



Pulpotomy Reborn – The Resurgence of Forgotten Hero

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Abstract: Background: Pulpotomy, a name traditionally associated with pediatric dentistry, has recently garnered rekindled interest in endodontics, particularly for fully developed permanent teeth. While historically used primarily for primary and young permanent teeth, pulpotomy is now being extended to mature teeth with symptomatic or asymptomatic irreversible pulpitis. These advancements, driven by cutting-edge technologies, allow for better tooth preservation and improved treatment outcomes. Despite these developments, traditional root canal therapy remains complex and costly, especially in general practice where pulpectomy success rates have been suboptimal. The resurgence of pulpotomy in mature teeth aligns with the broader trend toward minimally invasive and patient-centered dental care. By combining modern diagnostic tools with advanced biomaterials, this well-established technique provides a conservative approach to treating pulp-related issues in mature dentition. Proper case selection, eagle's eye diagnosis, operator skill, and long-term follow-up are very much crucial for successful pulpotomy procedures in the mature adult teeth.

Key Words: Pulpotomy, Irreversible pulpitis, Biomaterials, minimally invasive, Endodontics

INTRODUCTION

Pulpotomy, a concept traditionally linked with pediatric dentistry, is seeing a renewed interest in endodontics, specifically in treating fully developed permanent teeth. In the past, pulpotomy was mainly used for primary as well as young permanent teeth, while mature teeth with symptomatic or asymptomatic irreversible pulpitis typically underwent pulpectomy as the standard care. Recent advancements in endodontics have expanded the use of cutting-edge technologies, enabling the preservation of a greater number of teeth than previously possible and leading to enhanced treatment results. Despite these enhancements, traditional root canal therapy remains a complex, time-intensive, and costly procedure, especially in the general practice where success rates of pulpectomy treatments were frequently suboptimal¹. The growing need for endodontic re-treatment, driven by a considerable number of failed initial root canal procedures and a high incidence of the periapical disease, poses substantial clinical challenges for specialists². However, recent developments in the dental field have led to a renewed interest in vital procedures especially pulpotomy for mature tooth.

HISTORIC CONTEXT

The origins of pulpotomy can be traced back to 1756 when Phillip Pfaff, a German dentist to Frederick the Great, initially described a pulp-capping technique. This involved cutting out a piece of gold or lead to cover the exposed pulp, creating a

concave surface nearest to the pulp. This approach aimed to restore masticatory function while safeguarding the pulp. In the 1830s, Koecker, in an attempt to prevent tooth loss, gained popularity for promoting the pulp capping procedure and is credited with introducing this technique to dentistry. This technique held prominence during the vitalistic era for approximately 50 years until pulpectomy gained popularity through the introduction of arsenic toxin which facilitated pulp devitalization and addressed dentine hypersensitivity³. Following this development, advancements such as the creation of the first file by Dr. Edwin Maynard and the lead-in of nickel-titanium rotary instrumentation, latest root filling devices, operating microscopes, precise apex locator have notable streamlined pulpectomy procedure. As a result, the application of pulpotomy has become more limited, now primarily reserved for immature or deciduous teeth using substances like formocresol, glutaraldehyde, ferric sulfate, and calcium hydroxide.

Traditionally, calcium hydroxide has always been favoured for vital pulpal therapies due to its elevated pH, documented bactericidal properties, and its capacity to stimulate the formation of hard tissue in human teeth. Despite these advantages, calcium hydroxide comes with drawbacks such as subpar adhesion to dentin, limited sealing ability with unpredictable dentinal bridge formation and the occurrence of tunnel defect. These bridges may serve as potential pathways

for bacterial leakage⁴. As a result, pulpotomy in adult teeth was perceived as only a provisional or emergency measure.

CURRENT CONCEPT

The conventional belief was that once the dental pulp in mature teeth was compromised, complete pulpectomy was the only viable solution. This practice remained unchallenged for a significant period in the history of endodontics till the introduction of biomaterials and rubber dam.

Advancements in dental biomaterials have played a crucial role in reinvigorating pulpotomy being a viable treatment options for mature permanent teeth. Pulpotomy procedures now utilize biomaterials such as Bio dentine, Mineral Trioxide Aggregate (MTA), Bio ceramics, calcium-enriched mixture (CEM), enriched collagen solutions, Platelet-rich fibrin, and fully synthetic nanocrystalline hydroxyapatite paste.

These materials offer enhanced sealing properties, biocompatibility, and the ability to stimulate dentinogenesis, a vital factor for the long-term health of the tooth. Ex-vivo study conducted by Eghbal et al. demonstrated no signs of inflammation upon histological examination following the direct application of mineral trioxide aggregate on pulpal tissues.⁵

Asgary et al. conducted a comparison between coronal pulpotomy, utilizing the bioactive material calcium-enriched mixture and pulpectomy in permanent teeth exhibiting a close apex and irreversible inflammation of pulp. The clinical success rates at the 6th, 12th months of follow-up showed no discernible difference between pulpotomy and pulpectomy. On the contrast, radiographically, the pulpotomy group demonstrated substantial superior results compared to pulpectomy group. ($P < 0.001$).⁶

One of the key drivers behind the resurgence of pulpotomy in mature teeth is the paradigm shift towards minimally invasive dentistry. This approach prioritizes the conservation of natural tooth structure whenever possible. In the context of endodontic treatment, pulpotomy aligns with this philosophy by allowing for the partial removal of the pulp, thus preserving the remaining vital tissue within the tooth. This approach not only minimizes the loss of tooth structure but also leads to faster patient recovery and less discomfort compared to traditional pulpectomy.

Furthermore, the preservation of dental pulp through pulpotomy retains the tooth's natural functionality and sensory perception. Teeth treated with pulpotomy maintain their natural strength and can withstand chewing forces just as effectively when compared to the pulpectomy. Additionally, the preservation of pulp tissue allows for the maintenance of neuronal connections, ensuring normal sensations like temperature and pressure can still be experienced.

While the resurgence of pulpotomy in mature teeth brings numerous advantages, it is essential to consider several clinical aspects to ensure successful outcomes. Proper case selection and diagnosis are crucial. Not all cases are suitable for pulpotomy, and the dentist's expertise is essential in determining when this procedure is appropriate. Additionally, operator proficiency in performing pulpotomy is vital to ensure the procedure's success. Clinical guidelines and a clear understanding of the indications and contraindications for pulpotomy are necessary.

Selecting appropriate cases for pulpotomy is a critical consideration. Pulpotomy is not suitable for all adult teeth with pulp pathology, and a thorough evaluation is necessary. The dentist must assess the extent of pulp involvement, the presence of apical pathology, and the overall condition of the tooth. Generally, pulpotomy is indicated when the pulp tissue is inflamed but still vital, and the tooth exhibits good restorability. If there is extensive pulp necrosis or severe periapical disease, pulpotomy may not be the recommended course of action⁷.

Employing sophisticated diagnostic instruments is crucial in assessing the appropriateness of pulpotomy in fully developed teeth. Cone beam computed tomography (CBCT) and other imaging modalities provide precise visualization of the pulp chamber and root canals, facilitating an accurate diagnosis of pulp pathology. The utilization of an electric pulse tester helps determine the vitality of the tooth. These diagnostic tools are also valuable in identifying any root fractures or structural issues that could potentially affect the success of the pulpotomy procedure.

The pulpotomy procedure is recommended when the removal of caries leads to pulp exposure of the tooth with a normal pulp or reversible pulpitis, or following the traumatic pulp exposure. It was essential for clearly delineate factors such as the depth of caries, symptomatology, the surfaces affected, and the periodontal condition of the involved teeth⁷. In this process, the coronal tissue was excised and the remaining radicular tissue is assessed as vital, devoid of any kind of suppuration, purulence, necrosis, or excessive hemorrhage which cannot be controlled by a damp cotton pellet within few minutes. Additionally, there should be no radiographic indications of periapical infection or pathological root or bone resorption.

The sustained success of a pulpotomy in mature teeth hinges on the various factors, encompassing the proficiency of the dentist, the patient's oral hygiene practices, and the appropriateness of the tooth for the procedure. In a study carried out a study by Natacha Linas et al. (2020), the long-term effectiveness of the pulpotomy was assessed 608 teeth treated within a single session, with an average follow-up period of 24 months. The findings revealed that 89% of the pulpotomies were successful, 7.6% had uncertain outcomes, and 3.4% were deemed ineffective⁸. Regular follow-up appointments are imperative to monitor the tooth's condition, ensure the absence of symptoms, and identify any indications of reinfection or complications. Additionally, achieving adequate restoration and sealing of the tooth post-pulpotomy is crucial for ensuring long-term success.

CONCLUSION

The resurgence of pulpotomy in mature teeth reflects a broader shift in dental practice towards minimally invasive and patient-centered care. The amalgamation of modern diagnostic tools, advanced biomaterials, and a renewed emphasis on preserving tooth structure has breathed new life into this time-tested technique. As the dental community continues to explore the potential of pulpotomy in adult teeth, it is likely that its role in endodontics will continue to evolve, offering more conservative and patient-friendly options for treating pulp pathology in mature dentition. Proper case selection, accurate diagnosis, operator proficiency, and long-term follow-up are key components of

ensuring the success of pulpotomy procedures in mature teeth. As research and clinical experience in this area continue to grow, pulpotomy may become an increasingly important tool in preserving the natural dentition and enhancing the overall quality of dental care for adult patients.

REFERENCES

1. Boucher Y, Matossian L, Rilliard F, Machtou P. Radiographic evaluation of the prevalence and technical quality of root canal treatment in a French subpopulation. *Int Endod J.* 2002;35(3):229-238. doi:10.1046/j.1365-2591.2002.00469.x
2. Figdor D. Apical periodontitis: a very prevalent problem. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2002;94(6):651-652. doi:10.1067/moe.2002.130322
3. Cruse WP, Bellizzi R. A historic review of endodontics, 1689-1963, part 1. *J Endod.* 1980;6(3):495-499. doi:10.1016/S0099-2399(80)80008-2
4. Nosrat A, Peimani A, Asgary S. A preliminary report on histological outcome of pulpotomy with endodontic biomaterials 08. vs calcium hydroxide. *Restor Dent Endod.* 2013;38(4):227-233. doi:10.5395/rde.2013.38.4.227
5. Eghbal MJ, Asgary S, Baglue RA, Parirokh M, Ghoddsi J. MTA pulpotomy of human permanent molars with irreversible pulpitis. *Aust Endod J.* 2009;35(1):4-8. doi:10.1111/j.1747-4477.2009.00166.x
6. Asgary S. Calcium-enriched mixture pulpotomy of a human permanent molar with irreversible pulpitis and condensing apical periodontitis. *J Conserv Dent.* 2011;14(1):90-93. doi:10.4103/0972-0707.80733
7. Nawal RR, Logani A, Sangwan P, Ballal NV, Gopikrishna V. Indian Endodontic Society: Position statement for deep caries management and vital pulp therapy procedures. *Endodontology* 2023;35:167-94.
8. Linas N, Decerle N, Munoz-Sanchez ML, et al. Long-term Outcomes of Full Pulpotomy in Permanent Molars for Patients Treated in a Single, Short Session under Special Conditions. *J Endod.* 2020;46(11):1597-1604. doi:10.1016/j.joen.2020.