

Comparative Evaluation of Cotton PTFE Tape and Foam Pellets as Endodontic Spacer in Primary Teeth: An *In Vivo* Study

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ABSTRACT

Aim and objective: This study was conducted to microbiologically evaluate cotton, PTFE tape, and foam pellets as endodontic spacer in primary teeth.

Materials and methods: Thirty primary second molars indicated for pulpectomy were included in this study. Followed by the completion of pulpectomy in each teeth cotton, PTFE tape, and foam pellets were placed as endodontic spacers randomly in 10 teeth each. The samples were collected from the pulp chamber at baseline and after 7 days to evaluate for microbial contamination of the same. The data obtained was tabulated and subjected to appropriate statistical analysis.

Results: There was a statistically significant increase in the colony forming unit after 7 days in cotton and foam pellet group. But PTFE tape group showed very minimal contamination of the pulp chamber after 7 days.

Conclusion: Within the limitations of this study, it can be concluded that PTFE tape found to be the best alternative to cotton as an endodontic spacer.

Clinical significance: In case of multiple visit pulpectomy procedure, the state of sterility must be maintained in between the appointments until a definitive coronal restoration is placed following root-canal obturation. So it is mandatory to place an endodontic spacer under a provisional restoration to maintain the patency of the root canals and prevention of the microbial growth. The PTFE tape is inorganic, nonfibrous material which can be tightly packed without any voids under the provisional restoration. So PTFE tape is the best material to maintain the root canal patency and to provide a sterile environment by preventing the microbial growth under the provisional restoration as an endodontic spacer material in between the appointments.

Keywords: Cotton, Endodontic spacer, Foam pellets, Microbial contamination, PTFE tape, Pulpectomy, Randomized clinical trial.

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INTRODUCTION

The main objective of pulp therapy in the primary dentition is to retain every 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.¹ It can be carried out either by single visit or by multiple visit based on the indications. If pulpectomy is carrying out in multiple visit, it is mandatory to use endodontic spacer in between the appointments to prevent the microbial contamination. Sterile environment must be ensured between appointments up to the placement of permanent restoration during root-canal procedure.²

Previous studies showed that it is mandatory to use interappointment provisional restorations to provide a fluid-tight coronal seal. An important consideration in the seal provided by temporary restoration is its thickness. A thickness of more than 4 mm of the interim restoration is a prerequisite for an effective seal.³ Also sometimes, the kind of endodontic spacer used below the temporary restoration, can also cause microbial contamination. Apart from that endodontic spacers also help easy removal of provisional restoration by avoiding the chances of unwanted intact tooth structure loss, perforation on floor of pulp chamber, prevent provisional restorative materials entrapment into the root-canals which results in canal blockage.⁴

Cotton is the clinician of choice as an endodontic spacer since years. Cotton used to facilitate the removal of the temporary

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restoration without removing excess tooth structure and also to avoid canal blockage in the subsequent appointment. However, the cotton pellet placed in between the provisional and the root canal orifice can compromise the coronal seal by the reduction in thickness of temporary restoration. In addition, the cotton spacer can also adversely affect the coronal seal due to the wicking action of cotton fibers, or by interfering with the adaptation of temporary or by the sinking of the temporary under masticatory load especially in insufficiently flared access cavity walls.⁵

To overcome the pitfalls of cotton as an endodontic spacer, clinicians start using other materials like foam pellets and PTFE tape for trial. Polytetrafluoroethylene (PTFE) tape is an endodontic spacer which full fills all the ideal features like nonfibrous, inorganic, ribbon like material. As the same is nonfibrous, it reduces the

chances of getting impregnated into the provisional restoration. It is nonspongy; hence it gives better support to the overspreading provisional restoration.⁴

The aim of this study is to compare and evaluate the microbial contamination in PTFE tape, cotton and foam pellets used as endodontic spacer.

MATERIALS AND METHODS

The present *in vivo* study was carried out in the Department of Pediatric and Preventive Dentistry, DJ College of Dental Sciences & Research, Modinagar in association with Department of Oral Pathology and Microbiology, ITS Dental College and Hospital, Muradnagar.

Informed consent was obtained from the patient's parents/guardian for the treatment. Ethical clearance was taken from the Institutional Ethical Review Board (DJD/IBC/2019/A-27) to conduct the study.

Inclusion Criteria

Total 30 primary molars requires endodontic treatment were included in the study, with inclusion criteria like:

- Patients aged between 4 and 9 years.
- Primary molar teeth with no evidence of furcation radiolucency on IOPA.
- Teeth with less than one third root resorption.

Exclusion Criteria

- Patients with medical complications or who are taking antibiotics.
- Any teeth having fracture line.
- Teeth which are grossly decayed.

Thirty subjects full filling the inclusion criteria were enrolled for this study and undergone pulpectomy procedure. After metapex obturation the teeth were randomly allocated into three different groups having 10 teeth in each group. Cotton, PTFE tape, and foam pellets were placed as endodontic spacers in group 1, group 2, and group 3, respectively.

- Evaluation of microbial contamination:
- The study samples were collected in two phases- phase 1 base line sterility and after 7 days:
- Phase 1 (Baseline sterility sample)

After obturation using metapex (Meta Biomed co. ltd, Republic of Korea) under rubber dam (GDC dental, Horshiarpur) isolation; profuse irrigation was done on the pulp chambers with 5.25% sodium hypochlorite followed by saline. The first sample was collected in all the subjects from the pulp chamber using a sterile spoon excavator (Fig. 1) and transferred into 2 mL glucose broth (Fig. 2). This is to access the baseline sterility at this stage. The samples thus collected was sent for microbiological examination within 4 hours to evaluate the microbial growth on blood agar plates.

The glucose broth were incubated for 48 hours at 37°C in incubator for microbial growth and 0.1 mL of sample was inoculated on blood agar plates to evaluate microbial growth and bacterial colony count. Plates were incubated at 37°C in an incubator for 24–36 hours. The number of bacterial colonies in the plates were counted using digital colony counter in terms of CFU/mL of the inoculum.²

Sterilized cotton pellets, PTFE tape (Quickfix PTFE Tape, Wembley Laboratories Ltd, New Delhi) (Fig. 3) and foam pellets



Fig. 1: Pulp chamber using a sterile spoon excavator

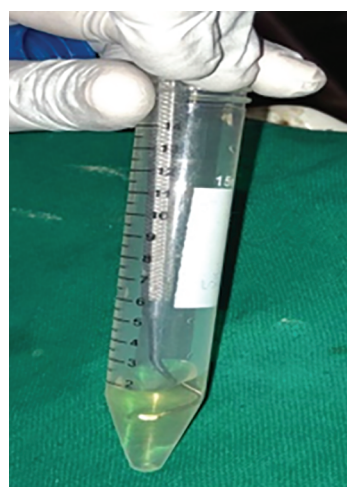


Fig. 2: 2 mL glucose broth

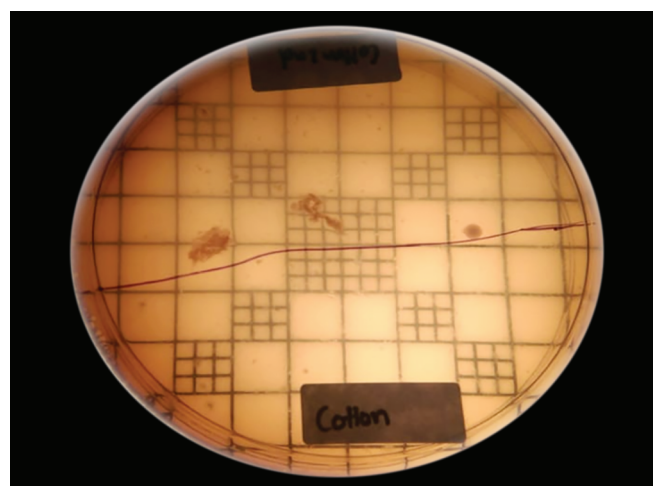


Fig. 3: Sterilized cotton pellets, PTFE tape

(Skubes foam pellets, Den MATLAB, New Delhi) of standardized size (2.5 mm)⁴ were placed as endodontic spacers in group 1, group 2, and group 3, respectively. Above these endodontic spacers Cavit G (3M ESPE, Bangalore), the provisional restoration was placed in a standardized thickness of 3 mm.⁶

- Phase 2 (After 7 days sample)

Patient were recalled after 7 days. Under rubber dam isolation temporary restorations were removed using micromotor hand piece (NSK, Japan) by aseptic technique. The spacers were removed using a sterile tweezer and samples were collected from the pulp chamber as collected for the baseline sterility sample. This is to determine the microbial leakage through the spacer materials to access cavity (Fig. 4).

The glucose broth were incubated for 48 hours at 37°C in incubator for microbial growth and A sample of 0.1 mL was inoculated on blood agar plates to evaluate microbial growth and bacterial colony count. Plates were incubated at 37°C in an incubator for 24–36 hours. The number of bacterial colonies in the plates were counted using digital colony counter in terms of CFU/mL of the inoculum (Fig. 5).²

The data were tabulated and statistically analyze using Paired *t*-test, ANOVA and Tukey's *post hoc* analysis.

RESULT

The values were tabulated and statistically analyzed using paired *t*-test, ANOVA, and Tukey's *post hoc* analysis.

Comparison of baseline and after 7 days microbial contamination in access cavity of group 1, group 2, and group 3 (Table 1).

On evaluation it was found that in group 1 (cotton as endodontic spacer material) base line colony count was zero but after seven days we found a significant amount of microbial leakage in the access cavity.

In group 2 (PTFE tape as endodontic spacer material) base line colony count was zero. Even after 7 days there was no significant amount of microbial leakage in the access cavity found.

In group 3 (foam pellet as endodontic spacer material) base line colony count was zero but after 7 days we found very significant amount of microbial leakage in the access cavity.

Comparison of Means of Microbial Contamination in Access Cavities of all Groups (Table 2)

The intergroup comparison of various groups was done using ANOVA test. The mean variation of microbial contamination were compared between different groups and within the groups. Statistical analysis showed F value of 2446.293 which was statistically significant with *p* value of 0.000*.

Multiple Comparisons using *Post Hoc* Turkey's test (Table 3)

Intergroup comparison of various groups was done using Tukey's two-sided *Post Hoc* tests. Inter group comparisons between the mean microbial contamination of various groups shows that group 1 (Cotton), group 2 (PTFE tape), and group 3 (Foam pellet) showed statistically significant difference with each other. There was a significantly lower colony count in the access cavity for group 1 (PTFE tape) as compared to group 2 (Cotton) and group 3 (Foam pellets). Foam pellets showed highest microbial leakage into the access cavity.

DISCUSSION

The main principles of endodontic treatment should be aimed at eliminating all bacteria from the tooth, and then attempting to maintain the tooth in this disinfected state by preventing any

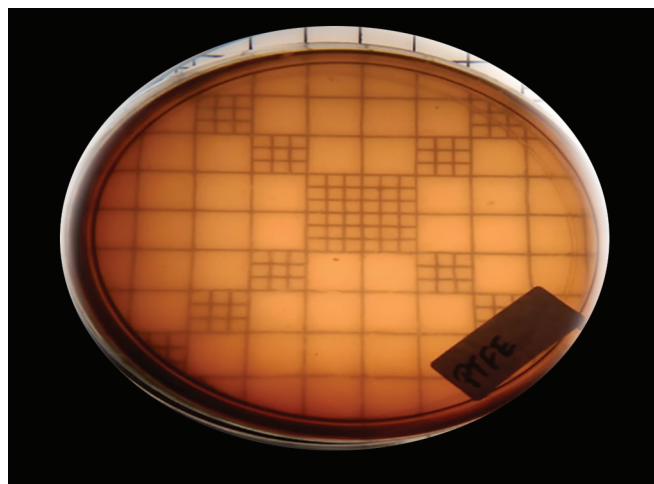


Fig. 4: Microbial colony formation seen in cotton group after 7 days

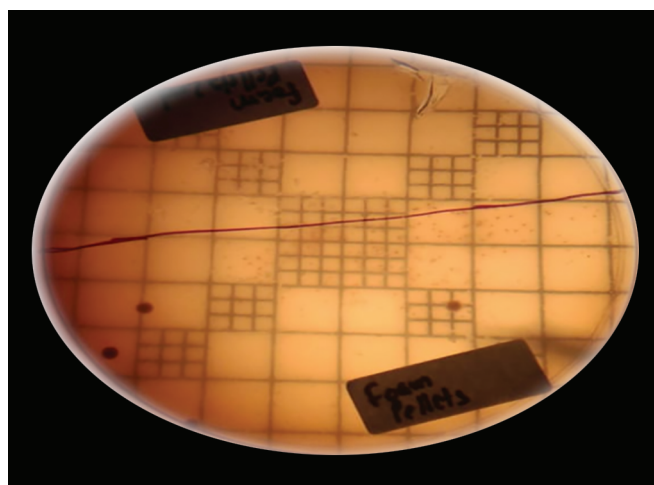


Fig. 5: Microbial colony formation seen in PTFE tape group after 7 days

further ingress of bacteria during and after treatment.⁷ Recent *in vitro* studies have demonstrated that the exposure of the coronal root canal filling to saliva for a few days resulted in extensive coronal leakage ranging from 33–85% of the total root length. Lack of satisfactory temporary restorations during endodontic therapy ranked second amongst the contributing factors in continuing pain after commencement of treatment.⁸

The protocols used in this study were similar to those of other studies that have evaluated leakage of Cavit restorations. There was a standardization on the length of PTFE tape (approximately 2.5 inches) as well as on the cotton used for each sample. A periodontal probe was used to measure the depth of the access cavity after placement of cotton or PTFE tape to ensure that it could lodge an average thickness of 3 mm temporary restorative material based on studies. Time period of 7 days were opted based on previous *in vitro* and *in vivo* studies. Obturated canals were considered to prevent any microbial leakage from canals to access cavity and thus any bacteria present on the spacer materials or in the access cavity will be due to coronal leakage only. Also obturation with Metapex was done as it is considered as nearly ideal obturating material for primary root canals. To prevent wetting of spaces and

Table 1: Comparison of baseline and after 7 days microbial contamination in access cavity of group 1, group 2, and group 3

	Paired differences					T value	df	p
	Mean difference	Std. deviation	Std. error mean	95% confidence interval of the difference				
				Lower	Upper			
Group 1	-721.800	26.050	8.238	-740.435	-703.165	-87.620	9	0.000
Group 2	-6.000	2.500	0.833	-7.922	-4.078	-7.200	8	0.000
Group 3	-980.111	48.084	16.028	-1017.072	-943.150	-61.149	8	0.000

Group 1, Cotton; Group 2, PTFE tape; Group 3, Foam pellets

Table 2: Comparison of means of microbial contamination in access cavities of all groups

	ANOVA				
	Sum of squares	df	Mean square	F	Sig.
Intragroup comparison	504,0270.200	2	252,0135.100	2446.293	0.000
	27,815.000	27	1030.185		

Table 3: Multiple comparisons using *post hoc* Tukey's test

		Mean difference (I-J)	Std. error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Group 1	Group 2	715.600*	14.354	0.000	680.01	751.19
	Group 3	-252.100*	14.354	0.000	-287.69	-216.51
Group 2	Group 3	-967.700*	14.354	0.000	-1003.29	-932.11

access cavity by an airtor, micromotor was used for removal of provisional restoration after 7 days.²

The results showed that access cavities of cotton and foam pellet spacer groups were positive for microbial contamination after 7 days. It indicates explicit microbial leakage and contamination underneath cotton and foam pellets when these were used as spacers below provisional restoration. These findings are in line with the study conducted by Newcomb et al. in which they evaluated the effect on the sealing of a zinc oxide-calcium sulfate based provisional restoration when cotton fibres entrapped through the filling material and reached the external surface of the provisional restoration. The results showed that even a very small amount of cotton entrapped between the wall of the dentinal tubes and the provisional restoration significantly reduced the sealing ability of the provisional restoration. And porous nature of the foam pellets will compromise a proper sealing.

In our study, the possible reasons for microbial contamination in the cotton group could be due to organic and fibrous nature of cotton which can cause entrapment of fibers within the provisional restorative material and may promote wicking as well as bacterial uptake from oral cavity to the access cavity.

In the present study, the possible reasons for significantly less contamination on PTFE tape must be due to its uncomplicated handling characteristics, mainly its unique property of nonadherence to any part of the pulp chamber. This promises an easy removal of tape in single piece, ensuring the access cavity being free of any remnant of spacer. Apart from this, the PTFE tape is inorganic and non-fibrous; hence avoiding bacterial uptake and getting entrapped within the provisional restoration.⁹

In our study, PTFE tape showed significant reduction in bacterial contamination compared to cotton and foam pellets as

endodontic spacer. These findings are important for pedodontist because one of the major objectives of multiple visit pulpectomy is difficulty in effective sealing off of the root canal system from the oral cavity. Hence PTFE tape can be considered as the ideal endodontic spacer underneath provisional restoration especially during multi visit pulpectomy.

LIMITATIONS OF THE STUDY

The study participants were different for each endodontic spacer. The microbial level in each participant's oral cavity will be different. It could have been better if this study was conducted in split mouth technique. Moreover, the sample size of this study was not up to the mark to drag into a proper conclusion.

CONCLUSION

Within the limitations of this study, it can be concluded that PTFE tape as endodontic spacer in primary teeth is a better alternate to cotton and foam pellets.

CLINICAL SIGNIFICANCE

In case of multiple visit pulpectomy procedure, the state of sterility must be maintained in between the appointments until a definitive coronal restoration is placed following root-canal obturation. So it is mandatory to place an endodontic spacer under a provisional restoration to maintain the patency of the root canals. PTFE tape is the best material to maintain the root canal patency and to provide a fluid tight seal under provisional restoration as an endodontic spacer material in between the appointments.

MANUFACTURER NAMES

- Meta Biomed Co. Ltd, Republic of Korea
- GDC Dental, Horshiarpur, Punjab, India
- Quickfix PTFE Tape, Wembley Laboratories Ltd, New Delhi, India
- Skubes foam pellets, Den MATLAB, New Delhi, India
- 3M ESPE, Bengaluru, Karnataka, India

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