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Pulpotomy: New Treatment Modalities: Review

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Abstract

Pulpotomy is a typical treatment for asymptomatic reversible pulpitis in primary molars. This article includes several pulpotomy materials that have been mentioned in the literature and have been used thus far for pulpotomy. This study of the literature covers all medications, including natural alternatives. In this study, a number of important medications and their success rates have been mentioned. Finding an innovative, potent, and preferably natural pulpotomy medication is required to improve the therapeutic outcome of the treatment.

Keywords: Medicament, primary teeth, pulpotomy

Introduction

Dental caries, a progressive bacterial injury to teeth that results in mineral loss, begins on the tooth's outer surface and can eventually spread through the dentin to the pulp, compromising the tooth's vitality. [1] Vital pulp treatment has increasingly been viewed as a minimally intrusive alternative to the standard root canal procedure for the management of teeth with stimulated pulps. [2] Pulpotomy is one of the essential pulp treatment procedures used to keep primary teeth from being extracted that are very carious but do not show signs of radicular pathology.Any pulpotomy material should have the following desirable properties: be bactericidal, safe for the pulp and surrounding structures, promote healing of the remaining radicular pulp without interfering with physiologic root resorption, and be toxic-free. [3] Of all the medications mentioned in the literature for pulpotomies, formocresol (FC) continues to be the gold standard. Despite the high success rate, there are a number of issues with FC usage, including its potential for mutagenic, carcinogenic, and allergic effects. [4] Identifying the materials utilised in pulpotomy is the goal of this literature review.

Formocresol

Sweet developed the FC pulpotomy procedure in 1930. FC has steadily gained popularity as a pulpotomy drug for baby teeth. It has a devitalizing and antibacterial effect. [1] At a 12-month follow-up, El Meligy et al. discovered that FC pulpotomy had a 100% clinical and 98.1% radiographic success rate. [5] FC's toxicity and probable carcinogenicity in humans have been questioned. Studies have shown that teeth that have had FC treatment exhibit systemic FC uptake and result in abnormalities in erupting teeth. [6]

Calcium Hydroxide

Herman first proposed calcium hydroxide as Calxyl in 1930. This substance was sought after for pulpotomy as well as pulp capping. Internal resorption in deciduous teeth is frequently brought on by calcium hydroxide pulpotomy [7]. [8] Compared to permanent teeth, the success rate of calcium hydroxide pulpotomy in primary teeth is lower. [9] However, for direct pulp capping (DPC) and pulpotomy methods in permanent teeth, calcium hydroxide is the preferred material (Mc Donald 1996).

Glutaraldehyde

In 1975, S'Gravenmade employed glutaraldehyde and suggested that it might take the place of FC. Comparing ferric sulphate and mineral trioxide aggregate to two percent buffered glutaraldehyde and ferric sulphate, researchers concluded that the latter two were least effective pulpotomy agents (MTA). [10],[11] As a result of insufficient attachment, a weak barrier to subbase irritation has been discovered, leading to internal resorption. [12]

Zinc oxide-eugenol

The first substance in the sector to be utilised for preservation was zinc oxide eugenol (ZOE). ZOE offers a strong seal that reduces microleakage and recurrent infections. When ZOE was used as a pulpotomy medication in 1965, James E. Berger noticed active inflammatory reactions in every tooth treated with it. Simple chronic to severe suppurative pulpitis were just a few of the reactions. The clinical success rate for FC pulpotomy using FC in the zinc oxide-eugenol subbase was 99%. [13]

Mineral trioxide aggregate

MTA, a brand-new endodontic cement, was initially introduced by Mohmond Torabinajad at the Almalinda University in 1993 as a substance for the repair of root perforations. For pulpotomies of primary teeth with normal pulps or reversible pulpitis, when caries ejection results in pulp presentation or after a traumatic pulp exposure, the American Academy of Pediatric Dentistry advised using MTA. [14] The advantages of MTA over FC, such as its potential injury, harshness, tissue disturbance, and irritation upon contact with delicate tissue, were overcome. [15] According to Farsi et al., pulpotomized primary molars treated with MTA performed significantly better than those treated with FC. [16] The long setting time, high cost, and risk for discoloration of MTA are some of its known downsides.When MTA comes into touch with tissue synthetic fluid, hydroxyapatite crystals start to grow on top of it. As a result of the use of this substance in endodontic treatments, this may serve as a nidus for the development of calcified structures.[44]

Biodentine

In 2009, biodentine (septodont), which was created specifically as a "dentine replacement" substance, became commercially available. [17] Biodentine has a high success rate when used as a pulpotomy medication, according to numerous research, making it a good and prospective alternative to the current pulpotomy medications. [18] At 6 and 12 months after biodentine pulpotomies in deciduous molars with physiologic root resorption, Nasseh et al. analysed the results and discovered 100% clinical and radiographic success rates. [19] Disadvantage can be reduced radiopacity.

Calcium enriched mixture

In 2006, Asgary et al. developed the novel endodontic material calcium-enriched mixture (CEM) cement, commonly known as new endodontic cement. Nosrat (2012) compared MTA and CEM pulpotomy; the findings indicated a 100% clinical and radiographical success rate for both groups at follow-ups of six and twelve months. [20]

Portland cement

In 1824, Joseph Aspdin obtained a licence for a product known as Portland cement, which was made by calcining a mixture of limestones from Portland, England, and silicon-argillaceous material. [21] As a substitute for MTA, Portland cement has attracted interest. [12] Numerous investigations that employed Portland cement as a standard reference material revealed that bismuth oxide is the only thing separating it from MTA materials. [22] It makes sense to think of portland cement as a potential MTA replacement due to its low cost. [12] Disadvantage may be less radiopacity.

Sodium hypochlorite

Due to its antibacterial and hemostatic properties, sodium hypochlorite, one of the most common endodontic irrigants, appears to be a suitable replacement for FC. The use of 5% NaOCl as a primary molar pulpotomy agent by Kola SR (2019) demonstrated promising results. [23] Drawbacks are when it comes into contact with tissue, it causes hemolysis and ulceration, inhibits neutrophil migration, and damages endothelial and fibroblast cells.

Hydroxyapatite

Nanohydroxyapatite, which has crystals ranging in size from 50 to 1000 nm, has exciting and impending uses in dentistry as a result of the recently increasing interest in nanotechnology in numerous sectors. [24] Shayegan et al. employed nanohydroxyapatite as a pulpotomy and DPC agent in pig teeth. [25] Adlakha et al. found that hydroxyapatite crystal pulpotomy in deciduous molars had a 100% clinical and 80.33% radiographic success rate in their investigation. [26]

Bioactive glass

Hench et al. created the first bioactive glasses, which are a class of reactive substances capable of adhering to mineralized bone tissue in a physiological setting. [27] In a study by Haghgoo and Ahmadvand, no significant differences were seen between the two groups in terms of the pulpal response of primary teeth following DPC with MTA and bioactive glass (BAG). [28] The biodegradable nature of BAG, which is dependent on glass composition and environmental pH, is one of its main drawbacks. A bioglass composition with a high degree of reactivity will break down more quickly. [29]

Platelet concentrate

Choukroun et al. produced platelet-rich fibrin (PRF) for the first time in France in 2001. With a clinical success rate of 89.5% and a radiographic success rate of 78.9%, Mostafa AA (2018) concluded that PRF can be utilised as an alternative pulpotomy agent to FC. [30]

Theracal light cured

Theracal light-cured, a tricalcium silicate modified with a light-curable resin, was introduced in 2011 by Bisco Inc., Schamburg, Chicago, IL, USA. [31] Theracal had much better calcium releasing ability and lower solubility than either MTA or calcium hydroxide when its chemical and physical properties were compared to those of MTA and calcium hydroxide. [32] Bakhtiar et al. observed that biodentine and MTA performed better than theracal when employed as a partial pulpotomy agent after comparing theracal with biodentine and pro root MTA to observe human pulp responses to partial pulpotomy. [33]

Propolis

Propolis is a naturally occurring resinous and balsamic substance that is utilised in dentistry as a storage medium for avulsed teeth, as an anti-cariogenic mouth rinse, in DPC, pulpotomy, endodontic therapy, root canal irrigant, and intracanal medication. [34] In a comparison of the efficacy of 10% propolis tincture and formocresol pulpotomy in primary molars, Carmen et al. (2007) found that 10% propolis tincture was more successful than FC. [35] Contact cheilitis, contact stomatitis, perioral eczema, labial edoema, oral discomfort, peeling of the lips, and dyspnea are all possible symptoms of a propolis allergy. [34]

Enamel matrix derivative

It has been recommended to use enamel matrix derivative (EMD, Emdogain) to regenerate dental tissues. In animal tests, the Emdogain gel (Straumann, Switzerland) has been used successfully for pulpotomies on teeth that are not diseased. [37] According to Yildirim et al., the clinical and radiographic success rates of EMD were comparable to those of formocresol, Portland cement, and MTA. [36]

Chlorhexidine polymer

A common and effective disinfectant for eliminating a variety of oral bacteria is chlorhexidine. Following vital pulp therapy, chlorhexidine is electrospun into a polymer scaffold and used as a pulp dressing. The chlorhexidine-loaded scaffold is made using a polyvinyl alcohol polymer with a molecular weight of 124,000 g/mol, 2% chlorhexidine gluconate, and distilled water. [38]

3Mix-tatins

In primary teeth, 3Mix-tatin has been employed as a DPC and a root canal filling material. It contains statin and 3Mix, a compound of metronidazole, minocycline, and ciprofloxacin. The bio-inductive effect of simvastatin may have contributed to the success of 3Mix-tatin. In a research by Jamali et al., pulpotomy of primary molars was successfully performed with 3Mix-tatin 90.5% of the time. [39]

Bone morphogenic protein

Nakashima employed bone morphogenic protein as a pulpotomy agent in 1991. [40] Using bone morphogenic protein-7, pulpotomy was performed on dog teeth. The responses at the apical and periapical levels were unsatisfactory, and BMP-7 did not exhibit any mineralized tissue deposition. [40]

Enriched collagen

Dental professionals employ collagen as a directed tissue regenerator, root conditioner, hemostatic, and dressing agent. [41] After pulpotomies, Michaeli Y (1984) used an enhanced collagen solution as a pulp dressing to study the role of pulp healing in baboons. As a result, the pulp chambers of 80% of teeth now have bridges made of dentin and viable pulp. [42],[43]

Natural derivatives

Numerous natural compounds, including Nigella sativa, curcuma longa, turmeric, thymus vulgaris, honey, Allium sativum oil, aloe vera, and acemannan, have been suggested to replace FC and claim to play important roles. To support its use in paediatric dentistry, greater quality evidence is necessary. [4]

Conclusion

It's crucial to carefully research, diagnose, and choose the medication for the pulpotomy method. Despite having a number of disadvantages, FC is still one of the most widely utilised pulpotomy agents. Alternative medications have been researched and used; each has its own benefits and drawbacks.

Several medications, including MTA and natural products, declare to be a competitive alternative to FC. A perfect pulpotomy agent has not yet been identified. For the optimal medication for pulpotomy of primary teeth, further long-term studies with the strongest levels of evidence (randomised control trial) are needed.

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