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Review Article

Success rates of pulpotomy in mature permanent teeth: A literature review

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Abstract

The success rates of pulpotomy in mature permanent teeth with irreversible pulpitis have garnered significant interest in recent dental research. This study aims to evaluate the outcomes of pulpotomy over various follow-up periods, focusing particularly on one-year results and extending to long-term follow-ups beyond five years. A comprehensive review of clinical studies and systematic reviews reveals that pulpotomy achieves favourable outcomes, with success rates remaining high at both the one-year mark and beyond. However, the durability of these outcomes is influenced by several critical factors. Chief among these is the integrity of the coronal restoration, as microleakage due to defective restorations is a primary cause of treatment failure. The application of bioactive materials for adequate sealing and meticulous coronal restoration plays a pivotal role in the success of vital pulp therapy. This review underscores the need for high-quality randomized controlled trials to further substantiate the long-term efficacy of pulpotomy and to optimize treatment protocols for mature permanent teeth with irreversible pulpitis.

Keywords: Irreversible pulpitis, Pulpotomy, Pulpotomy agents, Success rate, Vital pulp therapy

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1. Introduction

In dentistry and medicine, longstanding beliefs are maintained with unquestioned confidence, even when high-quality evidence is lacking. Changes to established treatment methods frequently encounter substantial resistance, potentially compromising patient care quality. A notable example of this is the conviction that a mature permanent tooth if diagnosed with irreversible pulpitis need to undergo root canal treatment for its long-term preservation. Conversely, vital pulp therapy techniques which are less invasive, such as pulpotomy, have traditionally been reserved for immature permanent teeth, aimed at promoting the root development completion (apexogenesis).[1]

Emerging evidence indicates that permanent teeth (mature and immature) can heal from irreversible pulpitis if the inflammation is controlled. This endorses the conservative management approach for such teeth. Recent declarations from the American Association of Endodontists and the European Society of Endodontology (ESE) indicate that a diagnosis of IP does not automatically require a pulpectomy.[2] This signifies the beginning of a new era for minimally invasive vital pulp therapy (VPT) in mature permanent teeth. This shift highlights the need for dentists to consider pulpotomy as a viable treatment option for mature permanent teeth with irreversible pulpitis or carious pulp exposures. This review discusses the rationale, supporting evidence and success rates of pulpotomy done in mature permanent teeth.

1.1. Rationale behind pulpotomy in permanent mature teeth

Performing pulpectomy and RCT on permanent teeth (mature) with irreversible pulpitis or pulp exposure due to caries may be viewed as a preventive measure to halt further pulpal inflammation and the subsequent onset of AP. Undoubtedly, a properly executed RCT can achieve notably good success rates. Regrettably, global cross-sectional studies have revealed that as many as 40% of root-filled teeth exhibit technical deficiencies, leading to persistent AP.[3] Managing IP in permanent teeth (mature) with pulpotomy

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presents several potential advantages over traditional RCTs. Pulpotomy offers several advantages over conventional RCT, particularly in preserving the vitality, neurosensory function, also proprioception of the tooth.[4] Additionally, pulpotomy is technically simpler, more cost-effective, and little time-consuming. It allows for a better evaluation of the inflammatory changes in the dental pulp tissue based on the level of hemostasis achieved clinically.

1.2. Diagnosis of irreversible pulpitis: a challenge

Pulp inflammation is termed as pulpitis, which is broadly classified as either reversible or irreversible pulpitis. Diagnosis is done on the basis of clinical signs and symptoms, and responses to diagnostic tests. Symptomatic IP is usually marked by prolonged, intense pain response to stimuli (hot or cold), which can be confirmed through sensibility tests of pulp. Additionally, it may cause radiating pain which is spontaneous in nature that can disturb the patient's sleep or intensify when lying down.

At present, there is lot of variability in the literature about the signs and symptoms that lead to a diagnosis of IP. Moreover, effectiveness of diagnostic tests is questionable, as they often don't accurately represent the actual histological state of the dental pulp. Therefore, the dentist faces the dilemma of diagnosing the status of dental pulp in clinical setting.

The simplistic binary classification of inflamed pulp which is vital as either reversible or IP no longer aligns with the current knowledge of biology of pulp and its complex defensive mechanisms. Histological evidence reveals that there is no clear boundary rendering the pulp irreversibly inflamed and incapable of repair. Therefore, it is more accurate to view inflammation of pulp as a condition that varies in degree over time and location. This modern knowledge of pulpal inflammation and healing has prompted calls to update the present diagnostic terminology.

The European Society of Endodontology (ESE) introduced the term irreversible pulpitis (partial) as a potentially precise clinical representation of the histological findings,[5] and some experts have suggested limiting the diagnostic term for pulpal inflammation to 'pulpitis' without additional qualifiers.[6] In the context of VPT, the terms 'reversible' and 'irreversible' are viewed as outdated, particularly given our enhanced comprehension about pulpal biology and the significance of preserving vital pulp.[7] These proposed revised diagnostic terms can assist clinicians in selecting conservative treatment modalities for patients suffering from pulpal inflammation of carious origin. The success outcome of pulpotomy in permanent mature teeth depends upon variable factors which include proper case selection, accurate diagnosis, aseptic techniques, achievement of hemostasis in stipulated time, adequate coronal seal and last but not the least choice of pulpotomy agent.

2. Success Rate of Pulpotomy in Mature Permanent Teeth According to Different Systematic Reviews

In a systematic review, Aguilar and Linsuwanont (2011) correlated various types of vital pulp therapies and discovered that MTA pulpotomy had the maximum success rate, achieving 96.6% at a three-year follow-up.[8]

Alqaderi et al.(2016) conducted a comprehensive systematic review to evaluate the success rate of pulpotomy(cervical) in mature permanent teeth with irreversible pulpitis. They found an overall success rate of 94% at twelve months and 92% at twenty-four months. The review highlighted that pulpotomies using bioactive materials such as MTA had greater success rates compared to those using calcium hydroxide. Given these high success rates, the authors proposed that coronal pulpotomy could be a feasible treatment option for permanent teeth with irreversible pulpitis.[9]

Other systematic review conducted by Li et al.(2019) correlated MTA pulpotomy with calcium hydroxide pulpotomy. They found that pulpotomy with MTA exhibited a higher clinical and radiographic success rate (93.1%) at one year compared to calcium hydroxide pulpotomy.[10]

Cushley et al.(2019*)* assessed the clinical success rate of pulpotomy (coronal) in permanent teeth afflicted with irreversible pulpitis. Their systematic review circumscribed various study designs including retrospective, prospective and randomized controlled trials. They perceived a success rate (clinically) of 97.4% and a success rate (radiographically) of 95.4% for coronal pulpotomy at one year follow-up.[11]

3. Success Rate of Pulpotomy in Mature Permanent Teeth According to Different Clinical Trials

Asgary et al.(2018) conducted a randomized controlled trial (RCT) to correlated four different vital pulp treatment therapies in teeth with irreversible pulpitis. They found that the success rate of pulpotomy(coronal) was maximum at 95.5% after a one-year follow-up, surpassing that of direct pulp capping (DPC) 94.7%and pulpotomy(miniature) 91.4%.[12]

In a randomized controlled trial conducted by Ramani A et al., a comparative assessment was made between partial and complete pulpotomy in mature permanent teeth with symptomatic irreversible pulpitis. The study revealed that both partial pulpotomy (PP) and complete pulpotomy (CP) yielded favourable outcomes in managing decayed exposed permanent teeth exhibiting signs suggestive of symptomatic irreversible pulpitis (SIP). Considering the conservative approach of partial pulpotomy, it will be considered as the initial intervention before resorting to complete pulpotomy in such cases.[13]

Table 1: Chronologic summary of research in VPT

Study	Year	Material Used	Success Outcome	Treatment Type / Notes
Zarrabi MH et al.[27]	2010	NEC	Thick dentinal bridge	-
Asgary et al.[28]	2010	CEM	Better than RCT radiographically	Closed apices
Tabarsi et al.[30]	2010	CEM, MTA, CH	CEM & MTA better than CH	Dog model
RojaRamya et al.[41]	2022	Propolis	90% (6 mo), 80% (12 mo)	Primary teeth
Ahangari et al.[31]	2012	Propolis	100% dentinal bridge	-
Trairatvorakul et al.[15]	2012	Calcium Hydroxide	95.03% to 75%	Partial Pulpotomy
Simon et al.[22]	2013	MTA	82% (2 years)	-
Tziafa C et al.[26]	2014	Biodentine	Thicker hard tissue bridge	Pulp capping
Gupta et al.[39]	2015	Laser	100% clinical & radiographic	12-month follow-up
Alqaderi et al.[9]	2016	MTA	90%	Children, closed apices
Daniele L et al.[14]	2017	MTA	92.5%	-
Kang CM et al.[19]	2017	ProRoot MTA, OrthoMTA, RetroMTA	96.0%, 92.8%, 96.0%	Partial Pulpotomy
Linsuwanont et al.[23]	2017	MTA	87.3% (62 months)	Cariously exposed pulp
Jalan AL et al.[25]	2017	Biodentine	80% dentinal bridge	Pulp capping
Ohran E et al.[35]	2017	PRP	Effective reparative dentine	Animal model
Saqib M et al.[17]	2017	MTA	88.57%	Irreversible pulpitis
Taha & Abdulkhader[18]	2018	Biodentine	100% clinical, 93.8% radiographic	Irreversible pulpitis
Asgary S et al.[12]	2018	NEC	75% dentin bridge formation	-
Taha et al.[21]	2018	Biodentine	Successful (12 months)	Full pulpotomy
Eghbal et al.[16]	2019	MTA	No inflammation	Ex vivo
Tan SY et al.[20]	2020	Tricalcium Silicate Cement	92%	Asymptomatic mature teeth
Govindaraj et al.[34]	2020	Hydroxyapatite	100% clinical, 84% radiographic	Deciduous molars
Mansour NK et al.[36]	2021	i-PRF	Better pulp adaptation	Compared to MTA
Doranala et al.[33]	2021	Endosequence	Higher than Dycal	Irreversible pulpitis
Anta S et al.[24]	2022	Biodentine	87% (12 months)	Irreversible pulpitis
Sharaan et al.[29]	2022	CEM	Favorable outcomes	Irreversible pulpitis
Wassel et al.[32]	2023	Theracal PT	96.15% pulpotomy, 42.6% PP	12-month follow-up
Taha et al.[6]	2023	MTA	100% (1yr), 92.7% (3 yrs)	Carious exposure
Asgary et al. [40]	2023	CEM	Full healing	Case report
Shobana S et al.[37]	2023	PRP & PRF	90% dentine bridge	-
Belatgy TM et al.[38]	2023	PRP	Promising result	Deciduous molars

*3.1. Success rate of clinical trials using Calcium hydroxide pulpotomy of mature permanent teeth(***Table 1**)

In study by Trairatvorakul et al.(2012) had a success rate ranged from 95.03% to 75% from 6 to 36 months for partial pulpotomy using calcium hydroxide.[15]

*3.2. Success rate of clinical trials using MTA and other MTA based materials pulpotomy in mature permanent teeth(***Table 1**)

Eghbal et al.(2019) *ex vivo* histologic study revealed zero sign of inflammation of teeth after the direct placement of mineral trioxide aggregate (MTA) on pulpal tissues.[16] According to Saqib M et al.(2017) the adequacy of pulpotomy treatment with mineral trioxide aggregate (MTA) in symptomatic mature permanent teeth with normal periapical periodontium and irreversible pulpitis and was 88.57%.[17]

Daniele L et al.(2017) suggested that survival rate of dental pulp in the teeth with MTA as a pulpotomy agent was 92.5%.[14] Taha et al.(2018)full pulpotomy using Biodentine procedure was a successful treatment option for decayed exposed pulps in mature permanent molar teeth with clinical signs and symptoms suggestive of irreversible pulpitis, up to twelve months.[18]

According to Kang CM et al.(2017) partial pulpotomy sustained a high success rate up to 1 year when treated with three MTA materials: ProRoot MTA, 96.0%; OrthoMTA, 92.8%; RetroMTA, 96.0%.[19] Alqaderi et al.(2016) also observed that when addressing carious pulp exposures in permanent teeth with closed root apices in children, MTA pulpotomy demonstrated a notable success rate of 90%.[9]

Tan SY *et al*. (2020) suggest that pulpotomy using a tricalcium silicate cement can reliably manage carious pulp exposures in asymptomatic mature permanent teeth, with an overall pulp survival rate of 92%.[20] This approach can be considered as a viable treatment option for mature permanent teeth with carious exposures.[14]

Taha et al.(2023) documented success rates of 100% at one year and 92.7% at three years in their investigation concerning the outcomes of MTA pulpotomy in mature permanent teeth with caries-induced pulp exposure.[21] In a separate study conducted by Simon et al., (2013)pulpotomy using MTA in permanent teeth showed a high success rate, reaching 82% over a span of two years.[22]

In their investigation, Linsuwanont et al.(2017) discovered a clinical success rate of 87.3% when conducting a study on MTA pulpotomy for cariously exposed pulp in 66 permanent teeth, with a follow-up period of 62 month.[23]

3.3. Success rate of clinical trials using Biodentine pulpotomy in permanent teeth (mature)(**Table 1***)*

Anta S *et al.* (2022) assessed the efficacy of complete pulpotomy using biodentine in mature permanent molars exhibiting signs and symptoms of symptomatic irreversible pulpitis. Their evaluation at 12 months post-operation demonstrated a success rate of 87% through clinical and radiographic analysis. Hence, adhering to the recommended indications and protocol for complete pulpotomy with biodentine in such cases yields favourable outcomes during the 12-month follow-up period.[24]

In their forward-looking research, Taha and Abdulkhader et al.(2018) conducted a study on complete coronal pulpotomy employing Biodentine in permanent teeth with mature apices and irreversible pulpal inflammation. Their findings revealed a significant clinical success rate of 100% and a radiographic success rate of 93.8% at the one-year follow-up.[18]

In a study conducted by Jalan AL et al. (2017) comparing the human dental pulp response to calcium hydroxide and Biodentine as pulp-capping agents, complete dentinal bridge formation was noted in 80% of the samples treated with Biodentine.[25]

In another study by Tziafa C et al. (2014), it was found that pulp capping with Biodentine resulted in significantly thicker hard tissue bridges compared to white MTA Angelus.[26] In recent study by Zheng and Lu et al.(2024)[27] Biodentine showed clinical and radiographic success rates (87.8 to 99.38%) comparable to other bio-ceramic materials in VPT for young permanent teeth, with the added advantage of significantly reducing the incidence of tooth discoloration.

*3.4. Success rate of clinical trials using Novel endodontic cement pulpotomy in permanent teeth (mature)(**Table 1**)*

Zarrabi MH et al.(2010) discovered that the dentinal bridge formed by novel endodontic cement (NEC) was thicker and exhibited a more tubular structure along with a palisade pattern of odontoblast-like cells after 8 weeks. This finding indicates that the dentinal bridge under NEC would gradually calcify and develop sufficient thickness (>0.25 mm).[27] In a comparative study by Asgary S et al.(2018), complete dentin bridge formation was observed in 75% of cases treated with novel endodontic cement.[12]

*3.5. Success rate of clinical trials using Calcium enriched mixture pulpotomy in permanent teeth (mature)(**Table 1**)*

In their multicentre trial, Asgary et al.(2010) compared coronal pulpotomy using the bioactive material calcium-enriched mixture (CEM) with root canal treatment (RCT) in permanent teeth with closed apices and irreversible pulpal inflammation. They found no clinical difference in success rates between the two treatments at 6 and 12 months of follow-up. However, radiographically, the pulpotomy group showed significantly better results than the root canal treatment group.[28]

According to Sharaan et al.,(2022) CEM is a straightforward, effective, and practical pulpotomy agent for treating permanent molars with irreversible pulpitis, yielding favourable results offering a simplified approach to treatment with positive clinical outcomes.[29] Tabarsiet et al.(2010) conducted a comparison of CEM with MTA and CH as cervical pulpotomy agents in dog teeth. Their findings indicated that MTA and CEM produced similarly favorable biological outcomes and were more effective at inducing dentinal bridge formation compared to CH.[30]

3.6. Success rate of clinical trials using propolis

Ahangari et al.(2012) found tubular bridge formation in 100% of tested cases treated with propolis. Also provides evidence that this material has advantages over calcium hydroxide as a capping agent in vital pulp therapy. In addition to producing no pulpal inflammation, infection or necrosis this material induces the production of high quality tubular dentin.[31] Propolis has demonstrated a clinically acceptable success rate of 90% and 80% at 6 and 12-month follow-up according to RojaRamya et al.(2022) in primary teeth pulpotomy.[41]

3.7. Success rate of clinical trials using theracal pulpotomy in permanent teeth (mature)

According to Wassel et al,(2023) the 12-month success rates (combined clinicaly and radiographically) for PP and

pulpotomy were 42.6%and 96.15%, respectively when using Theracal PT.[32]

3.8. Success rate of clinical trials using endosequence pulpotomy in mature permanent teeth

According to Doranala et al.(2021) Endosequence demonstrated higher success rates compared to Dycal when used as a pulpotomy agent in permanent teeth with irreversible pulpitis.[33]

3.9. Success rate of clinical trials using Hydroxyapatite

According to a study by Govindaraj et al.(2020) hydroxyapatite crystals may be used as pulpotomy agents in deciduous molars with 100% success clinically and 84% success radiographically.[34]

3.10. Success rate of clinical trials using PRP and PRF

In a study by Ohran E et al.,(2017) reparative dentine formation was observed, indicating that PRP can stimulate or enhance intrinsic reparative processes in the rat dental pulp. Despite the limitations of this animal study, PRP was found to induce reparative dentine formation in exposed pulps as effectively as MTA and calcium hydroxide.[35]

According to Mansour N K et al.,(2021) injectable PRF provides a better adaptation to the pulp and dentin when compared to MTA or bioactive graft.[36] Shobana S et al. found that the dentine bridge formed by PRP and PRF was 90%.[37] According to Belatgy et al.,(2018) PRP has a successful outcome (100% for PRP), a potent therapeutic medicament and had a promising alternative to the presently used pulpotomy medicament in deciduous molars.[38]

3.11. Success rate of clinical trials using laser pulpotomy in mature permanent teeth

According to Gupta et al, (2015) Laser pulpotomy demonstrated superiority in terms of operating time, patient cooperation, ease of use, and pain management, achieving a 100% clinical and radiographic success rate at the 12-month follow-up.[39] VPT done in irreversible pulpitis with condensing ostetitis (Singular case). Asgary (2023) presented a case report on a molar tooth with irreversible pulpitis and condensing osteitis that was treated using coronal pulpotomy with CEM cement. Over a two-year follow-up period, the tooth remained clinically asymptomatic, and complete healing of the periradicular tissue was observed. Additionally, the root canals did not exhibit calcification, a common occurrence seen with calcium hydroxide pulpotomy.[40]

4. Gap Present in Pulpotomy Treatment

One of the most pressing challenges in pulpotomy treatment lies in the accurate identification of the degree of pulpal inflammation at the time of intervention since it's a histological feature and clinical differentiation become difficult. Clinicians are often required to make critical decisions regarding the extent of tissue removal based primarily on subjective clinical signs such as pain history, bleeding characteristics, or indirect radiographic findings. However, these indicators do not consistently correlate with the histological status of the pulp, leading to variability in diagnosis and potentially affecting treatment outcomes. The absence of standardized, chair side diagnostic tools for objectively evaluating pulp vitality and inflammation adds a significant degree of uncertainty to clinical decision-making.

This diagnostic ambiguity complicates the selection between partial and full pulpotomy and may result in either under-treatment or over-treatment. Furthermore, while numerous studies report high success rates for pulpotomy procedures, the variability in diagnostic criteria and treatment endpoints makes it difficult to establish consensus on best practices. The need for an evidence-based framework incorporating reliable biomarkers or imaging techniques to assess pulp status remains unmet. Additionally, standardized outcome measures are lacking, which hinders cross-comparison of studies and limits the establishment of universally accepted clinical guidelines. Addressing these gaps is essential to improving the predictability and long-term success of pulpotomy procedures.

5. Conclusion

Systematic reviews and clinical studies have consistently demonstrated that the pulpotomy procedure yields positive outcomes in mature permanent teeth with IP over follow-up periods of two to three years and up to five years. However, the success of coronal pulpotomy is frequently compromised by defective coronal restorations, which can lead to micro leakage. The key to achieving favourable results with VPT lies in ensuring an adequate seal using materials which are bioactive and proper restoration. When restorations fail to maintain their integrity, micro leakage can occur, potentially reducing the survival rate of pulpotomy. This highlights the need of regular evaluations and follow-ups to monitor the condition of the restorations. Timely repair of any defects in the restorations is crucial to maintaining their effectiveness and ensuring the longevity of the pulpotomy treatment.

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7. Conflict of Interest

None.

References

1. Ritwik P. A review of pulp therapy for primary and immature permanent teeth. *J Calif Dent Assoc*. 2013;41(8):585–95.
2. AAE position statement on vital pulp therapy. *J Endod*.2021; 47(9)**:**1340–4.
3. Philip N, Suneja B. Minimally invasive endodontics: a new era for pulpotomy in mature permanent teeth. *Br Dent J*. 2022;233(12):1035–41.

4. Simon DS. Endodontic case difficulty assessment: the team approach.*Gen Dent*. 1999;47(4):340–4.
5. Duncan HF, Galler KM, Tomson, PL Simon S, El-Karim I, Kundzina R et al. European society of endodontology position statement: management of deep caries and the exposed pulp. *Int Endod J.* 2019; 52(7): 923–34.
6. Taha NA, About I, Sedgley CM, Messer HH. Conservative management of mature permanent teeth with carious pulp exposure. *J Endod*. 2020;46(9S):S33–41.
7. Galicia JC, Peters OA. Proposal for a new diagnostic terminology to describe the status of the dental pulp. *Int Endod J*. 2021;54(8):1415–16.
8. Aguilar P, Linsuwanont P. Vital pulp therapy in vital permanent teeth with cariously exposed pulp: A systematic review. *J Endod*. 2011;37(5):581–7.
9. Alqaderi H, Lee CT, Borzangy S, Pagonis TC. Coronal pulpotomy for cariously exposed permanent posterior teeth with closed apices: A systematic review and meta-analysis. *J Dent*. 2016:44:1–7.
10. Li Y, Sui B, Dahl C, Bergeron B, Shipman P, Niu L *et al.* Pulpotomy for carious pulp exposures in permanent teeth: A systematic review and meta-analysis. *Dent J*. 2019;84(1):1–8.
11. Cushley S, Duncan HF, Lappin MJ, Tomson PL, Lundy FT, Cooper P *et al*. Pulpotomy for mature carious teeth with symptoms of irreversible pulpitis: A systematic review. *J Dent*. 2019;88(1):103158.
12. Asgary S, Hassanizadeh R, Torabzadeh H, Eghbal MJ. Treatment outcomes of 4 vital pulp therapies in mature molars. *J Endod*. 2018;44(4):529–35.
13. Ramani A, Sangwan P, Tewari S, Duhan J, Mittal S, Kumar V. Comparative evaluation of complete and partial pulpotomy in mature permanent teeth with symptomatic irreversible pulpitis: A randomized clinical trial. *Int Endod J*. 2022;55(5):430–40.
14. Daniele L. Mineral Trioxide Aggregate (MTA) direct pulp capping: 10 years clinical results. *G Ital Endod*. 2017;31(1):48–57.
15. Trairatvorakul C, Koothiratrakarn A. Calcium hydroxide partial pulpotomy is an alternative to formocresol pulpotomy based on a 3-year randomized trial. *Int J Paediatr Dent*. 2012;22(5):382–9.
16. Eghbal MJ, Asgary S, Baglue RA, Parirokh M, Ghoddusi J. MTA pulpotomy of human permanent molars with irreversible pulpitis. *Aust Endod J***.** 2009;35(1):4–8.
17. Saqib M, Ahmed MA, Jouhar R, Hemani A, Ziaullah. Pulpotomy: assessment of clinical outcome in mature permanent teeth using mineral trioxide aggregate. *Professional Med J*. 2017;24(12):1909–13.
18. Taha NA, Abdelkhader SZ. Outcome of full pulpotomy using Biodentine in adult patients with symptoms indicative of irreversible pulpitis. *Int Endod J.* 2018;51(8):819–28.
19. Kang CM, Sun Y, Song JS, Pang NS, Roh BD, Lee CY, *et al.* A randomized controlled trial of various MTA materials for partial pulpotomy in permanent teeth. *J Dent*. 2017;60(3):8–13.
20. Tan SY, Yu VSH, Lim KC, Tan BCK, Neo CLJ, Shen L, *et al.* Long-term pulpal and restorative outcomes of pulpotomy in mature permanent teeth. *J Endod*. 2020;46(3):383–90.
21. Taha NA, Hamdan AM, Al-Hiyasat AS. Coronal discoloration induced by calcium silicate-based cements used in full pulpotomy in mature permanent molars: A randomized clinical trial. *Clin Oral Investig*. 2023;27(4):1723–30.
22. Simon S, Perard M, Zanini M, Smith AJ, Charpentier E, Djole SX *et al.* Should pulp chamber pulpotomy be seen as a permanent treatment? Some preliminary thoughts. *Int Endod J*. 2013;46(1):79–87.
23. Linsuwanont P, Wimonsutthikul K, Pothimoke U, Santiwong B. Treatment outcomes of mineral trioxide aggregate pulpotomy in vital permanent teeth with carious pulp exposure: The retrospective study. *J Endod*. 2017;43(1):225–30.
24. Anta S, Diouma N, Ousmane NS, Fatou LB, Florence F, Babacar T. Evaluation of complete pulpotomy with biodentine on mature permanent molars with signs and symptoms of symptomatic irreversible pulpitis: 12-months follow-up. *J Endod*. 2022;48(3):312–9.
25. Jalan AL, Warhadpande MM, Dakshindas DM. A comparison of human dental pulp response to calcium hydroxide and Biodentine as direct pulp-capping agents. *J Conserv Dent*. 2017;20(2):129–33.
26. Tziafa C, Koliniotou-Koumpia E, Papadimitriou S, Tziafas D. Dentinogenic responses after direct pulp capping of miniature swine teeth with Biodentine. *J Endod*. 2014;40(12):1967–71.
27. Zarrabi MH, Javidi M, Jafarian AH, Joushan B. Histologic assessment of human pulp response to capping with mineral trioxide aggregate and a novel endodontic cement. *J Endod*. 2010;36(11):1778–81.
28. Asgary S, Eghbal MJ. The effect of pulpotomy using a calcium-enriched mixture cement versus one-visit root canal therapy on postoperative pain relief in irreversible pulpitis: A randomized clinical trial. *Odontol*. 2010;98(2):126–33.
29. Sharaan M, Ali A. Mineral Trioxide Aggregate vs Calcium-Enriched Mixture Pulpotomy in Young Permanent Molars with a Diagnosis of Irreversible Pulpitis: A Randomized Clinical Trial. *Iran Endod J*. 2022;17(3):106–13.
30. Tabarsi B, Parirokh M, Eghbal MJ, Haghdoost AA, Torabzadeh H, Asgary S. A comparative study of dental pulp response to several pulpotomy agents. *Int Endod J*. 2010;43(7):565–71.
31. Ahangari Z, Naseri M, Jalili M, Mansouri Y, Mashhadiabbas F, Torkaman A. Effect of propolis on dentin regeneration and the potential role of dental pulp stem cell in Guinea pigs. *Cell J*. 2012;13(4):223–8.
32. Wassel M, Hamdy D, Elghazawy R. Evaluation of four vital pulp therapies for primary molars using a dual-cured tricalcium silicate (TheraCal PT): One-year results of a non-randomized clinical trial. *J Clin Pediatr Dent*. 2023;47(2):10–22.
33. Doranala S, Surakanti JR, Vemisetty H, Loka SR, Sudireddy K, Punna R. Comparative assessment of titanium-prepared platelet-rich fibrin, Endosequence root repair material, and calcium hydroxide as pulpotomy agents in permanent teeth with irreversible pulpitis: A randomized controlled trial. *J Conserv Dent*. 2021;24(6):606–10
34. Govindaraj N, Shah K, Subramaniam P, Gupta M. Evaluation of bioactive glass and hydroxyapatite crystals as pulpotomy agents in primary molars: A clinical study. *Contemp Pediatr Dent*. 2020:1(1):42–51.
35. Orhan E, Uysal AC, Başer E, Keskin D, Demiroglu-Yakut C. The effect of intradermal administration of inactive platelet-rich plasma on flap viability in rats. *Actas Cir Bras*. 2017;32(4):280–6.
36. Mansour NK, Hashem MA, Sharraan M, Fayad DM,. Effect of injectable-platelet rich fibrin on marginal adaptation of bioactive materials used as direct pulp capping; an experimental animal study. *Dent Sci updates*. 2021;2(2):185–95.
37. Shobana S, Kavitha M, Srinivasan N. Efficacy of platelet rich plasma and platelet rich fibrin for direct pulp capping in adult patients with carious pulp exposure- A randomised controlled trial. *Euro Endod J*. 2022;7(2):114–21.
38. Beltagy TM. Platelet-rich Plasma Pulpotomy in Primary Molars. *Egypt Dent J*. 2018;64(2):159–70.
39. Gupta G, Rana V, Srivastava N, Chandna P. Laser pulpotomy– An effective alternative to conventional techniques: a 12 months clinicoradiographic study. *Int J Clin Pediatr Dent*. 2015;8(1):18–21.
40. Asgary S. Two vital pulp therapy techniques for treating a molar with established irreversible pulpitis and condensing osteitis. *J Dent Sci*. 2023;18(4):1948–9.
41. RojaRamya KS, Chandrasekhar R, Uloopi KS, Vinay C. Treatment Outcomes of Pulpotomy with Propolis in Comparison with MTA in Human Primary Molars: A 24-month Follow-up Randomized Controlled Trial. *Int J Clin Pediatr Dent*. 2022;15(Suppl 1):S3–7.

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