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MICROBIOLOGIC EVALUATION OF DIFFERENT ENDODONTIC SPACER MATERIALS: AN IN VIVO STUDY

Dental Science

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ABSTRACT

Maintaining the sterility of root canal system in between the endodontic treatment appointments is very important to prevent the growth of micro-organism.

AIM: To comparatively evaluate the efficacy of cotton and polytetrafluoroethylene (PTFE) tape used as spacer materials under intermediate restoration.

METHODOLOGY: Twenty patients undergoing root canal treatment in mandibular molar were selected and randomly divided into two groups. After obturation, in the pulp chamber, placed either cotton or PTFE and restored with Glass ionomer restorative material. Samples were obtained from the access cavity at baseline and after seven days. They were checked for microbial contamination with digital colony count.

RESULT: No microbial colony at baseline for both materials, but after seven days, significant increase in microbial growth in both materials. Significant difference in colony count on cotton, compared to PTFE and PTFE showed less microbial contamination.

CONCLUSION: Compared to cotton, PTFE proves to be a better spacer material.

KEYWORDS

INTRODUCTION

Endodontic treatment could be completed in a single sitting, but in certain conditions, requires multiple sittings. The later situation has certain inherent drawbacks in the form of a possibility of contamination of the root canal system in between the appointments.[1]Thiscould lead to initiation of the secondary infection or exacerbation of the existing primary infection.[2]

In between the appointments, the root canal is filled with an intra-canal medicament and the pulp chamber is filled with a spacer material followed by a provisional restoration. The provisional restorative material bears the occlusal forces and seals the outer portion of the access cavity. Thus they act as a stress bearing material and have to be placed in a thickness of or greater than 3mm.[3]The endodontic spacer materials that are placed underneath these provisional restorative materials tend to occupy the remages of cotton. The ideal spacer material should be inert, inorganiaining space of the pulp chamber. They have an important role in facilitating the removal of the overlying filling material, preventing the same from entering the pulp chamber, leading to blockage of the orifice and the canal.[4]

Cotton has conventionally been the most widely used endodontic spacer material.[5] It has certain inherent disadvantages of adhering to the cavity walls, acting as an unstable cushion, compromising the stability of the provisional restoration.[6] It may encroach upon the lateral space, thus limiting its thickness.[3] They could even compromise the seal of the provisional restoration.[7]

Polytetrafluoroethylene (PTFE) tape, have been used as spacers by many practitioners to overcome the disadvantc, readily available, inexpensive, easy to use, autoclavable, and easy to place and remove.[2] Various studies have proved PTFE to be a better spacer material.. Thus this study was conducted to comparatively evaluate PTFE and cotton as endodontic spacer material.

MATERIALS AND METHODOLOGY:

This in vivo study was coducted in the Department of Conservative Dentistry and Endodontics, RKDF Dental College and Research Centre in association with Department of Oral pathology and Microbiology, Peoples University, Bhopal.

It was conducted on patients, in the age group of 18-25yrs, who were scheduled for endodontic treatment in mandibular 1st molar with symptomatic irreversible pulpitis and normal periapical tissue. Ethical clearance to conduct this study was obtained from the RKDF Institutional Ethical Review Board.

Inclusion criteria:

- Teeth with adequate and resistant walls.
- Teeth with roots without any periapical pathology and defects.
- Salivary PH (6.5-7.5) detected, for uniform flora.

Exclusion criteria:

- Medically compromised patients
- Patient on or were on antibiotic coverage within last 4 weeks
- Periapical lesion
- Caries extending to roots
- Craze line
- Fractured tooth
- Resorption- Internal or external

26 patients were selected and randomly assigned to either control or experimental group. Prior to start of the treatment, patients were explained in detail about the study and their informed consent was obtained.

In each of these patients, after rubber dam placement, access cavity was prepared using a No.3 bur in an aerotor hand piece, patency and working length of the canals was checked and biomechanical preparation was carried out to a size of no: 30 in the apical portion of the mesial canals and No.35 in the distal canals, using the step back technique. After the completion of biomechanical preparation, canals were obturated with gutta-percha and AH plus sealer /subsequently cavity was filled with temporary filling material (cavit) (3M ESPE,united states). After 24hrs under rubber dam placement, the temporary filling was removed from pulp chamber and irrigated using 1% sodium hypochlorite followed by saline. By gently scrapping the access cavity with a sterile, sharp spoon excavator, first sample was taken. The collected sample was then placed into brain heart infusion broth, spread on agar plates and incubated for 24hrs and digital colony count was carried out.

After exclusion, there were 40 samples in total, 20 in each group. In patients assigned to the control group, pulp chamber was filled with autoclaved cotton and a 3mm thick overlying restoration with glass ionomer cement was done. In the experimental group patients, autoclaved PTFE tape was placed into the pulp chamber and overlying GIC was placed.

After one week, patients were recalled and under rubber dam isolation, GIC restoration was removed. The underlying spacer material was collected in separate test tubes, containing brain heart infusion broth. The samples were centrifuged at 2500 rpm for 10 minutes in a centrifuge machine for homogenization of mix. A 100 ml of sample was taken in the micropipette and inoculated on blood agar plates. Plates were incubated for 24 hours at 37˚c in an incubator. The plates were then examined and the number of bacterial colony was counted using digital colony counter in terms of cfu/ml of the innoculum.

Statistical Analysis:
The collected data was statistically analysed by student t test.

RESULT:

In the study, participants, where cotton was used as an endodontic spacer material, no microbial colony was observed at baseline but over a period of seven days there was a significant increase in microbial growth with an average bacterial count of 129.60 (Table 1) The same result was obtained from the PTFE group, no microbial colony at baseline but after seven days, significant increase in microbial growth with an average bacterial count of 31 ($P \leq 0.05$). (Table 2)

On comparison of microbial contamination of cotton and PTFE tape, after seven days, significantly higher colony count was observed on cotton. (Table 3; Graph 1)

Table 1: Comparison of Bacterial colony count among the patient using cotton as spacer material

Time	N	Mean	Std. Deviation	t	P value
Baseline	10	0.00	0.00	35.57	0.00
After 7 days	10	129.60	11.52		

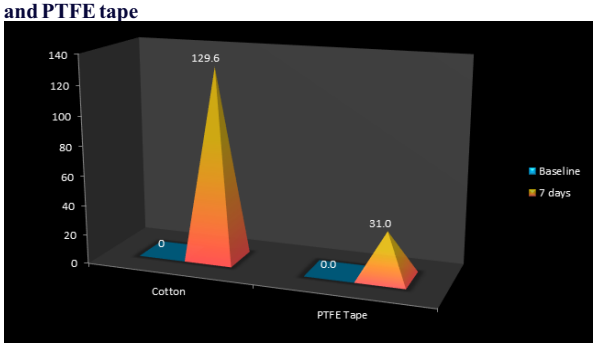
Table2: Comparision of Bacterial colony count among the patient using PTFE as spacer material

Time	N	Mean	S.D	t	P value
Baseline	10	0.00	0.00	4.10	0.01
After 7 days	10	31.00	23.87		

Table 3: Comparison between Cotton and PTFE tape for Bacterial colony count after 7 days

Group	N	Mean Bacterial count	S.D	t	P value
cotton	10	129.6000	11.52003	11.760	0.00
PTFE tape	10	31.0000	23.87933		

Graph 1: Comparison of Bacterial colony count between Cotton and PTFE tape



DISCUSSION:

The main condition, determining the completion of endodontic treatment, in single or multiple sittings, is the severity of pulpal or periapical lesion. When endodontic treatment is performed in multiple visits, temporary restorations are used to seal the access cavity, to prevent contamination of root canal system in between the visits. According to Naoum et al spacers are placed, beneath the temporary restorations, to facilitate the removal of provisional restorative material, to prevent them from entering into root canals and to aid in relocation of the chamber and the canals.[4]

Although, cotton is a commonly used spacer material, it has some disadvantages. Their removal can be challenging because they frequently get trapped on the cavity walls, potentially compromising the integrity of the definitive restoration.[6] In some instances, such as in mandibular anterior teeth with a conservative access cavity, removal of the cotton pellet can be quite difficult.[4] If a definitive restoration is not provided relatively soon after endodontic therapy, masticatory forces may cause wear or abrade the surface of the provisional restoration,[6] thereby reducing its thickness to below the desired 3.0 mm, that can compromise the intended seal and lead to increased microbial leakage.[8] Fibres of cotton can get incorporated within the temporary restorative material and can reach the external surface of the material, thereby acting as a channel for ingress of contaminants.[9,6]

Hence, many practitioners have tried other materials such as foam pellets, sponges and PTFE tape.[10] In dentistry, based on the various studies, PTFE has been used for guided tissue regeneration, coating of instruments to improve handling properties and clear-based matrices.[11,12] According to Moráguez et al PTFE can be used for screw access channel filling.[13]

Compared to cotton, PTFE has become the material of choice for many practitioners because of its peculiar properties that are conducive for the clinical use. The relatively inert nature of PTFE, renders it capable of resistance to solvents and acids.[14] Consequently it does not degrade when used with dental etchants.[15] According to Hongxiang, PTFE possesses a low static and kinetic coefficient of friction (0.1) ensuring a 'non-stick' application, thus allowing the removal without leaving any residue.[16] Despite the material being available in thin sections (30–120 μm) it does not significantly lose its shear strength.[14] In addition to excellent insulating properties, PTFE has a high melt viscosity, which allows the tape to be sterilized for dental purposes in an autoclave.[17]

On comparison of microbial contamination of cotton and PTFE tape, after seven days, there was a significantly higher colony count on cotton. The possible reasons for this could be due to organic and fibrous nature of cotton which can cause entrapment of fibres within the provisional restorative material and may promote wicking as well as bacterial uptake from oral cavity to the access cavity.[6] According to Newcomb et al, even a very small amount of cotton trapped between the wall of the tube and the filling material dramatically reduces the sealing quality of the temporary restoration.[7]

Similarly, the possible reasons for non-contamination of PTFE tape could be its easy handling characteristics, the property of not adhering to any part of the access cavity. This ensures that tape can be removed easily in one piece, leaving behind an access cavity free of any remnant of spacer. Also, the tape is inorganic and non-fibrous thus preventing the bacterial uptake and eliminating the chances of getting impregnated within the temporary restorative material.[6]

The result of the present study is in confirmation with the studies of Paranjpe et al[5] and Prabhakar et al[6] who promoted PTFE as a better space material because of its less leakage and resistance to bacterial contamination. These findings are important in endodontic treatments, where it is performed in multiple visits to effectively seal off the root canal system from the oral cavity between visits.

CONCLUSION:

Based on the results, it can be concluded that PTFE is a better endodontic spacer material than cotton. Hence it can be recommended in the multiple visit endodontic treatments.

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