An Observational Study on the Materials and Techniques Commonly Adopted by Pediatric Dentists for Single Visit Pulpectomy

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ABSTRACT

The outcome of an endodontically treated primary tooth is affected not only by the biomechanical root preparation and disinfecting solutions, but also by the biocompatibility and resorbing properties of the obturating materials used through techniques that provide adequate fill and adherence of the material. The aim of the study is to recognise the most preferred obturating material and technique used by pediatric dentists for single visit pulpectomy. A total of 2496 pulpectomy procedures were obtained by reviewing case sheets and were analysed using descriptive statistics on SPSS Software. Among 2496 procedures, 96.6% utilised Metapex as the obturating material and 77.5% employed condensation technique for obturation. Metapex was the most common obturating material used and condensation technique was the preferred technique by which primary root canals were filled by pediatric dentists for single visit pulpectomy.

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INTRODUCTION

Early childhood caries (ECC) is still one of the prevailing chronic diseases affecting children around the globe. ECC not only affects a child’s oral health but also their overall general well being and can also be influenced by parents’ attitude. (Naidu et al., 2016; Gurunathan and Shanmugaavel, 2016) Early Childhood caries may be defined as the presence of one or more decayed (cavitated or non cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary teeth in a child 71 months of age or younger. Initiation and progression of caries is altered by immunological defense mechanism present in saliva. Recently, saliva has been used as a biomarker for the detection of free radicals and subsequent caries formation. (Subramanyam et al., 2018)

Root canal therapy was advocated around 1932 and its aim is to preserve deciduous teeth where pulpal tissue is affected by caries due to microbes or pathology (Packiri, 2017), trauma (Ravikumar et al., 2017) or other causes (Christabel, 2015) in a functional state until they are replaced by permanent teeth. For primary teeth which demonstrates chronic inflammation or necrosis beyond coronal pulp, pulpectomy is the preferred treatment. (Jeevanandan, 2017) Cleaning and shaping of the root canal is an important step in pulpectomy. (Govindaraju et al., 2017b) With the introduction of rotary endodontics, the overall instrumentation time for pulpectomy has reduced, increased quality of obturation with a beneficial consequence of improved child behaviour. (Govindaraju et al., 2017c,a; Jeevananda-
Hence, the primary teeth act as natural space maintainers, (Nair et al., 2018) capable of normal masticatory functions and esthetics, preserve the arch length, prevent aberrant tongue habits and speech alterations. (Panchal et al., 2019) However, the complex root morphology of deciduous teeth makes it difficult to achieve sufficient disinfection by endodontic therapy utilising chemo-mechanical instrumentation. (Govindaraju et al., 2017b)

The optimal requirements of a root filling materials are: It should not be soluble and must not cause irritation to the pulpal tissues, should have resorbable property equivalent to physiologic root resorption, be radiopaque and should not set to a hard mass which could deflect an erupting succedaneous tooth. Until now, in spite of numerous investigations involving novel combinations of obturating materials, none have been acquired to exhibit the requisite properties of an ideal agent. The success rate is defined by a fluid tight seal of the obturating material as well as that of the final restoration to prevent reinfection. Maintenance post-procedure can also be essentiated through the usage of fluoride in the form of drinking water (Somasundaram et al., 2015) and toothpastes (Ramakrishnan and Bhukri, 2018) and by adequately following oral hygiene instructions. (Govindaraju, 2017)

Zinc oxide eugenol has been used as a root filling material as early as the 1930’s and is considered as the gold standard. However, owing to its many drawbacks in regard to its antimicrobial and resorbing properties, alternative materials containing iodoform, calcium hydroxide or a combination of both have been investigated. Iodoform, despite its non-esthetic property, provides sufficient disinfectant action. (Mortazavi and Mesbah, 2004) In combination with calcium hydroxide, is responsible for superior antimicrobial effects. EndoFLAS, a novel material, has the advantage of resorbing only the extruded apical material and does not undergo hollow tube effect overcoming one of the major detrimental effects of calcium hydroxide.

The different obturation techniques of filling the canals includes conventional manual condensation by pluggers, disposable syringe technique, pressure syringes, navitips, lentulospirals etc. Previous literature quotes that disposable syringes are a simple method which amply fills the canal space. The lentulospiral is an easy and effective tool. It is of two types, namely manual lentulo spiral or mounted on a micromotor handpiece. However, the compact filling has much reliance on adherence of the material to the walls. So far, no obturation techniques have been found ideal for obturation of root canals in primary teeth.

The aim of this study is to infer the most preferred obturating material and technique used by pediatric dentists of a private dental college so as to achieve adequate root filling for a single visit pulpectomy.

**METHODOLOGY**

The observational study was conducted in the Department of Pediatric and Preventive Dentistry, during the period of June 2019 to March 2020. The ethical approval for this study was obtained from the Institutional Ethical Committee. The data collection was based on treatment procedures performed by the postgraduate students of the Pediatric Dentistry Department.

The inclusion criteria involves pulpectomies performed by the pediatric dentists in children aged 2-10 years old with the diagnosis of irreversible pulpitis. Procedures performed by undergraduates, those pulp therapies other than pulpectomy and procedures performed on special children and those with medical history were excluded from the study. The obturating materials used in this study for pulpectomy procedures were Zinc oxide eugenol, Metapex and EndoFLAS.

Data required for the study was obtained by reviewing 86,000 patient case sheets. Of which, records pertaining to children aged 2-10 years and those undergoing pulpectomy procedures were specifically analysed to extract data for this study. The obturating materials used for primary teeth pulpectomy were Metapex, Zinc oxide eugenol and EndoFLAS in two techniques namely, condensation and pressure syringe. This collective data was imported into Statistical Package for Social Sciences Software (SPSS) for data analysis. A total of 2496 pulpectomy procedures were included. Any incomplete data was excluded. The internal and external validity of the study is high by generalising the results to the Chennai city population. The obtained data was analysed using descriptive statistics on SPSS Software by IBM and the results were represented graphically.

**RESULTS AND DISCUSSION**

A total of 2496 pulpectomy procedures were analysed using Descriptive statistics on SPSS version 23.0 based on the obturating materials and techniques utilised. The study samples included pulpectomy procedures performed on 1460 males (58.5%) and 1036 females (41.5%) [Figure 1]. 72.2% of the participants belonged to the age group of 2-5 years, whereas 27.8% belonged to 6-10 years of
Out of 2496 procedures, 2359 involved Metapex as the obturating material (96.6%), 46 procedures were done using Zinc oxide eugenol (1.9%) and 38 procedures involved the use of Endoflas (1.6%). [Figure 3] Condensation technique was preferred in 1850 pulpectomies (77.5%) and pressure syringe technique in 538 cases (22.5%). [Figure 4] The application of Metapex as an obturating material was independent of gender and age group. [Figures 5 and 6] Chi-square test was performed to associate gender and the obturating material used and to correlate the obturating technique used for Metapex obturation. \( p < 0.05 \) was found to be statisti-
An indifferent attitude towards treatment of irreversible pulpitis of deciduous teeth can cause damage to the succedaneous tooth such as enamel hypoplasia or hypomineralisation and produce a negative impact on the quality of life of a child (pain, missed school days, difficulty in mastication). Such teeth must be subjected to either extraction or root canal treatment. Primary teeth with pulpal necrosis are polymicrobial in nature with a dominant activity of anaerobic bacteria residing deeply in dentin and cementum around the periradicular area. (Pinky et al., 2011) The rationale of pulpectomy includes the removal of irreversibly inflamed pulpal tissue by biomechanical root preparation following of root canals with a suitable material that resorbs at the same rate as the physiologic root resorption and that which can be eliminated if accidentally extruded through the apex. However, microorganisms in the fins and isthmus can remain even after adequate preparation and debridement. Owing to this risk, and the proximity of the succedaneous tooth to the primary root, the obturating material must be biocompatible and antimicrobial. It must be able to neutralise toxic products and prevent canal re-infection to create a favourable environment for healing to take place.

Until 2008, Zinc oxide eugenol was explicitly recommended in clinical guidelines developed by American Academy of Pediatric Dentistry. But Zinc oxide eugenol is not considered ideal as it presents with limited antimicrobial action and it tends to resorb at a rate slower than the roots of deciduous teeth. (Mortazavi and Mesbahi, 2004) It is also known to irritate the periapical tissues, cause necrosis of bone, cementum and alter the pathoferuption of the succedaneous tooth when extruded beyond the apex. Later on, based on studies the AAPD guidelines began to cite iodoform based pastes as a suitable alternative to zinc oxide eugenol. (Soleiman, 2015) Iodoform is used either in pure form or is combined with other materials. It is a potent bactericidal, non-irritant, radiopaque, and well suited for a non-shrinking and non-soluble paste. Different combination of iodoform are available: KRI paste (Iodoform, camphor, menthol, para-chlorophenol), Vitapex/Metapex (calcium hydroxide 30.3%, iodoform 40.4%, silicone oil 22.4%, others 6.9%), Endoflas (Zinc oxide eugenol - 56.5%, barium sulfate - 1.63%, iodoform - 40.6%, calcium hydroxide -
1.07%, eugenol, and pentachlorophenol). Calcium hydroxide is considered to have potent antimicrobial action primarily due to liberation of hydroxyl ions and inactivation of enzymes in the bacterial cytoplasmic membrane. It is easily resorbed when inadvertently forced beyond the apex. In this study, zinc oxide eugenol as well as iodoform combination obturating materials were used and among which the most preferred material was sought after.

In our study, a wide age range was selected; 2-5 years old (72.2%) and 6-10 years (27.8%). This was taken to consider a complete primary dentition (2-5 years) and a mixed dentition phase (6-10 years) for obturation. Metapex was the most common material used (96.6%). Metapex are available in pre-formed syringes which can be directly placed into the canals and the materials are extruded by simple pressure. Pastes containing an oily vehicle promote the lowest solubility and diffusion. Metapex, being an oil based vehicle, has enhanced fluidity and permeability, which improves the collateral benefit of root canal filling. It has a slightly faster rate of resorption than that of the deciduous teeth. This resorption may cause voids within the canal leading to the formation of hollow tube defects. (Al-Ostwani et al., 2016)

Metapex was more effective than zinc oxide eugenol because it produced a greater decrease in abnormal tooth mobility and pre-existing bone radiolucency. (Mortazavi and Mesbahi, 2004) Metapex had no toxic effect on permanent successors, and was radiopaque. This calcium hydroxide iodoform mixture to be a nearly ideal pulpal filling material for primary teeth. (Basir et al., 2019) Zinc oxide eugenol was preferred less (1.9%) maybe due to its disadvantages such as retaining the filled material and its influence on the succedaneous teeth (enamel defects on permanent incisors). A study by Sadrian and Coll reflected a mean time of 50 months for zinc oxide eugenol resorption. They advised a fill short of the apex than at/beyond the apex to avoid retention. A recent retrospective study by Bahrololoomi and Zamaninejad concluded that pulpectomy of primary molars using zinc oxide eugenol was one of the most reliable and successful treatments.

A novel material named Endoθlas was the least utilised in our study (1.6%). The combination has been made to overcome the disadvantages of combining materials. This material is hydrophilic and adheres to root canals. It has a broad spectrum of antibacterial activity and disinfects even accessory canals. It resorbs at the same pace as the physiological resorption of the primary root. The resorption is limited to excess extruded material and it is not depleted intra-radicularly. Endoθlas has high clinical as well as radiographic success over zinc oxide eugenol.

The common observation technique used was condensation (77.5%) even when Metapex was the common obturating material used. Metapex usually adopts the pressure syringe technique. This may be due to the opinion that condensation is the easier method which does not require additional equipment and the plunger pressure provides adequate flow. However, Metapex through a pressure syringe is shown to result in good quality of obturated canals. Condensation technique may be used for zinc oxide eugenol with a fill adequacy of 57%. Endoθlas may be best employed with lentilospiral and has a fill adequacy of 64.5% In a study by Khubchandani et al, the highest number of voids were seen in canals filled using lentulo spiral (20%). This is contradicting with earlier studies by Torres et al. and Memarpour et al. who found that the lentulo spiral fills the root canals better than syringe technique. Available injection techniques provided by literature have a universal defect, which is the over-filling of the obturating material that leads to inflammation and related complications.

However, all the techniques used to fill the root canals tended to form voids according to previous literature. The voids may produce microleakage in the paste leading to microorganism regrowth, re-infection and an increased risk of post-operative symptoms, especially if there are several large voids. Factors that influence the location and size of the voids include the type, viscosity, and consistency of the paste, the method used to apply the paste, and operator skill and experiences.

The merits of the study are its enormous sample size and it allows the need to procure novel and better materials for pulpectomy for the greater good irrespective of cost and handling characteristics. The limitations of the study include it’s restricted geographical location and the usage of available and cost-effective materials. Future studies may aim for a larger sample size involving different geographical locations which would yield satisfactory results.

**CONCLUSIONS**

Within the limitations of the study, Metapex was the preferred obturating material of choice by paediatric dentists for single visit pulpectomy. However, it was preferred to be used through condensation technique owing to the easy maneuverability of the material obtained through this technique.
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Conflict of interest

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REFERENCES

Al-Ostwani, A., Al-Monaqel, B., Al-Tinawi, M. 2016. A clinical and radiographic study of four different root canal fillings in primary molars. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, 34(1):55–55.

Basir, L., Khanehmajasdi, M., Khosravi, A., Ansarifar, S. 2019. Investigating The Antimicrobial Activity Of Different Root Canal Filling Pastes In Deciduous Teeth. *Clinical, Cosmetic and Investigational Dentistry*, 11:321–326.

Christabel, S. L. 2015. Prevalence of Type of Frenal Attachment and Morphology of Frenum in Children, Chennai, Tamil Nadu. *World Journal of Dentistry*, 6(4):203–207.

Govindaraju, L. 2017. Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study. *Journal of clinical and diagnostic research*, 11(3):31–34.

Govindaraju, L., Jeevanandan, G., Subramanian, E. M. G. 2017a. Clinical evaluation of the quality of obturation and instrumentation time using two modified rotary file systems with manual instrumentation in primary teeth. *Journal of clinical and diagnostic research*, 11(9):55–58.

Govindaraju, L., Jeevanandan, G., Subramanian, E. M. G. 2017b. Comparison of quality of obturation and instrumentation time using hand files and two rotary file systems in primary molars: A single-blinded randomized controlled trial. *European Journal of Dentistry*, 11(03):376–379.

Govindaraju, L., Jeevanandan, G., Subramanian, E. M. G. 2017c. Knowledge and practice of rotary instrumentation in primary teeth among indian dentists: A questionnaire survey. *Journal of International Oral Health*, 9(2):45–45.

Gurunathan, D., Shanmugaavel, A. 2016. Dental neglect among children in Chennai. *Journal of Indian Society of Pedodontics and Preventive Den-
tistry*, 34(4):364–364.

Jeevanandan, G. 2017. Kedo-S Paediatric Rotary Files for Root Canal Preparation in Primary Teeth – Case Report. *Journal of clinical and diagnostic research*, 11(3):3–05.

Jeevanandan, G., Govindaraju, L. 2018. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. *European Archives of Paediatric Dentistry*, 19(4):273–278.

Mortazavi, M., Mesbahi, M. 2004. Comparison of zinc oxide and eugenol, and Vitapex for root canal treatment of necrotic primary teeth. *International Journal of Paediatric Dentistry*, 14(6):417–424.

Naidu, R., Nunn, J., Donnelly-Swift, E. 2016. Oral health-related quality of life and early childhood caries among preschool children in Trinidad. *BMC Oral Health*, 16(1).

Nair, M., Jeevanandan, G., R, V., EMG, S. 2018. Comparative evaluation of post-operative pain after pulpectomy with k-files, kedo-s files and mtwo files in deciduous molars -a randomized clinical trial. *Brazilian Dental Science*, 21(4):411–411.

Packiri, S. 2017. Management of Paediatric Oral Ranula: A Systematic Review. *Journal of clinical and diagnostic research*, 11(9):6–09.

Panchal, V., Jeevanandan, G., Subramanian, E. M. G. 2019. Comparison of instrumentation time and obturation quality between hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, 37(1):75–75.

Pink, C., Subbareddy, V. V., Shashibhushan, K. K. 2011. Endodontic treatment of necrosed primary teeth using two different combinations of antibacterial drugs: An in vivo study. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, 29(2):121–121.

Ramakrishnan, M., Bhukri, M. 2018. Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children Review. *International Journal of Pharmaceutical Research*, 10(4):109–114.

Ravikumar, D., Jeevanandan, G., Subramanian, E. M. G. 2017. Evaluation of knowledge among general dentists in treatment of traumatic injuries in primary teeth: A cross-sectional questionnaire study. *European Journal of Dentistry*, 11(02):232–237.

Soleiman, B. N. 2015. Pulp Therapy for Primary and Immature Permanent Teeth in Children: Review of Literature. *Iranian Journal of Pediatric Dentistry*, 34(4):364–364.
Somasundaram, S., Ravi, K., Rajapandian, K., Gurunathan, D. 2015. Fluoride content of bottled drinking water in Chennai. *Tamilnadu Journal of Clinical and Diagnostic Research: JCDR, 9*(10).

Subramanyam, D., Gurunathan, D., Gaayathri, R., Priya, V. V. 2018. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries. *European Journal of Dentistry, 12*(01):067–070.