentalink software®, and retroalveolar radiographs were obtained with a Dürr Dental® phosphor plate scanner. The material of choice for this study was Biodentine®, which was mixed according to the manufacturer's instructions.

Clinical cases reports

Clinical Case 1

In December 2020, a 6-year-old female patient, apparently healthy, Frankl 4, presented with spontaneous, sharp pain localized in the lower left posterior region with a 5-day evolution. The caregiver reported no administration of analgesics. Extraoral examination showed no swelling; intraoral examination revealed an active

ICDAS 6 carious lesion on the occlusal surface of tooth 36, with normal surrounding tissues. An additional ICDAS 6 lesion was observed on tooth 54. The patient was in the first phase of mixed dentition and had a history of early childhood caries.

Radiographically, tooth 36 showed a radiolucent lesion with diffuse borders, extending from the distal to the middle third mesiodistally and involving all three thirds of the crown occlusocervically, in relation to the distal pulp horn. Root formation was incomplete, corresponding to Nolla's stage 8 (Figure 1).

Based on the clinical and radiographic findings, a diagnosis of irreversible pulpitis of tooth 36 was established. Vital pulp therapy was selected to promote complete root development and adequate growth of the patient.

Local anesthesia (2% lidocaine) was administered via direct inferior alveolar nerve block on the left side. Rubber dam isolation was achieved. Caries was removed with a sterile round diamond bur at high speed. The pulp chamber roof, mesial and distal pulp horns, and approximately 2 mm of coronal pulp tissue were removed (partial pulpotomy) until healthy pulp tissue was observed. The pulp was irrigated with saline and dried with sterile cotton pellets. Hemostasis was achieved, and the chamber was filled with Biodentine® according to manufacturer's instructions. The cavity was temporarily restored with glass ionomer cement (type IX, GC America®). An immediate postoperative radiograph was taken (Figure 2). It was decided to wait at least 3 months to evaluate the evolution of the procedure and then proceed with the final restoration.

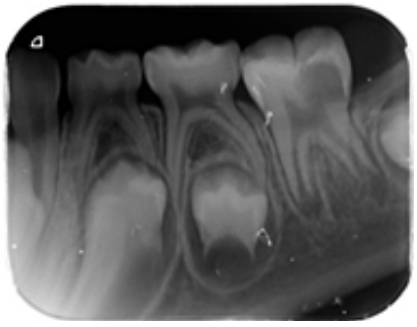

Figure 1. *Initial periapical radiograph of 3.6*

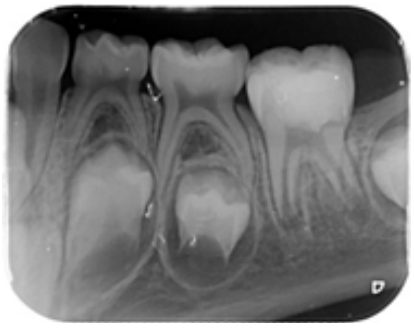

Figure 2. *Immediate postoperative periapical radiograph of 3.6.*

The patient continued attending regular consultations to treat other carious lesions and for preventive treatments. After 3 months (March 2021) of the partial pulpotomy on tooth 3.6, in the absence of signs and symptoms, it was decided to place a direct class I resin restoration with Z350 resin (3M), following local anesthesia of the respective area and absolute isolation. A periapical control radiograph of tooth 3.6 was taken (Figure 3).

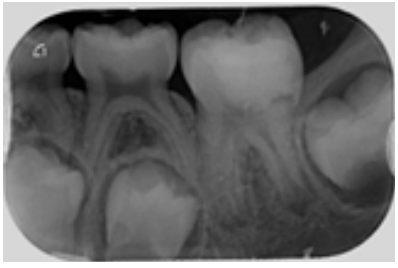

Figure 3. *Periapical radiograph control of definitive restoration of 3.6.*

The patient was discharged once comprehensive treatment was completed and continued with preventive follow-ups. A radiographic control was performed at 8 months (June 2021) (Figure 4) and at 12 months (December 2021) (Figure 5), showing progressive root formation. The patient was lost to follow-up but returned for a preventive check-up, when a current radiograph was taken (January 2024), showing 37 months of evolution with Nolla's stage 9 (Figure 6).

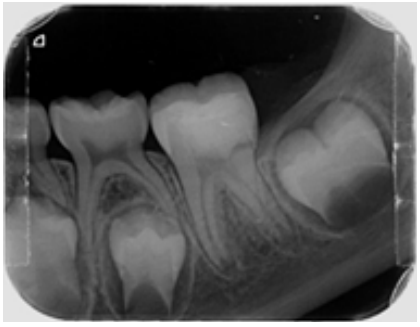

Figure 4. *Periapical radiograph of tooth 3.6 with 8 months of evolution*

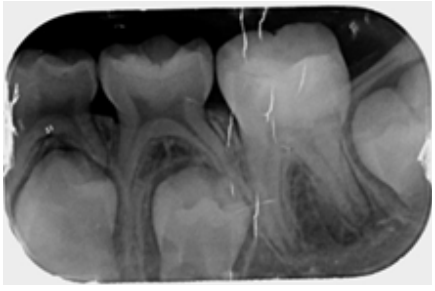

Figure 5. *Periapical radiograph of tooth 3.6 with 12 months of evolution.*

Figure 6. *Periapical radiograph of tooth 3.6 with 37 months of evolution.*

Clinical Case 2

In June 2021, an 8-year-old female patient with controlled bronchial asthma, Frankl 4, attended the consultation due to a molar with discoloration in the lower left posterior area. The patient was asymptomatic. On clinical examination, active ICDAS 6 carious lesions were observed on teeth 3.6 and 4.6. Tooth 7.4 was close to exfoliation. The patient was in the second phase of mixed dentition and had caries of the second childhood.

On radiographic examination, a carious lesion was observed on tooth 3.6, involving the mesial, middle, and distal thirds mesiodistally, extending through all three thirds of the dental crown occluso-cervically and in relation to the mesial horn of the pulp organ. At the root level, incomplete root formation was observed in Nolla's stage 9 (Figure 7). Tooth 4.6 presented similar radiographic characteristics (Figure 8).

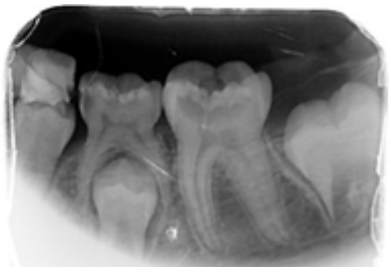

Figure 7. *Initial periapical radiograph of tooth 3.6.*

Figure 8. *Initial periapical radiograph of tooth 4.6.*

Due to the extent of the carious lesion and the amount of tooth structure compromised, it was decided to treat tooth 3.6 in order to contribute to root development, prevent acute pain, and promote the growth and development of the patient by maintaining the molar in the mouth. A diagnosis of asymptomatic irreversible pulpitis of tooth 3.6 was established. The caregiver was informed and consented to the treatment.

Local anesthesia was administered by inferior alveolar nerve block using the direct technique on the left hemiarch with 2% lidocaine, and absolute isolation of the operative field was achieved. Caries removal was performed with a sterile round diamond bur at high speed. Subsequently, the chamber roof and approximately 2 mm of coronal pulp were removed; however, profuse bleeding was observed, so pulp tissue was removed in small layers of approximately 2 mm. Inflammation of the pulp extended throughout the entire coronal portion, so a total pulpotomy was performed, observing healthy radicular pulp tissue, which was irrigated with saline solution and dried with sterile cotton pellets. Hemostasis was achieved, and the pulp chamber was filled with Biodentine® according to the manufacturer's instructions. The cavity was provisionally restored with glass ionomer type IX (GC America®). An immediate postoperative radiograph was taken (Figure 9).

The patient did not return for further appointments, despite several attempts to contact her, until September 2023, when she was seen by another professional at the clinic due to spontaneous nocturnal pain localized in the lower right posterior area, associated with tooth 4.6. In addition, fracture of the restorative material of tooth

Figure 9. *Immediate postoperative periapical radiograph of tooth 3.6.*

3.6 was noted. Due to the symptoms associated with tooth 4.6, the patient was referred to Endodontics, where multiradicular treatment was performed, followed by definitive restoration. The patient did not return for continuation of treatment on tooth 3.6.

In May 2024, the patient returned to the clinic, seen by another colleague, due to complete loss of the restorative materials from tooth 3.6 (Figure 10). She was referred to Endodontics for the second time. However, in the periapical radiograph (Figure 10), complete root formation of tooth 3.6 was observed, reaching Nolla's stage 10.

Figure 10. *Current periapical radiograph of tooth 3.6.*

Clinical Case 3

In October 2020, an 8-year-old female patient, apparently healthy, Frankl 1, attended, referred from Endodontics, due to pulp exposure in tooth 3.6 with incomplete root formation, Nolla's stage 9 (Figure 11). She had previously attended the emergency service of the public health system due to spontaneous pain associated with tooth 3.6, where urgent treatment was performed, but it is unknown whether absolute isolation was used or if direct medication was applied to the pulp organ. The patient was in the first phase of mixed dentition.

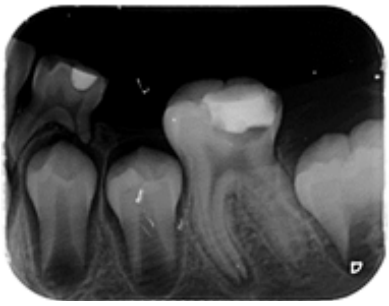

Figure 11. *Initial periapical radiograph of tooth 3.6.*

Local anesthesia was administered by inferior alveolar nerve block using the direct technique on the left hemiarch with 2% lidocaine, and absolute isolation of the operative field was achieved. Removal of the provisional restorative material was carried out with a sterile round diamond bur. Subsequently, with a sterile spoon excavator, a small cotton pellet was removed; the pulp organ was observed with vitality and without profuse bleeding. It was irrigated with saline solution, dried with a sterile cotton pellet, and a direct pulp capping was performed with Biodentine® according to the manufacturer's instructions. Given the patient's difficult behavior management, the cavity was also restored with Biodentine®, and an immediate postoperative radiograph was taken (Figure 12).

In March 2021, the patient attended a follow-up appointment, where the integrity of the restoration and absence of symptoms were observed. A control radiograph was taken (Figure 13), showing continued root formation, for which an occluso-distal class II restoration was placed with 3M Z350® resin (Figure 14).

In June 2024, the patient attended a consultation due to lack of space for the eruption of tooth 1.3. Preventive

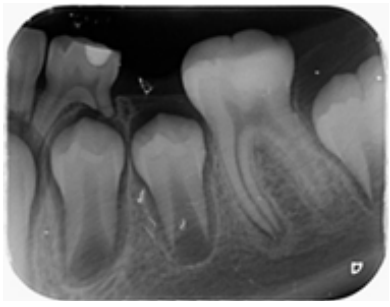

Figure 12. *Immediate postoperative periapical radiograph of tooth 3.6.*

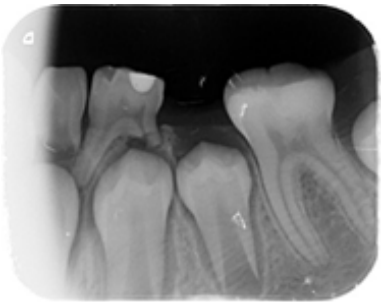

Figure 13. *Periapical radiograph of tooth 3.6 with 5 months of evolution.*

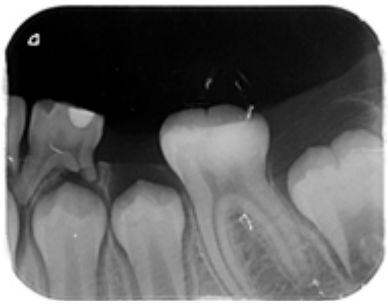

Figure 14. *Periapical radiograph, control of definitive restoration of tooth 3.6.*

control was performed including scaling, prophylaxis, fluoride varnish, and clinical and radiographic check-up of tooth 3.6. Clinically, the molar had a restoration in optimal condition, with normal surrounding tissues and no symptoms. Radiographically, the molar showed complete root formation, Nolla's stage 10, without periapical lesions (Figure 15).

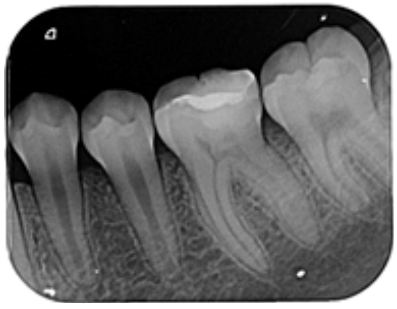

Figure 15. *Current periapical radiograph of tooth 3.6.*

Discussion

Dental caries is a very common disease both in children and adults, and pulp exposure due to dental caries is also frequently observed in clinical practice. In the past, given the limitations of available materials, teeth with irreversible pulpitis caused by caries were commonly considered a condition that could not be reversed by any treatment, regardless of the presence or absence of symptoms of inflammation. Currently, with the development of new materials, vital pulp therapy is increasingly being applied as an individualized treatment to preserve the pulp and obtain a better prognosis, even when the tooth is diagnosed with irreversible pulpitis[5].

The key to the success of partial pulpotomies lies in the following factors: accurate pulp diagnosis, correct absolute isolation of the tooth to be treated, adequate removal of infected pulp tissue, reasonable choice of materials, and an optimal definitive restoration. Hemorrhage control is also crucial in the success of partial pulpotomy; pulp hemostasis should be achieved within the first 2–4 minutes if adequate removal of the infected pulp tissue has been performed[8]. In the three cases presented in this study, biosafety protocols were followed (absolute isolation of the operative field and sterilization of instruments used) to ensure treatment success. The removal of infected pulp tissue directly depends on its degree of inflammation, its clinical appearance (color, surface, and texture), and hemorrhage control is fundamental in the clinical decision of whether or not to continue with the removal of pulp tissue. The three cases were managed in the most conservative way possible, with only one case (Case 2) requiring total pulpotomy, perhaps due to the extent of the carious lesion, which resulted in a greater degree of pulp inflammation.

The affected surface of the tooth may influence the success rate of the treatment. Higher treatment failure has been found

in teeth with proximal surfaces affected compared to occlusal surfaces. Occlusal surfaces have a favorable prognosis because the permeable cervical third is preserved, making isolation easier[8]. It is well known that pediatric patients who present in emergency situations require greater behavioral management compared to patients who attend preventive consultations, or when the characteristics of the disease allow proper adaptation to the dental visit. The characteristics of the carious lesion and the patient's behavior can directly influence both the treatment choice and its success. In Cases 1 and 2 presented in this study, the patients were Frankl 4, with occlusal carious lesions, which facilitated clinical procedures. However, Case 2 did not obtain a favorable result in the sense that the patient required conventional multiradicular endodontic treatment, not because of failure in vital pulp therapy itself, but due to lack of follow-up appointments and failure to attend control visits. Conversely, in Case 3, with a disto-occlusal carious lesion and a Frankl 1 patient, proper isolation of the operative field was achieved, showing favorable evolution.

In the systematic review and meta-analysis published by Camoni et al.[8], they concluded that vital pulp therapy has a high rate of clinical and radiographic success, over 85% in a 12-month follow-up. This coincides with the findings of this study, in which all molars completed their root development, achieving apical closure after more than 12 months of evolution.

Permanent teeth treated with signs and symptoms indicative of irreversible pulpitis in patients aged 6 to 18 years were successfully treated with partial pulpotomies using MTA or Biodentine®[12]. In the study by Uesrichai et al.[12], a clinical success rate of 87% and a radiographic success rate of 97% were reported for the 30 teeth treated with Biodentine®, compared with 97% and 95% clinical and radiographic success, respectively, for the 37 teeth treated with MTA, thus not considering Biodentine® an inferior material to MTA when used as a pulp capping material in partial pulpotomies of teeth with signs and symptoms indicative of irreversible pulpitis in patients aged 6 to 18 years. These results can be compared with the findings of this study, in which radiographic success was evaluated through complete root formation of the treated molars and the absence of radiographic signs of infection.

Regarding definitive restorations, in this study they were performed three months after vital pulp therapy in all three cases, with the objective of evaluating the immediate pulp tissue response to the vital pulp therapy applied in each case. This differs from the studies presented by Uesrichai et al.[12] and Taha et al.[4], in which definitive restorations were performed in the same session. However, this did not result in negative consequences for the therapies applied to the molars in this study, but it does represent a risk that the patient, not presenting signs or symptoms of pulp inflammation, may not return to the clinic. Therefore, performing definitive restorations in the same session is recommended.

Similarly, Uesrichai et al.[12] and Taha et al.[4] used, within their treatment protocols, irrigation with sodium hypochlorite at a concentration of 2.5%. In addition, they controlled hemorrhage with cotton pellets soaked in NaOCl for 6 to 10 minutes. This

differs from the protocol applied in this study, where irrigation was performed with saline solution and hemorrhage control was achieved through the removal of affected pulp tissue and drying with sterile cotton pellets, without applying pressure to the remaining pulp tissue, thereby preserving the integrity of the remaining pulp tissue.

It is true that each irrigant presents qualities, advantages, and disadvantages that must be considered when choosing them for vital pulp therapy. An antibacterial effect can be obtained using sodium hypochlorite or chlorhexidine; however, both have the disadvantage of cytotoxic effects and a high degree of discoloration of the tooth structure after treatment. On the other hand, more biocompatible irrigants, which cause less discoloration in teeth such as saline solution or EDTA, have a very low or null antibacterial effect. Although saline solution does not have bioactive properties, it does not present adverse effects on the remaining tooth structure. Conversely, EDTA offers bioactive properties but may negatively affect the remaining tooth structure. Currently, there is no ideal irrigant, and therefore specialists may balance the benefits and risks of each by using more than one irrigant as a solution to their disadvantages and to meet the objectives of vital pulp therapy. More studies are needed to determine which irrigant is ideal, its concentration, and its method of use[13].

On the other hand, patient age is often a controversial factor in vital pulp therapy. It has been suggested that the more fibrous and less resistant characteristics of dental pulp in older patients may reduce its ability to overcome injury. The abundant blood supply and defense mechanisms of the pulp in young, immature permanent teeth may provide greater resistance against bacterial infection and contribute to high success rates[4]. This may be related to the cases presented here, given the young age of the patients (6 and 8 years, respectively), with incompletely formed roots that responded favorably to vital pulp therapy and continued their process of growth and development, ensuring longevity of the tooth in the oral cavity.

Conclusion

Pediatric patients with pain symptoms in young permanent teeth have constituted a challenge in treatment for both Pediatric Dentists and Endodontists. The difficulty of behavioral management in endodontic treatments, which involve anesthesia, long duration, and multiple instruments inside the mouth, generate anxiety and rejection of the procedure both in the pediatric patient and in the treating specialist. This often led to multiple referrals and fatigue for the family, resulting in extractions of permanent teeth at early ages and negative experiences in dental visits.

Currently, vital pulp therapy constitutes an alternative treatment for pediatric patients diagnosed with irreversible pulpitis in young permanent teeth. Being a simple procedure, it can be performed by Pediatric Dentists, providing an immediate solution to dental emergencies and promoting root development, thereby increasing the longevity of the affected tooth and contributing to the growth and development of the patient's maxillofacial complex.

Bioactive materials, especially Biodentine®, constitute an important tool in the management of deep carious lesions with or without pulp tissue involvement. For vital pulp therapy, the multiple advantages of Biodentine® make it the material of choice since its mixing does not depend on a dental assistant, its consistency and handling are easy, allowing greater adherence to cavity walls ensuring proper sealing, its working time is short, and its bioactive and biomechanical properties are high. This makes it the material of choice in permanent teeth with open apices to promote pulp tissue repair and continue root development.

Vital pulp therapy constitutes the first-choice treatment in young permanent teeth diagnosed with irreversible pulpitis. It guarantees the immediate care of the pediatric patient by the Pediatric Dentist, the preservation of pulp vitality of the remaining pulp tissue, the repair capacity of the pulp organ, and the continuity of root development until apical closure.

Conflicts of interest:

The authors declare no Conflicts of Interests.

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