

## Insights of Primary Teeth Root Canal Obturation Techniques: A Mini Review

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### ABSTRACT

**Background:** Pulpectomy is the complete extirpation of the pulp from coronal and radicular portion followed by obturating the root canals with a suitable obturating material. Retaining primary teeth in oral cavity also support the function of esthetic, mastication, maintaining arch length and guidance for eruption of permanent tooth. **Objective:** The main objective of pulpectomy is to prevent re-infection of the canal from coronal and radicular portion. **Methodology:** Various obturating technique have been used till date such as; NaviTip, Past inject, disposable syringe, lentulospiral, endodontic pressure syringe, premixed syringe, etc to obdurate root canal of primary teeth. Each of these obturating techniques has their own pros and cons which is also influenced by the obturating material used for obturation of primary teeth. A review has been conducted to assess the best obturating technique for primary teeth. **Result:** As per reported literature all most all the obturating technique is either lacking in ability to generate quality obturation in terms of optimal obturation and minimal voids. **Conclusion:** The purpose of this article is to insight the pros and cons of root canal obturating techniques and to generate new focus clinical research using the ideal requirement of obturating technique that can influence endodontics success.

### Keywords

Apical extrusion, obturation technique, optimal obturation, Primary teeth, voids

### Introduction

Primary teeth are the best space maintainers and hence should be preserved and retained as long as possible (da Costa CC et al, 2008). 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 (Rodd, 2006) Root canal therapy was advocated as early as 1932 as a method of retaining those primary teeth which had shown signs of pulpal degeneration such as abscess, sinus etc. Pulpectomy is the procedure of extirpating the diseased pulp associated with microorganism and debris from the root canal and obturating with an antibacterial resorbable filling material. The main objective of pulp therapy in the primary dentition is to retain primary tooth as a fully functional component in the dental arch to allow for proper mastication, phonation, swallowing, preservation of the space required for eruption of permanent teeth and prevention of detrimental psychological effects due to tooth loss (Erasquin & Muruzabal, 1967). The success of pulpectomy depends on obturation material and obturating technique of which latter play a very important role to achieve good hermetic seal, optimal quality of obturation and achievement of minimum voids (Ellana Jermiah, 2019). Till date various techniques/devices have been used to obdurate the root canal of primary teeth. But none of the technique fulfills ideal requirement i.e. optimal obturation, minimum voids, extrusion of filling material, obturation time and acceptability of obturation technique. Therefore it is very important to select the best technique fulfilling most of the ideal requirement and is economical as well as easy to use.

### Obturation

According to American Association of Endodontists : “ Obturation is the method used to fill and seal a cleaned and shaped root canal using a root canal sealer and core filling material (da Costa CC et al, 2008).

### Rationale for Sealing

The anatomy of primary teeth root canal system is complex due to curve and numerous accessory canals. The complex anatomy makes complete debridement of necrotic or infected pulp virtually impossible which can lead to re-infection of root canal system from toxic by-products of micro-organism and necrotic tissue. Therefore sealing the root canal system from coronal and radicular portion prevents percolation of toxic fluid from root canal system to periodontal system (Rodd, 2006), (Muruzabal, 1967).

## Obturation techniques

The ultimate goal of endodontic obturation has remained the same for the past 50 years: a) to create a fluid-tight seal along the length of the root canal system from the coronal opening to the apical termination; b) to prevent recontamination of canal from either apical or coronal leakage and to isolate and neutralize any remaining pulpal tissue or bacteria (Ellana Jermiah et al, 2019), (Kumar et al 2016). Till date various obturating technique have been used to obdurate the root canal system of primary. Ideal filling technique should assure complete filling of the canal without overfill and with minimal or no voids. It is important to select an obturation technique that offers consistency and is easy to use (Kumar S et al, 2016).

Table 1: Classification of root canal obturation techniques for primary teeth.

| Syringe techniques of obturation | Non-syringe techniques of obturation        |
|----------------------------------|---|
| Disposable needle                | Lentulospiral                               |
| Insulin syringe                  | Bi-directional spiral                       |
| Tuberculin syringe               | Incremental technique (Endodontic pluggers) |
| NaviTip                          | Past Inject                                 |
| Pressure syringe                 |   |
| Capillary tips                   |   |
| Jiffy tube                       |   |

So far, none of the obturation techniques available have been found ideal for obturation of root canals in primary teeth. As one of the major causes 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.

## Non-syringe techniques of obturation

### Incremental filling technique

In this method a thick mix of flame shaped obturating paste is place into the canal in increment. Endodontic plunger resembling to the size of canal is selected. After determining the canal length the rubber stop is adjusted 2mm short of the apex and the paste is gently push into the apical area using endodontic plunger. Studies conducted by Kumar et al in 2016 and Memarpour et al in 2013 stated that obturation quality of NaviTip and lentospiral was much better than endodontic plunger. Voids were more in root canal obturated with endodontic plunger. Similar observation was also observed by Chandreshekhar et al in 2018 in which Endoflass was used as an obturating material for primary teeth. They stated that incremental technique was associated with incomplete obturation and increase voids as compared to lentulo spiral, past inject and bi directional spiral.

### Disadvantages

Placing the paste in a narrow, apically curved canal is more difficult than in a wider apical preparation. Flexibility of endodontic pluggers is limited, the paste cannot be placed to the full working length of narrow, curved canals. In addition, movements of the plunger during paste application may increase the risk of large voids (Kumar et al, 2016), (Memarpour et al 2013).

### Lentulospiral

Lentulospiral obturation technique was advocated by Kopel in 1970. It is one of the most effective, widely accepted and successful technique for coating root canal, placing calcium hydroxide into the permanent tooth or for carrying pastes into the primary tooth. Simple design and flexibility of the lentulo spirals carry the paste uniformly through the narrow and curved canals in primary molars. Attach lentulospiral to slow or high speed handpiece, dip it into mixture of obturating paste then place the lentulospiral into the root canal to its predetermined length. Rotate the lentulospiral in the canal, if required additional paste is added into the canal till the root canal is filled. Lentulospiral rotating at 15000 rpm is effective in filling the apical third of root canal, whereas 5000rpm is more effective in filling the cervical and middle thirds of canal (Kahn et al, 1997). However it is also associated with disadvantages like difficulties in fitting the rubber stop, instrument fracture and tendency for extrusion of obturating material beyond the

apex. Study conducted by Torres et al in 2004 and Sigurdsson et al in 1992 demonstrated that the root canals obturated with lentulospiral are more homogeneous than injection paste of calcium hydroxide syringe. It has been also documented that lentulospiral is more effective in filling the cured and straight root canals of primary teeth than other techniques (Aylard & Johnson, 1987), (Dandashi et al, 1993). On the contrary study conducted by Gandhi M et al in 2017 reported that maximum number of underfilled canals was seen with lentulospiral whereas 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. They concluded that that past inject was the more superior over lentulospiral and disposable syringe.

### **Reamer technique**

Reamer technique has been the most widely accepted technique for root canal obturation of primary teeth preferably with zinc oxide eugenol cement. Obturation paste is mixed in a slurry consistency. The rubber stopper of the reamer is adjusted to the predetermined length of root canal. Reamer is coated with obturating paste and rotates clockwise into the root canal. The procedure is repeated till the canal is filled with obturating paste. Canal should be dried with paper point before obturation as moisture leads to voids and under obturation of root canal. A study conducted by Nagar et al in 2011 showed that the obturation quality of insulin syringe and reamer were closely related. However study conducted by Singh et al reported that motor driven lentulo spiral is associated with more optimally filled canal and lesser voids than reamer (Singh et al, 2015).

### **Bi-directional spiral technique**

Bi directional spiral is a relatively new method of root canal obturation for primary teeth with minimal voids and optimal obturation of root canals. The file has two directional spirals i.e from coronal and apical that meets in the centre of file. Spirals from coronal direction spin the obturating material apically whereas spirals from apical end spin the obturating material coronally. At the junction of spirals the obturation material is spin laterally ensuring minimum apical extrusion of material, minimum voids and optimal obturation. The spiral is mounted on a slow hand piece, quoted with obturating material and inserted into the root canal. The spiral is gently removed from the root canal while still rotating. The procedure is repeated till the root canal is filled. Muskant et al in 1998 conducted a study using bi-directional spiral in permanent teeth and observed that it prevents apical extrusion of material. Similar observations were reported by Chandrasekhar et al in 2018 in which they compared the efficacy of past inject, bi-directional, lentulospiral and incremental obturating technique. They stated that the bidirectional spiral was superior over other root canal obturating technique in terms of voids, over fill and optimal obturation. On the contrary study conducted by Gibson et al in 2008 reported that injected NS Ca (OH)2 showed better result as compared to bidirectional spiral, also there is always a possibility of instrument fracture.

### **Past inject**

Past inject is a specially designed engine driven instrument similar to lentulo spiral with flattened blade that used to carry obturating paste into the root canal. Its high flexibility allows it to follow the shape of the root canal and helical shape creates a translational movement that facilitates good quality obturation with minimal transport. Success of obturation with past inject is dependent on flexibility and shape of tip. Literature search revealed limited data on use of past inject as an obturating technique for primary teeth. Grover et al in 2013 stated that past inject was the most effective obturating technique for primary teeth as compared to lentulo spiral and pressure syringe, additionally placement of obturating material was much easier with past inject. However

Oztan et al in 2013 reported that special design of the past inject seems to favor a better intracanal placement of calcium hydroxide paste in single rooted teeth but studies are lacking to evaluate their use as an obturation technique in primary teeth. Bi-directional spiral and past inject 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. Similarly recent study conducted by Rajasekhar et al in 2019 stated that Capillary tips resulted in better optimal filled canals with less obturation time compared to disposable needle and past inject but no significant difference was seen among three groups in relation to voids.

## Syringe Techniques of Obturation

### Endodontic pressure syringe

The device/technique was described by Krakow & Berk in 1965. Pulpdent pressure syringe device is still considered the most simple and precise device to obturate root canal of primary teeth. It eliminates voids, incomplete fills at the apex and along the length of canals, difficulties encountered with narrow-tortuous canals and problems associated with inaccessibility with posterior teeth. The device consists of threaded plunger, needle, syringe barrel and wrench. Appropriate pulpdent pressure syringe needle is selected, place a radiopaque stop on it and insert the needle 2mm short of the apex. Fill the root apex first and then back fill the remaining root canal space by removing the needle. Before filling the remaining root canal space, withdraw the needle slightly to break contact with the canal walls. This assures that additional sealer will not be forced through the apex. Threaded plunger has 4 thread 90 degree apart indicating one-quarter turn. Turn the plunger one-quarter clockwise and wait 5 seconds which fills 1-2 mm of root apex. Thereafter keep on turning the plunger and withdrawing the needle in 3mm interval till the canal is filled completely. Moist cotton pellet is placed over the filled canal to create vertical additional vertical pressure for condensation. Remove and discard the needle. Remove excess sealer from the Pressure Syringe by turning the screw plunger clockwise as far as it can go. Wonder Orange Cleaning Solution can be used to clean the screw plunger and barrel (Berk, Karkow, 1975). Reddy et al in 2015 conducted an in vivo study to evaluate the efficiency of endodontic pressure syringe as a root canal obturation technique in terms of apical seal, periapical extrusion of obturating material and voids. They observed no statistically significant difference when compared with lentulo spiral and incremental technique. However, study conducted by Hiremath & Srivastava in 2016 reported favorable result for endodontic pressure syringe. They reported best result in terms of voids, optimal obturation and periapical extrusion with endodontic pressure syringe as compared to insulin syringe, local anesthesia syringe and jiffy tube. In-spite of having excellent review endodontic pressure syringe is associated with disadvantages that have prohibited its use in routine practice. These include:

- Apical extrusion of obturating material especially in cases with apical root resorption
- Difficulties in placing the rubber stop correctly and removing the needle (because of the need to refill the hub of the syringe several times during the procedure)
- May lead the clinician to remove and reinsert the syringe repeatedly, which, in turn, may displace the paste, create voids, and thus decrease filling quality
- In addition, the need to clean the syringe immediately after use makes this method more complex and time-consuming.

Table 2: Comparison of file size with needle gauge [20, 21]

| File size | Pressure syringe needle gauge |
|-----------|-------------------------------|
| 15-30     | 30 (Dark blue)                |
| 40        | 27 (Yellow)                   |
| 50        | 25 (Red)                      |
| 60-80     | 22 (Light blue)               |
| 90-110    | 18 (Green)                    |

### Disposable syringe

It is the simplest, cost-effective technique for root canal obturation of primary teeth. Disposable syringe of 2ml or 5 ml can be used along with 24 gauge needle. Adjust the stopper applied to a syringe to a predetermined length of root canal. Remove the syringe piston, fill the obturating material, reapply the piston and push it gently, material is seen flowing out of needle. Insert the needle into root canal to a predetermined length, push the syringe piston and gradually remove the needle till the needle reaches the pulp chamber (Bhandari & Prajapati, 2012), (Nagarathna, 2018). All most all kind of obturating material can be used with disposable syringe. Bhandari et al in 2015 stated that disposable syringe can be used with all kind of obturating material with minimal chance of failure. Nagarathna et al in 2018 compared modified disposable syringe technique with handheld lentulospiral and observed no difference in number of voids and extent of obturation with both techniques. On the contrary Gandhi et al in 2017 reported maximum number of overfilled canals and minimum number of voids with disposable syringe.

### **Jiffy Tube**

Rifficin in 1980 popularized the technique of jiffy tube. It is available in straight and curved models. Jiffy tubes are used for the placement of cements, fillings and medicaments in difficult areas. Mixed the obturating material in slurry consistency and back loaded into the tube. The jiffy tube tip is placed at the canal orifice and material is squeeze downward into the root canal till the root canal is filled. Result of jiffy tube as an obturating technique for primary teeth is not encouraging. Poor result in terms of optimal obturation of root canal and voids were reported for Jiffy tube (Hiremath & Srivastava, 2016).

### **Tuberculin Syringe**

Tuberculin syringes are the syringes often used primarily for skin tests or small subcutaneous doses that could be dispensed by the pharmacy. Aylard & Johnson in 1987 utilized tuberculin syringe for root canal obturation of primary teeth. The obturation material is mixed in a slurry type consistency and is back loaded into the syringe. After inserting the needle into root canal plunger of tuberculin syringe is pressed with slow finger pressure to dispense the obturating material into the root canal till the canal is filled completely. It has been documented tuberculin syringe is effective in filling the straight canal particularly of anterior teeth. However worst result are reported in terms of length of obturation and presence of voids as compared to other technique (Memarpour et al, 2013). The main drawback of the tuberculin syringe technique is the difficulty of separating the tip during injection, which results in the need to repeatedly replace the needle. This may compromise optimal filling and increase the presence of voids in the paste.

### **Insulin Syringe technique**

An insulin syringe has three parts: a needle, a barrel and a plunger. Its principal is similar to tuberculin syringe. It has a rubber seal at the lower end to prevent leaking out of liquid. A homogeneous mixture of obturating paste is back loaded into the insulin syringe according to manufacturer's instructions (Nagar et al, 2011). The needle is kept 2mm short of apex after insertion in the canal. Similar to tuberculin syringe plunger is slowly pressed to push obturating material into root canal; simultaneously the needle is withdrawn from the root canal outwards. Finally the material is pressed over the orifice and compressed using wet cotton (Mahajan & Bansal, 2015). Literature review revealed mixed observation in terms of quality of obturation using insulin syringe. Study conducted by Hiremath et al in 2016 stated that insulin syringe can be used an alternative technique for primary teeth root canal obturation but the results are poor as compared to endodontics pressure syringe in terms of apical extrusion of obturating material and presence of voids.

### **NaviTip Delivery tips**

NaviTip delivery tip is a thin, flexible metal tip available in four length (17, 2, 25 and 27 mm) and two gauges (29- or 30-gauge). It is used for easy delivery of endodontics sealers, irrigants and other medicaments of varying viscosities to the apex of root canal. The tip of the NaviTip is flexible at the tip for easy navigation of curved canals whereas slightly rigid through the base and centre (cannula). Each NaviTip is color coded that corresponds to endodontic file lengths. The advantages of NaviTips are: available in different length, controlled delivery to apex, economical, single use tip, rubber stop can be adjusted to a predetermined length of canal, obturating paste can be injected uniformly giving a densely filled obturation and also increases the feel of operator during obturation (Memarpour et al, 2013). However the main disadvantage of NaviTip is the thickness of paste that prevents dispensing of obturating paste through the NaviTip lumen leading to incomplete obturation. Memarpour et al in 2013 conducted a comparative study using syringe, NaviTip syringe, pressure syringe, tuberculin syringe and lentulo spiral in terms of quality of obturation and extrusion of obturating material beyond the root apex. They stated that NaviTip was efficient enough to prevent extrusion of obturating material beyond the root apex but was associated with incomplete obturation. Khubchandani et al in 2018 compared lentulospiral mounted to a slow speed contra angle handpiece and NaviTip used in conjunction with endodontic pressure syringe. They observed presence of voids was higher with lentulospiral and no significant difference in apical seal and extent of obturation. Similar observations were also reported by Joseph et al in 2019, in which NaviTip proved to reduce number of voids and extrusion of obturation material beyond the apex.

### **Premixed syringe:**

Premixed syringes are the syringes that contain mixture of obturation paste used to obdurate root canal of primary teeth. Vitapex is a premixed syringe device that contains mixture of calcium hydroxide and iodoform. It is an

antibacterial-bacteriostic paste with radiopaque properties, available in 2 gram syringe. As it is a premixed syringe available with disposable syringes it eliminates messy mixing and has excellent accessibility to apex. However syringe form of the device creates anxiety among children which ultimately affects obturating time and quality of obturation. Study conducted by Torres et al in 2004 and Sigurdsson et al in 1992 documented that obturation with premixed syringe (vitapex) is not so homogeneous when compared with lentilospiral.

### Parameters and criteria's used to assess obturation quality

#### Coll and Sadrian criteria, 1996

Assesses the length of obturation

- Under filling (Score 1) – Canal filled more than 2mm short of the apex
- Optimal filling (Score 2) – Canal filling ending at the radiographic apex or up to 2 mm short of apex
- Overfilling (Score 3) – Any canal showing filling outside the root apex

#### Time taken for obturation

Time taken for obturation also influences the endodontic success since pediatric patients have a short attention span. Prolonged dental procedures tend to make the child cranky and hence disrupt their cooperation. This was assessed in one study conducted by Rajasekhar et al in 2019 wherein he had compared three techniques: Past Inject, Disposable needle and Capillary tips. The observations showed significantly lesser time taken for syringe techniques of obturation (Capillary tips followed by disposable needle).

#### Conclusion

Till date many obturating techniques have been used to obturate root canals of primary teeth. Each one of this technique has its own limitation and advantage in terms straight or curved canal, anterior or posterior teeth, quality of obturation, presence of voids and apical extrusion of obturating material. Till date research has focused on device or technique itself, none of these studies has considered the factors that can also influence the obturation quality such as time required for obturation and anxiety associated with the technique. Many obturating devices are syringe based which influence the uncooperative behavior of child that ultimately affects obturation quality. Therefore more clinical trials are to be conducted using existing and new obturating techniques/devices incorporating the parameters like time required for obturation and acceptability of obturating device/technique.

#### References

- [1] da, Costa CC., Kunert, GG., da, Costa Filho LC., & Kunert, IR (2008). Endodontics in primary molars using ultrasonic instrumentation. *J Dent Child (Chic)*, 75, 20-23.
- [2] Rodd, HD (2006). UK national clinical guidelines in paediatric dentistry. *Int J Paediatr Dent, Suppl*, 15-23.
- [3] Erasquin, J., & Muruzabal, M (1967). Root canal fillings with zinc oxide eugenol in the rat molar. *Oral Surg Oral Med Oral Pathol*, 24,547-58,1967.
- [4] Ellana Jermiah, J., Rao, A., Srikant, N., Rao, A., & Suprabha, BS (2019). Comparative Evaluation of Three Obturating Techniques in Primary Molars: An in Vivo Study. *J Clin Pediatr Dent*, 43,372-375.
- [5] Kumar, S., Raj, S., Konde, S., & Rai, K (2016). Comparison of obturation techniques using three delivery systems: An in vitro study. *Manipal Journal of Dental Sciences*, 1,13-17.
- [6] Memarpour, M., Shahidi, S., & Meshki, R (2013). Comparison of different obturation techniques for primary molars by digital radiography. *Pediatr Dent*, 35,236-240.
- [7] Chandrasekhar, S., Prasad, MG., Radhakrishna, AN., Saujanya, K., Raviteja, NVK., Deepthi, B., & Ramakrishna, J (2018). A comparative In vivo efficacy of three spiral techniques versus incremental technique in obturating primary teeth. *J Indian Soc Pedod Prev Dent*, 36,71-75.
- [8] Kahn, FH., Rosenberg, PA., Schertzer, L., Korthals, G., & Nguyen, PN (1997). An in vitro evaluation of sealer placement methods. *Int Endod J*, 30,181-86.
- [9] Torres, CP., Apicella, MJ., Yancich, PP., & Parker, MH (2004). Intracanal Placement of Calcium Hydroxide: A Comparison of Techniques, Revisited. *Journal Of Endodontics*, 30, 225-227.

- [10] Sigurdsson, A., Stancill, R., & Madison, S (1992). Intracanal Placement of Ca(OH)2: A Comparison of Techniques. *Journal of Endodontics*, 18, 367-370.
- [11] Aylard, SR., & Johnson, R (1987). Assessment of filling techniques for primary teeth. *Pediatric Dentistry*, 9, 195-198.
- [12] Dandashi, MB., Nazif, MM., Zullo, T., Elliott, MA., Schneider, LG., & Czonstkovsky, M (1993). An in vitro comparison of three endodontic techniques for primary incisors. *Pediatric Dentistry*, 15, 254-256.
- [13] Gandhi, M., Tandon, S., Vijay, A., Kalia, G., & Rathore, K (2017). Clinical Assessment of Various Obturating Techniques for Primary Teeth: A Comparative Study. *J Clin Diagn Res*, 11, ZC48-ZC51.
- [14] Nagar, P., Araali, V., & Ninawe, N (2011). An alternative obturating technique using insulin syringe delivery system to traditional reamer: An in-vivo study. *Journal of Dentistry and Oral Biosciences*, 2:7-19.
- [15] Singh, R., Chaudhary, S., Manju, N., Chaitra, TR., & Sinha, AA (2015). Evaluation of Different Root Canal Obturation Methods in Primary Teeth Using Cone Beam Computerized Tomography. *J Clin Pediatr Dent*, 39, 462-469.
- [16] Musikant, BL., Cohen, BL., & Dentush, AS (1998). Simplified obturation of tapered canal preparation. *Compend Contin Educ Dent*, 19, 1152-1155.
- [17] Gibson, R., Howlett, P., & Cole, BOI (2008). Efficacy of spirally filled versus injected nonsetting calcium hydroxide dressings. *Dent Tramatol*, 24, 356-359.
- [18] Grover, R., Mehra, M., Pandit, IK., Srivastava, N., Gugnani, N., & Gupta, M (2013). Clinical efficacy of various root canal obturating methods in primary teeth: a comparative study. *Europ J Paed Dent*, 13, 104-108.
- [19] Oztan, DM., Akman, A., & Dalat, D (2013). Intracanal placement of calcium hydroxide: a comparison of two different mixtures and carriers. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 2002;94:93-97.
- [20] Rajasekhar, S., Mallineni, SK., & Nuvvula, S (2019). Comparative evaluation of three obturation systems in primary molars - A randomized clinical trial. *J Indian Soc Pedod Prev Dent*, 37, 297-302.
- [21] KarKow, AA., & Berk, H (1965). Efficient endodontic procedure with use of the pressure syringe. *Dent Clin N Am*, 9, 387-399.
- [22] Berk, H., & Karkow, AA (1975). The endodontics pressure syringe. *CDS Review* 68, 20-23.
- [23] Reddy, PVR., Hugar, SM., Shigli, A., Suganya, M., Hugar, SS., & Kukreja, P (2015). Comparative Evaluation of Efficiency of Three Obturation Techniques for Primary Incisors - An In Vivo Study. *Int J Oral Health Med Res*, 2:15-18.
- [24] Hiremath, MC., & Srivastava, P (2016). Comparative evaluation of endodontic pressure syringe, insulin syringe, jiffy tube, and local anesthetic syringe in obturation of primary teeth: An in vitro study. *J Nat Sci Bio Med*, 7:130.
- [25] Bhandari, SK., & Prajapati, AU (2012). Root canal obturation of primary teeth: disposable injection technique. *J Indian Soc Pedod Prev Dent*, 30:13-18.
- [26] Nagarathna, C., Vishwanathan, S., Krishnamurthy, NH., & Bhat, PK (2018). Primary Molar Pulpectomy Using Two Different Obturation Techniques: A Clinical Study. *Contemp Clin Dent*, 9, 231-236.
- [27] Mahajan, N., & Bansal, A (2015). Various obturation methods used in deciduous teeth. *Int J Med Dent Sci*, 4:708-713.
- [28] Khubchandani, M., Baliga, MS., Rawlani, SS., Rawlani, SM., Khubchandani, KM., & Thosar, N (2017). Comparative evaluation of different obturation techniques in primary molars: An in vivo study. *Eur J Gen Dent*, 6:42-47.
- [29] Joseph, EJ., Rao, A., Srikant, N., Rao, A., & Suprabha, BS (2019). Comparative evaluation of three obturating techniques in primary molars : An in vivo study. *J Clin Pediatr Dent*, 43, 372-75.
- [30] Coll, JA., & Sadrian, R (1996). Predicting pulpectomy success and its relationship to exfoliation and succedaneous dentition. *Pediatr Dent*, 18, 57-63.