



Non-Instrumental Endodontic Therapy: An Alternative Approach for Pulpectomy

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Abstract

This article provides a comprehensive review on the alternative techniques of pulpectomy in primary molars. For a comprehensive understanding this article aims in providing an insight knowledge of pulpotomy in irreversible pulpitis.

Keywords: Tampon Pulpotomy; LSTR; Irreversible Pulpitis; Primary Tooth; Molar Pulpotomy

Abbreviations: MID: Minimal Invasive Dentistry; NIET: Non-Instrumental Endodontic Therapy; LSTR: Lesion Sterilization and Tissue Repair.

Introduction

In spite of the invention of numerous remineralizing agents, dental caries is still one of the most common oral diseases in the world. Untreated dental caries progress into the dental pulp and causes pulpal inflammation which in turn if not treated leads to pulpal necrosis, abscess formation [1]. The primary tooth serves as a natural space maintainer, the dentist aims in preserving the tooth in an asymptomatic, healthy and functional state until its exfoliation [2]. The irreversible pulpitis in primary teeth is universally treated by pulpectomy which refers to the amputation of coronal pulp and radicular pulp with subsequently filling the root canals using a suitable resorbable material [3,4]. Successful pulpectomy is challenging in primary teeth due to complexity of root canals, physiologic root resorption, root curvature

in molars, multiple accessory canals. Moreover, it requires patient co-operation which is difficult to achieve in pediatric population [5,6]. Further, obtaining a hermetic seal in apical portion of the root in primary teeth because, it undergoes physiologic resorption [7,8].

The evolution of Minimal Invasive Dentistry (MID) has greater impact in the modern dentistry. Its centre of focus lies on minimal invasion and maximal preservation of tooth structure [9]. With the advancement in dental material and extension of dental research on the wound healing potential of root canal the treatment modalities for irreversible pulpitis is shifting from conventional pulpectomy to coronal pulpotomy [10-12]. Pulpotomy in permanent tooth was considered as an emergency management for root canal treatment. In primary tooth pulpotomy is a treatment option for reversible pulpitis. The recent researches have demonstrated pulpotomy as a reliable treatment for a tooth with irreversible pulpitis [13]. This article gives an overview of pulpotomy in chronic irreversible pulpitis and non-vital

primary tooth.

Non-Instrumental Endodontic Therapy (NIET)

NIET is an alternative technique for the conventional root canal treatment and pulpectomy. It is a biological treatment approach for a tooth with the signs and symptoms of irreversible pulpitis or a non-vital tooth [14,15]. The term NIET is synonymously used with Lesion Sterilization and Tissue Repair (LSTR) technique [8]. Recent evidences suggests that NIET can be performed using the materials other than antibiotics [14-16].

Conceptualization of NIET

Microorganisms play an important role in the initiation and progression of dental caries. Untreated dental caries paves way for microorganisms to enter into the pulp. As a consequence of microbial invasion in the dental pulp, the inflammatory changes take place within the pulp. Histologically, irreversible pulpitis is detected with the presence of inflammatory infiltrates, micro abscess and tissue necrosis with plenty of bacteria in the coronal portion of the pulp confined to the area beneath the carious exposure.

A precise diagnosis of pulpitis can be made only with histopathological examination which is impossible to achieve. Clinically, assessment of bleeding from the pulp after access opening is a reliable diagnostic step than symptoms. Pulpal bleeding reflects the extent of inflammatory reaction and its healing capability. In irreversible pulpitis, the pulpal bleeding is prolonged and deep red in colour. In mild pulpal inflammation, the bleeding is minimal and the colour is bright red in colour. Uncontrolled bleeding indicates the irreversible inflammation of the pulp.

The recent evidences suggests that, a tooth with vital pulp irrespective of irreversible or reversible pulpitis responds the material placed over it by inducing the formation of reparative dentin beneath the material. It can be hypothesized that the biomaterial acts on the dental pulp of irreversible pulpitis could respond in a similar way as it acts in a tooth with reversible pulpitis. Generally, a vital tooth has plenty of undifferentiated mesenchymal cells. These cells when contacts a biomaterial, that induces the formation of reparative dentin.

Two Reasons could be suggested for the Success of NIET

a) Removal of coronal portion of dental pulp. Histologically, necrosis and micro abscess are evident only in the area below the carious dentin. With the removal of

coronal portion of pulp it can be said that the necrotic part of pulp is removed. Further, the formation of reparative dentin acts as a barrier to the microorganisms, to invade the radicular pulp. Thus, reducing the risk of secondary infection and treatment failures.

b) Formation of reparative dentin.

Classification of NIET

Based on the type of medication used, we can classify NIET into the following two types:

- i. Tampon pulpotomy
- ii. Lesion sterilization and tissue repair (LSTR)

Objective of NIET

To maintain the primary tooth with irreversible pulpitis in an aseptic and asymptomatic state until its exfoliation.

Tampon Pulpotomy

Research on this subject was executed since past decade but, the term "tampon pulpotomy" was coined by Asgary S in 2021 [14]. The word tampon was originated from French language which refers to a plug of material used to absorb blood or other human secretions. But, in recent decades with advancement in researches, the ability of the healing potential of the pulp is studied. An unexpectedly the tampon pulpotomy in primary molar induced blastic cells. S Asgary, et al. suggested tampon pulpotomy using calcium enriched biomaterial as a viable treatment alternative in vital irreversibly inflamed primary teeth (hyperplastic/hyperemic dental pulp).

The biocompatible material to be placed directly over the pulp canals should be capable of providing a good marginal seal, promote the healing of remaining vital pulp, induce tertiary dentinogenesis [7]. Pulpotomy using calcium silicate-based bioactive material has proved to induce dentine bridge formation beneath the material in a tooth with irreversible pulpitis. Tampon pulpotomy in primary molars has shown a success rate of 95% when MTA was used and 100% when bioceramic was used at one year follow up [6].

Lesion Sterilization and Tissue Repair (LSTR)

The LSTR is a NIET in which a mixture of three antibiotics is placed over the pulp canals. The concept of LSTR is to sterilize the pulp chamber and the root canals by reducing the bacterial load. In contrast to tampon pulpotomy, LSTR can be performed in vital and non-vital tooth. It was introduced by Hoshino, et al. in 1990. Due to the polymicrobial nature of the infected root canal, a combination of antimicrobial agent which is toxic to different microorganisms is preferred over

a single antibiotic agent. This procedure does not require instrumentation of root canals. However, some studies suggest a minimal instrumentation of the canals. The most commonly used LSTR agents are metronidazole, ciprofloxacin, minocycline mixed in the macrogol and propylene glycol

vehicle. LSTR has its own disadvantages such as developing antibiotic resistance, tooth discolouration. The success rate of LSTR is better observed in a primary tooth in which pre-operative root resorption is present.

	Tampon pulpotomy	LSTR
Number of visits	Single visit	Single visit
Indications	Symptomatic vital primary tooth with irreversible pulpitis	Symptomatic tooth with irreversible pulpitis
	Uncooperative children	Non-vital tooth
	Children lacking cooperative ability	Children lacking cooperative ability
	Primary tooth with more than 1/3 rd of root present.	Primary tooth with less than 2/3 rd of root but more than 1/3 rd of root present.
	Vital tooth with non-negotiable root canals	Vital and non-vital tooth.
	Not willing for extraction	Not willing for extraction
		Primary tooth that has to be retained for a period of a year or less than that.
		A tooth with abscess, sinus tract, pathologic root resorption.
Contraindications	Physiologic or pathologic tooth mobility	Physiologic or pathologic tooth mobility
	Non-vital tooth	
Hemostatic agent used	Saline/ Sodium hypochlorite	Saline/ Sodium hypochlorite
Material used	Calcium silicate-based materials like MTA, biodentine.	Antibiotics in different combinations
Treatment objective	To induce the formation of tertiary dentin in the root canal orifice.	To maintain the irreversibly inflamed or nonvital primary molar in aseptic environment.

Table 1: Tampon pulpotomy.

Pulpotomy in Reversible and Irreversible Pulpitis (Procedural differences)

The procedure is similar to the conventional pulpotomy. Maintaining a complete asepsis during the procedure is essential. Under local anaesthesia administration, access opening is carried out. Irrigating the pulp chamber using sodium hypochlorite in the concentration ranging from 0.5% to 5% is recommended to reduce the bacterial load [8,14,16]. Sodium hypochlorite in the given concentration is shown to disinfect the pulp chamber without affecting the cytodifferentiation viable pulpal cells and reparative dentin formation. 8, 9 A moist cotton pellet or cotton pellet with sodium hypochlorite or cotton pellet with saline is placed over the root canals with moderate pressure to achieve hemostasis. The time required for attaining pulpal hemorrhage is longer in case of tampon pulpotomy. The freshly prepared antibiotics or calcium silicate-based

biomaterial is placed over the pulp stumps. Followed by final restoration and stainless-steel crown placement [8,14,16].

Advantages of NIET

In uncooperative children, children with special health care needs. Minimal invasive dentistry to preserve the vitality of the remaining pulp. It reduces the physical and mental burden of the patient/ parents. It reduces the number of clinical visits. Moreover, it eliminates the procedural errors like instrument breakage, overfilling, underfilling, perforations, ledge formation. Although pulpotomy in irreversibly inflamed permanent teeth is been cited in the literature, aforementioned procedure in primary teeth could be a matter of controversy. Further, it could activate the clastic cells instead of blastic cells, which in turn can result in internal/ external root resorption. But the recent studies have shown high success rate with NIET in primary tooth.

Numerous clinical trials and animal experiments has to be conducted on NIET to identify its underlying mechanism, response of the pulp cells to the material, its effect on root resorption.

Conclusion

With the present evidences, we can conclude that NIET could be a viable alternative for conventional pulpectomy treatment in primary tooth with chronic irreversible pulpitis.

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