

ENDODONTIC SPACER MATERIAL: A REVIEW

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ABSTRACT

In endodontics, in order to achieve a successful outcome in root canal treatment, the root canals need to be properly cleaned and shaped to remove debris and micro-organisms, and root canals should be sealed completely with the temporary restorative material when multiple visit approach is chosen. A 'spacer material' is placed apically to temporary restoration which is termed as endodontic spacer material. Endodontic spacer materials like cotton pellet, teflon tape, sponge, foam temporarily seal the tooth and prevent the entry of debris, fluids and micro organisms into the canal. Moreover, they prevent the escape of medications inserted in pulp chamber and root canal and aid in their retention. The subsequent article will offer an overview about various endodontic spacer materials used in dentistry.

Key words: spacer, barrier material, cotton pellet, teflon tape, sponge, foam.

INTRODUCTION

The main causative factors of pulpal and periradicular diseases are related to microbial origin.¹ As a consequence, the principal goal of root canal treatment is to eradicate bacteria from the root canal and prevent reinfection.² Root canals should be completely sealed after cleaning and shaping is done to remove debris and micro organisms for its successful outcome.³ Failure in adequate sealing of root canal space can cause inflammation in the periapical tissues by micro-organisms themselves and their toxins.⁴ Root canal treatment can be accomplished in single visit, therefore, eliminating the need for dressing and temporization.⁵ 'One-visit' endodontic treatment is endorsed by some practitioners but this is not universally accepted, especially in cases with necrotic or infected root canals.⁶ Hence, many professionals prefer multiple visit approach to ensure no pain or postoperative complications before obturation of root canal system and for reduction of microbial levels which are compatible with tissue repair through use of intracanal medication, chemical and mechanical preparation and additional therapies.⁷ In these conditions, provisional restorations are required and are placed within an endodontic access cavity.⁸ Temporary material prevents the saliva with its micro-organisms from gaining entrance into root canal, also, it prevents medicaments placed into pulp chamber from escaping into the oral cavity.⁹ Temporary restorative material should be used clinically with the thickness of 3.5mm.¹⁰

Endodontic spacer materials are commonly placed onto canal orifices and underneath the provisional restorations. Endodontic spacers are placed between endodontic appointments or after completion of endodontic therapy, and

until the final restoration is placed.¹ These are also known as 'pulp spacer' or 'barrier material'.^{3,8}

Endodontic spacers are used because of following reasons -

- 1) For the facilitation of easy removal of temporary restorative materials without running risk of unnecessary removal of intact tooth structure or perforating the floor of pulp chamber.
- 2) For the prevention of temporary materials from entering into canals and causing canal blockade.
- 3) To aid in relocation of chamber and canals.¹¹

Ideally, endodontic access spacers should possess following properties -

- Easy to place and remove.
- Minimize bacterial leakage and should not promote bacterial growth.
- It should be inexpensive.
- Inorganic.
- Easily accessible.
- Autoclavable.
- Consists of minimal volume.¹

Spacer materials should enhance or should not compromise the sealing ability of the provisional restoration.¹²

TYPES OF ENDODONTIC SPACER MATERIALS

Spacer material are used as a small-sized pellet that covers canal orifice but avoids the floor of the pulp chamber or as thin and well adapted layer to cover the floor of the chamber.⁵ Various spacer materials used are enlisted below-

COTTON-

A cotton layer is frequently used to place in pulp chamber before the placement of temporary restoration.¹³ Cotton was widely advocated as an endodontic spacer material in

literature from the late 1970s.¹⁴ It was observed by Dillard et al that cotton was used as spacer by 62% of general practitioners and 80% of endodontists.¹⁵ The sufficient thickness of cotton pellet should be used to prevent the lodgment of temporary material inside the canals and simplify the access for endodontic procedure and restoration. It should also be thin enough to permit adequate space with the cavosurface margin of the access cavity. This space allows the placement of a sufficient thickness of the temporary material.³

The advantage of cotton pellet use includes less time being taken in preparing the pulp chamber for restoration. Additionally a positive factor is the reduction of the risk of iatrogenic perforation during this preparatory step.¹⁶ The use of cotton has increasingly been challenged by growing evidence.¹² Although, the use of cotton pellets fulfils the aims of spacer materials, it also has following disadvantages-

1. The fibrous, organic, and hydrophilic nature of the cotton can elevate bacterial growth and induce leakage.
2. Cotton fibers may be entrapped between the restorative material and the access cavity walls, resulting in the formation of gaps or unfilled spaces in these areas and further leakage may be promoted subsequently.
3. The adequate compaction of the overlying temporary restoration may be interfered by the soft and porous nature of the cotton pellet, possibly leading to formation of voids within the restorative material.¹²
4. Cotton layer between the temporary and pulpal floor does not allow the temporary to seal the furcal accessory canal.¹³
5. The displacement of overlying restorative material during masticatory loading may be caused by cotton pellet because of its yielding nature which compromise stability of restorative material.
6. The cavity walls may be adhered to by the cotton fibers, hence the marginal integrity of the provisional restoration is affected and fluids may be drawn from the oral cavity by cotton acting as a wick.⁸

PTFE TAPE- Polytetrafluoroethylene (PTFE) tape, commonly known as Teflon tape. It is a polymer material which possesses several unique properties and has been used in different dental applications including endodontic access spacers.¹²

Various properties of PTFE tape which suggest its potential

use in restorative dentistry are enlisted below –

1. PTFE is an inert material, it is capable of resistance to solvents and acids and it do not degrade when used with dental etchants.
2. PTFE has a low static and kinetic coefficient of friction (0.1) which ensures a 'non-stick' application and removal without leaving behind a residue.
3. PTFE's 'high break elongation' makes it capable of being stretched up to 400% of its original length without tearing.
4. PTFE does not significantly lose its shear strength despite the material being available in thin sections (30–120 µm)
5. In addition to excellent insulating properties, PTFE has a high melt viscosity (approximately six times that of most fluoropolymers), this allows the tape to be sterilised for dental purposes in an autoclave.
6. Non-flameouts structure of PTFE ensures restorative materials are not contaminated.¹⁷

PTFE is commonly known as plumber's tape, it satisfies all the ideal requirements for its use as endodontic spacer material. It possesses many advantages for its use as a spacer material-

1. The ribbon like quality and non fibrous nature of PTFE ensures that the overlying provisional restoration is not impregnated with spacer material.
2. Inorganic nature of PTFE tape reduces the potential of bacterial uptake by wicking.
3. PTFE being non-spongy allows better support of overlying provisional restoration.¹⁸
4. PTFE is firm when condensed, thus, it allows better compaction and increased thickness of the provisional restoration as compared with the soft cotton pellet.¹²

Hence, PTFE has been gaining popularity as an endodontic spacer because it possesses many of the advantages of cotton spacers and it has the potential to overcome the disadvantages of unsatisfactory stiffness and the potential to allow microbial growth.¹⁹ Despite being highly advantageous, it possess some disadvantages of-

1. Accumulation and blockage of pipes if disposed in the water waste system, owing to its non-biodegradable nature.
2. The tape can be easily distorted or displaced by the high volume suction, if not secured.¹⁷

OTHER ENDODONTIC SPACER MATERIALS-

Other materials such as foam pellets have been tried as spacers by many practitioners. These endodontic sponges serve as chairside storage and mechanical cleaning aid of root canal instruments. Rotary NiTi endodontic instruments can be sterilized effectively with or without rubber stoppers when inserted into endodontic sponges. As an endodontic spacer, foam do not adhere to the walls of the access cavity and it can be easily placed and removed, as compared to cotton, which does tend to leave fibers behind and is more difficult to remove.¹⁴

According to survey done by Alnasar F, it revealed that other than cotton as pulp spacer, Sponge and Foam pellet are also being used by 1.6% of dentists in both Saudi and Non- Saudi region as an endodontic spacer material.³ However, their use as an endodontic spacer has been only mentioned and not explored in any clinical study.¹⁴

EVALUATION BETWEEN ENDODONTIC SPACER MATERIALS

Olsson et al. (2017) evaluated which spacer showed less bacterial leakage between endodontic treatments. Cotton and PTFE spacers were collected after a 2- to 4-week interval between the first and second appointments. The study found that PTFE (polytetrafluoroethylene) is a more effective material than cotton for use as an endodontic spacer. The results strongly support the recommendation of PTFE over cotton for this purpose.¹⁹

Alkadi M et al. (2023) conducted a micro-computed study which aimed to evaluate the effect of two spacer materials (cotton pellet and polytetrafluoroethylene [PTFE]) on gap and void formation in the cavitation restoration used for endodontic temporization. The findings of study indicated that PTFE was associated with less gap formation and, hence, it performed better than the cotton pellet as a spacer material beneath the Cavit restoration during endodontic treatment.¹²

Pisal NS et al conducted a study in 2021 which was an ex vivo investigation aimed at microbiologically evaluating cotton, polytetrafluoroethylene (PTFE) tape, and foam as potential endodontic spacer materials in permanent premolars and molars. The research compared the effectiveness of these materials in preventing microbial contamination and assessed their suitability for use in endodontic procedures. Results of this study stated that PTFE tape and foam group performed better than cotton.¹⁴

CONCLUSION

This review revealed that temporary coronal restorations and endodontic spacers are integral parts of a two-appointment endodontic procedure. It revealed that both cotton and PTFE tape are both effective spacer materials, however, PTFE is more superior than cotton as an endodontic spacer and it can be considered clinically as potential alternative spacer.

REFERENCE-

1. Alkadi M, Alsalleeh F. Ex vivo microbial leakage analysis of polytetrafluoroethylene tape and cotton pellet as endodontic access cavity spacers. *J Conserv Dent*. 2019 Jul-Aug;22(4):381-386. doi: 10.4103/JCD.JCD_555_18. PMID: 31802824; PMCID: PMC6873601.
2. Atila-Pektaş B, Yurdakul P, Gülmez D, GÖrduysus O. Antimicrobial effects of root canal medicaments against *Enterococcus faecalis* and *Streptococcus mutans*. *IntEndod J*. 2013 May;46(5):413-8. Doi: 10.1111/iej.12004. Epub 2012 Oct 24. PMID: 23095092.
3. Alnassar F. Common Temporization of Access Cavity and Pulp Spacers Practiced by Endodontists in Saudi Arabia: A Cross-sectional Study. *Open Dent J*, 2023; 17: e187421062308091. <http://dx.doi.org/10.2174/18742106-v17-230925-2022-158>
4. Saunders WP, Saunders EM. Coronal leakage as a cause of failure in root-canal therapy: a review. *Endod Dent Traumatol*. 1994 Jun;10(3):105-8. Doi: 10.1111/j.1600-9657.1994.tb00533.x. PMID: 7995237.
5. Naoum HJ, Chandler NP. Temporization for endodontics. *IntEndod J*. 2002 Dec;35(12):964-78. Doi: 10.1046/j.1365-2591.2002.00600.x. PMID: 12653314.
6. Abbott PV. Factors associated with continuing pain in endodontics. *Aust Dent J*. 1994 Jun;39(3):157-61. Doi: 10.1111/j.1834-7819.1994.tb03084.x. PMID: 8067931.
7. Moreira MS, Anuar ASN, Tedesco TK, Dos Santos M, Morimoto S. Endodontic Treatment in Single and Multiple Visits: An Overview of Systematic Reviews. *J Endod*. 2017 Jun;43(6):864-870. Doi: 10.1016/j.joen.2017.01.021. Epub 2017 Apr 27. PMID: 28457639.
8. Mathew A, Lee S, Ha W, Nagendrababu V, Rossi-Fedele G. Microbial Contamination Comparison Between Cotton Pellet and Polytetrafluoroethylene Tape Endodontic Spacers: A Systematic Review. *EurEndod J*. 2021 Aug;6(2):143-150. Doi: 10.14744/eej.2021.52244. PMID: 34650011; PMCID: PMC8461481.
9. Webber RT, del Rio CE, Brady JM, Segall RO. Sealing quality of a temporary filling material. *Oral Surg Oral Med Oral Pathol*. 1978 Jul;46(1):123-30. Doi: 10.1016/0030-4220(78)90446-2.

- PMID: 277870.
10. Weston CH, Barfield RD, Ruby JD, Litaker MS, McNeal SF, Eleazer PD. Comparison of preparation design and material thickness on microbial leakage through Cavit using a tooth model system. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2008 Apr;105(4):530-5. Doi: 10.1016/j.tripleo.2007.10.014. PMID: 18329588.
 11. Prabhakar AR, Dixit K, Raju OS. Microbiologic Evaluation of Cotton and Polytetrafluoroethylene (PTFE) Tape as Endodontic Spacer Materials in Primary Molars An in Vivo Study. *J Clin Pediatr Dent.* 2018;42(1):21-26. Doi: 10.17796/1053-4628-42.1.4. Epub 2017 Sep 22. PMID: 28937894.
 12. Alkadi M, Algahtani FN, Barakat R, Almohareb R, Alsaqat R. Assessment of the effect of spacer material on gap and void formation in an endodontic temporary restoration using micro-computed tomography. *Sci Rep.* 2023 Mar 16;13(1):4354. Doi: 10.1038/s41598-023-31290-8. PMID: 36927887; PMCID: PMC10020472.
 13. Newcomb BE, Clark SJ, Eleazer PD. Degradation of the sealing properties of a zinc oxide-calcium sulfate-based temporary filling material by entrapped cotton fibers. *J Endod.* 2001 Dec;27(12):789-90. Doi: 10.1097/00004770-200112000-00020. PMID: 11771593.
 14. Pisal NS, Shah NC, Dedania MS, Bajpai NA, Gandhi N. Microbiologic evaluation of cotton, polytetrafluoroethylene tape, and foam as an endodontic spacer material in permanent premolars and molars: An ex vivo study. *Endodontology* 2021;33:139-43.
 15. Vail MM, Steffel CL. Preference of temporary restorations and spacers: a survey of Diplomates of the American Board of Endodontists. *J Endod.* 2006 Jun;32(6):513-5. Doi: 10.1016/j.joen.2005.11.009. Epub 2006 Apr 4. PMID: 16728239.
 16. Dillard CR, Barfield RD, Tilashalski KR, Chavers LS, Eleazer PD. Comparison of endodontist versus generalist regarding preference for postendodontic use of cotton pellets in pulp chamber. *J Endod.* 2002 Sep;28(9):656-7. Doi: 10.1097/00004770-200209000-00007. PMID: 12236310.
 17. Sattar MM, Patel M, Alani A. Clinical applications of polytetrafluoroethylene (PTFE) tape in restorative dentistry. *Br Dent J.* 2017 Feb 10;222(3):151-158. Doi: 10.1038/sj.bdj.2017.110. PMID: 28184055.
 18. Paranjpe A, Jain S, Alibhai KJ, Wadhwani CP, Darveau RP, Johnson JD. In vitro microbiologic evaluation of PTFE and cotton as spacer materials. *Quintessence Int.* 2012 Sep;43(8):703-7. PMID: 23034423.
 19. Olsson T, Chan D, Johnson JD, Paranjpe A. In-vivo microbiologic evaluation of polytetrafluoroethylene and cotton as endodontic spacer materials. *Quintessence Int.* 2017 Jul 20:609-614. Doi: 10.3290/j.qi.a38679. Epub ahead of print. PMID: 28740972.