Journal of Current Medical Research and Opinion

Received 10-07-2020 | Accepted 15-08-2020 | Published Online 16-08-2020

DOI: https://doi.org/10.15520/jcmro.v3i08.326 ISSN (O) 2589-8779 | (P) 2589-8760 CMRO 03 (08), 589-596 (2020)

RESEARCH ARTICLE



Obturating Techniques in Pediatric Dentistry : Literature Review

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Abstract

Primary teeth should be preserved until their normal exfoliation time so as to maintain arch length and function in order to provide proper guidance for the eruption of permanent teeth , enhance esthetics and mastication, prevent aberrant tongue habits, aid in speech and prevent the psychological effects associated with tooth loss. Pulpectomy consists of removing the pulp tissue associated with micro-organisms and debris from the canal and obturating with resorbable filling material. Success rate of endodontic therapy depends on many factors like familiarity with the complexity of primary tooth canal systems, their formation and resorption pattern, obturating material as well as obturation technique used that is capable of densely filling the entire root canal system and providing a fluid tight seal from the apical segment of the canal to the cavosurface margin in order to prevent reinfection. This review article basically focuses on various obturating techniques used in deciduous teeth with their comparison, pros and cons.

Keywords: Deciduous teeth, Obturation techniques, Pulpectomy, Treatment

1 | INTRODUCTION:

Primary teeth are the best space maintainers and hence should be preserved and retained as long as possible. (1) Pulpectomy is the procedure of extirpating the diseased pulp associated with microorganism and debris from the canal and obturating with an antibacterial resorbable filling material (2) and it is indicated when the inflammation of the pulpal tissue involves the radicular pulp or when nonvital tooth is diagnosed. (3) Ultimately, pulpectomy is needed to achieve good hermetic seal which depends on various factors such as good biomechanical preparation, type of obturating material used and achievement of minimum voids. Obturating the canal creates a fluid tight seal along the length of the root from the coronal opening

Supplementary information The online version of this article (https://doi.org/10.15520/jcmro.v3i08.32 6) contains supplementary material, which is available to authorized users.

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to the apical system and eliminating all portals of entry between the periodontium and the root canal system. (4, 5)

Cost effectiveness of carrier which is used to carry the material to the canal, ease of obturation, control and manipulation of material have been the key factors for successful outcome of clinically precise obturation. Commonly used techniques for obturation of primary canals are conventional manual incremental lateral condensation by tuberculin syringe, amalgam pluggers, navi tip, disposable injection technique, hand-held, rotary lentulospiral, jiffy tubes, endodontic pressure syringe, past inject etc. (3)

Among all these, lentulo spiral is the most commonly used instrument as the root canal paste carrier and it can be used manually or can be mounted on micromotor handpiece. The process is easy and economical. Filling the root canal does not produce a densely compacted root canal filling and much reliance is placed on adherence of the paste to the walls of the canal. (4)

Disposable syringe is the simplest method of completely obturating canal space and filling the apical portion of the root canal and thereby, eliminating voids and incomplete filling along the root canal space. (6) The past inject paste carrier is similar to lentulospiral and it provides good placement of the obturating material, while eliminating voids and providing a high density of the obturating materials. (7, 8)

So far, none of the obturation techniques available have been found ideal for obturation of root canals in primary teeth. Past inject is used for the placement of calcium hydroxide and root canal sealers in the permanent teeth, but there are not enough studies to evaluate its use as obturation technique in primary teeth. As one of the major cause of endodontic failure is incomplete obturation of the root canal system, it leads to exposure of canals to periapical fluids, which acts as a base for growth of microorganisms or localization of bacteria in such dead spaces leading to subsequent sequelae of inflammation. So, the great emphasis needs to be placed on root canal filling materials as well as the technique of obturation. Various studies have been conducted to find out the ideal root canal filling material and best technique of obturation, but they all have been inconclusive. (3)

2 | DISCUSSION:

Deciduous dentition maintenance is very important till the permanent successors eruption so as to maintain the arch form. (3) Functional restoration and preservation of arch space can be done with endodontic treatment by resolution of the pulpal infection. Pulp therapy not only preserves but also maintain primary dentition integrity by preventing speech problems, maintaining normal masticatory function, aberrant tongue habits and preserve aesthetics. (1) Most of the studies had evaluated the success rate of different root canal filling materials used in com-parison to obturating technique for primary teeth. (3) So, the purpose of this review article is to describe the efficacy of different obturation techniques used in pediatric dentistry.

American Academy of Pediatric Dentistry Guidelines stated that primary teeth with carious pulp exposure where the radicular pulp exhibits clinical signs of hyperemia or evidence of radicular pulp necrosis with or without caries involvement is indicated for pulpectomy. (9) Success rate is influenced by both by the obturation method as well as the mixing technique of the material. The ultimate goal of obturation is to create a fluid tight seal along the length of the root canal system from the coronal opening to the apical termination. (10) Ideal filling technique assure complete filling of the canal without overfill and with minimal or no voids. (9) Various techniques have been used to fill the material into the root canals of primary teeth.

Root canal filing methods (11)

- Endodontic pressure syringe
- Lentulo spiral
- Mechanical syringe
- Incremental filling technique
- Jiffy tube

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- Tuberculin syringe
- Disposable injection technique
- Reamer technique
- Insulin syringe technique
- Navitip
- Bi-directional spiral
- Pastinject

Other techniques (12)

- 1. Amalgam plugger by Nosonwitz (1960) and King (1984)
- 2. Paper points by Spedding (1973)
- 3. Plugging action with wet cotton pellet by Donnenberg (1974)

1. Endodontic pressure syringe

This technique was developed by Greenberg (1963) and described by Spedding and Krakow et al (1965). (11) Pulpdent Pressure Syringe device is the simplest and most accurate method of filling the apical portion of the root canal and completely obturating the root canal space. (13) Voids and incomplete filling at the apex and along solid core length and the canal walls has been eliminated. This technique also eliminates difficulties encountered when filling narrow and tortuous canals and also inaccessibility of some posterior teeth. (14)

The apparatus consists of a threaded plunger and needle, syringe barrel and wrench. With pressure syringe, first fill the apex and then back fills the remaining root canal space. (11)

The pressure syringe extrudes the filling material slowly and material flow can be stopped instantly. Until wall resistance is encountered, needle is inserted into the simulated canal. (15) With slow, withdrawing-type motion, the needle is withdrawn in 3-mm intervals with each quarter turn of the screw until the canal can be visibly filled at the orifice. (11) The 13 to 30 gauge needle can be used for instrumentation of the root canal. The needles are very

flexible and can easily be maneuvered in the tortuous canals of primary molars. (10) Overfilling of the root canal is the most common finding in the deciduous dentition, especially when apical resorption and/ or the paste is applied via pressure syringe. (16)

Difficulty in removing the needle and placement of rubber stop correctly may cause the clinician to remove and reinsert the syringe repeatedly, which may displace the paste, creating voids and thereby decreasing filling quality. As the syringe has to be cleaned immediately after use, it makes the method more complex and time consuming. (17)

Reddy PVR et al (2015) conducted an in vivo study to evaluate the efficiency of 3 different obturation techniques used for primary teeth. Endodontic pressure syringe, Lentulo spiral and Incremental filling technique were tested for apical seal, extrusion and voids and the difference was found to be statistically non significant. (18)

2. Lentulo spiral

This technique was advocated by Kopel in 1970. Aylard and Johnson (1987) and Dandashi et al (1993) in vitro evaluated the obturation methods in deciduous teeth and concluded that the lentulospiral mounted in a slow speed handpiece show superior root canal filling in straight and curved root canals of deciduous teeth. No significant differences were demonstrated between the pressure syringe and lentulo spiral techniques while filling straight canals. (11, 15, 19)

Instructions (20)

- Lentulospiral is dip into the mixture
- Introduce into the canal to its predetermined length
- Rotate in the canal
- Additional amount of paste is added into the canal, till it is filled

Disadvantages (16)

- Difficulties in fitting the rubber stop
- Instrument fracture

• Tendency for extrusion beyond the apex

Gandhi M et al (2017) conducted an in vivo study for the comparison and evaluation of efficacy of 3 different obturation methods i.e. Lentulo spiral, Past inject and Disposble syringe.Maximum number of underfilled canals were seen with lentulospiral and maximum number of overfilled canals was seen with disposable syringe. Past inject exhibited maximum number of optimally filled canals. Least number of voids was observed in canals filled with the past inject technique and disposable syringe. It was concluded that past inject was the most successful technique for obturation of primary teeth. (3)

3. Mechanical syringe

This technique was proposed by Greenberg in 1971. Filling technique is governed by the shape of canal. Aylard and Johnson in their study found that the mechanical syringe performed poorly in both straight and curved canals. The screw mechanism of mechanical syringe would be able to generate much more pressure than a plunger system. (11, 15) With 30 gauge needle, cement is loaded into the syringe as per the manufactures recommendation and expressed into the canal. (17)

4. Incremental filling technique

This technique was first used by Gould in 1972. An endodontic plugger similar to canal size with rubber stop is used for the placement of a thick cement mix into the canal. Length of the endodontic plugger is equal to the predetermined root canal length minus 2 mm. (19) Flame shape thick mix is prepared which corresponds to shape and size of the canal and the paste is tapped gently into the apical area with the help of plugger. (20) Additional 2mm blocks are added until the canal is filled till the cervical area. (10)

Paste placement is difficult in a narrow, apically curved canal than in a wider apical preparation. As the endodontic plugger flexibility is limited, the paste cannot be placed to the full working length of narrow, curved canals. Also, there is an increase risk of large voids due to the movement of plugger during paste application. (11)

Kumar S et al (2016) conducted an in vitro study to compare the obturating ability of traditional plugger,

lentulo spiral, and NaviTip delivery system. Quality of obturation was determined by analyzing the presence of voids and the amount of material in the canal. The obturation with NaviTip had least number of voids as compared to other two techniques. (21)

5. Jiffy tube

In 1980, Rifficin popularised this technique. (15) It is available in curved and straight tubes. (17) First, the obturating material is mixed as slurry and carried into the canals with the help of paper points, a Jiffy tube, a syringe or a lentulo spiral root canal filler. (22) The mixture is then back-loaded into the tube. In the simulated canal orifice, the tube tip is placed and the material is placed in the canal with a downward squeezing motion till the orifice appears completely filled. (11)

Hiremath MC et al (2016) conducted an in vitro study to compare Endodontic pressure syringe, Local anesthetic syringe, Insulin syringe and Jiffy tube in obturation of primary teeth. When compared for length of obturation, Endodontic pressure syringe show best results and poor results were shown by Jiffy tube. Acceptable results were shown by Local anesthetic syringe and Insulin syringe. (17)

6. Tuberculin syringe

This syringe was used by Aylard and Johnson in 1987. The mixture is backloaded into the syringe with a 3/8-inch, 26- gauge, needle. The material is placed in the canal by slow finger pressure on the plunger till the orifice of the canal is completely filled. No difference was seen in the straight canal filling capabilities with either the mechanical or tuberculin syringes. (11, 15)

Drawback of Tuberculin syringe

During injection, tip separation is difficult resulting in repeated replacement of the needle which may compromise with optimal filling and results in increased number of voids in the paste. (16)

7. Reamer technique

A reamer is coated with obturating paste and is rotated clockwise in the canal, which is accompanied by a vibratory motion allowing the material to reach the apex and then it is withdrawn from the canal while continuing the clockwise rotary motion simultaneously. Rubber stopper keep the reamer to

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the predetermined working length and the process is repeated 5 to 7 times for each canal till the canal orifice appears filled with the paste. (11, 13)

8. Insulin syringe technique

A homogeneous mixture of obturating paste is loaded into the insulin syringe according to manufacturer's instructions and after assessing the working length of the canal, a stopper is used. The needle is kept 2mm short of apex after insertion in the canal. Material is pressed into the canal and simultaneously the needle is retrieved from the canal outwards whereas the material is pressed continuously into the canal. This avoid voids incorporation into the canal. (11) Finally, more material is pressed over the orifice and compressed using wet cotton. It can be concluded that with optimum operator skills and proper mixing of material, optimal filling with less voids and good radiopacity can be achieved with both Insulin Syringe and hand reamer technique with comparable results. (13)

Difference between insulin and tuberculin syringe

Main difference between insulin and tuberclin syringe is of markings . Insulin syringes (1ml) are of 2 types U 40 & U-100, In U-40 Insulin Syringes markings on the barrel are upto 40 Units. In U-100 markings are upto 100 Units. While in case of 1 ml Tuberculin Syringes the markings are in upto 1 ml. (23)

Disposable injection technique (6, 11)

Filling material is loaded in 2 ml syringe with 24 gauge needle in which stopper is adjusted to measured length taking RCT instrument as guide and the material is gently pushed into the canal till the material is seen flowing out of the canal orifice, after this, needle is gradually withdrawn while pushing the material till the needle reaches the pulp chamber.

Advantages

- Simple
- Economical
- Used with almost all filling materials
- Minimal chances of failure.

NaviTip

To overcome the disadvantages of previous tips, a thin and flexible metal tip was introduced viz., NaviTip (Ultradent), in the market to deliver root canal sealer. Main advantage is that it comes in different lengths and a rubber stop may be adjusted to it. (24) Flexibility is advantageous as tip can penetreate into the curved and narrow canal close to the apex. Paste is injected uniformly which gives a densely filled canal with minimum possible voids. The thin metal tip also increases operator feel during injection. (25) These tips are economical for single use and are available in 17, 21, 25, and 27 mm lengths and 29or 30-gauge cannula. Filling quality is determined radiographically. Ideal results are not achieved due to tip thickness, limited flexibility, difficulty to adapt a stopper and operator experience with the Vitapex delivery system. (21, 26)

Unfortunately, paste thickness is one of the hindrance in delivering the material through NaviTip lumen. (11) EndoSeal, a syringe delivered zinc oxide eugenol based canal sealer can be expressed by the NaviTip system. (26)

Joseph EJ et al (2019)conducted a study for the evaluation of extent of obturation and presence of voids in primary teeth using Rotary lentulospiral, Navitip and Navitip with Double Sideport techniques. It was found that Navitip Double Sideport showed the better results in terms of extent of obturation and absence of voids when compared to the Rotary lentulospiral and Navitip. No significant difference were seen between three groups for extent of obturation. (27)

Bi-directional spiral

This is a new technique developed by Dr. Barry Musikant in 1998 with bi-directional spiral. Main advantage of this technique is that it ensures that a minimal amount of obturating material will past the apex, as spirals at the coronal end of the instrument spin the material down the shaft towards the apex, while the spirals at the apical end spin the material upward towards the coronal end. Where they meet (about 3-4 mm from the apical end of the shaft), the material is thrown out laterally. (11) Bi-directional spiral mounted on slow-speed handpiece, inserted into the canal and withdrew gently while still rotating. The process is repeated until the canal orifice appeared filled with paste. (20)

Chandrasekhar S et al (2018) in their study compared the efficacy of Past inject, Bi-directional, Lentulo spiral and Incremental obturating technique. The assessment was made for a depth of fill in the canal and the presence of any voids. It was found that Bidirectional Spiral and Lentulo Spiral were superior to other techniques in providing optimally filled canals. Also, the Bi-directional spiral was superior to Lentulo Spiral in preventing overfill. (20)

Pastinject (micromega)

It is a specially designed paste carrier with flattened blades, which improves material placement into the root canal. (11) Success of obturation is dependent on flexibility and shape of tip. Its great flexibility allows it to perfectly follow the shape of the canal and also helical shape creates a translational movement, facilitates the transport of the filling material and guarantees its perfect application onto the canal walls. (20) Bi-directional spiral and Pastinject are used for the placement of calcium hydroxide and root canal sealers in the permanent teeth, but there are not enough studies to evaluate their use as obturation techniques in primary teeth. (24)

Rajasekhar S et al (2019) evaluate and compare the radiographic efficacy of the quality of obturation and assess the number of voids and the obturation time in primary teeth using Pastinject, Disposable needle and Capillary tips. Capillary tips resulted in better optimal filled canals and less obturation time, compared to disposable needle and Pastinject. No significant difference were seen among three groups in relation to voids. (28)

3 | CONCLUSION:

Perfect filling of canals is very essential for the success of root canal procedure in both primary and permanent teeth. In past, various obturation techniques have been used with success. Every technique is associated with pros and cons, however, pastin-ject seems to be more preferred than other methods as concluded from various studies but it is totally dependent on dentist choice which technique he or she want to use . But further controlled studies and research are still necessary to find an ideal obturating technique for deciduous teeth which is fast, conve-nient yet efficient.

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How to cite this article: Dalsania R., Arora A., Singla K., Vyas D., Sareen K., Chowdhury C. Obturating Techniques in Pediatric Dentistry : Literature Review. Journal of Current Medical Research and Opinion . 2020;589–596. https://doi.or g/10.15520/jcmro.v3i08.326

