



Antimicrobial Efficacy of Some Root Canal Filling Materials for Primary Teeth



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Abstract:

Objective: The present study aimed to evaluate and compare some filling materials used for filling the root canals of primary teeth for antimicrobial efficacy against some of the microorganisms commonly found in infected root canals.

Materials and Methods: The antibacterial activities of obturating materials, Endoflas, Iodoform, ZOE; Vitapex was done by two methods. The first was the agar diffusion method in which the filling materials were tested against four microbial isolates (Ps. Aeruginosa, E. coli; E. faecalis; E. coli and S. aureus). Second was, CFU count in which thirty extracted primary mandibular molars roots were incubated in mixed-species suspension, obturated, cultured and the CFU were reported for each filling material. The data were collected and statistically analyzed using ANOVA and Kruskal Wallis tests.

Results: The results of this study showed statistically significant difference between all the obturating materials and the antimicrobial effect of Endoflas was superior to ZOE, Vitapex and Iodoform against all microorganisms were tested. While in roots specimens test there was no statistically significant difference between groups.

Conclusion: The tested obturating materials demonstrated varying antimicrobial efficacy against the microorganisms tested. Endoflas paste and material containing eugenol were found to be more effective against the microorganisms compared to materials without eugenol.

Keywords: antimicrobial efficacy, obturating materials, primary teeth, pulpectomy

Introduction

Pulpectomy in primary teeth is challenging as the root canals have complex anatomy due to presence of numerous accessory and lateral canals which makes it difficult to remove infecting bacteria completely with instrumentation and irrigation. Numerous materials have been tried in dentistry as intracanal antimicrobials.¹ Bacteria remaining in obturated root canals may proliferate and invade ramifications, apical deltas, isthmuses, and dentinal tubules.^{2,3} In these locations, bacteria remain unaffected by chemomechanical preparation and may result in persistent endodontic infections.⁴ Therefore, the use of intracanal medicaments is essential to eliminate bacteria that remain after mechanical debridement.⁵

Material and Methods

Antimicrobial susceptibility testing:

This study protocol approved by the Faculty of Dentistry, Mansoura University. The study was carried out using four root canal filling materials namely Zinc oxide eugenol ZOE, Iododorm, Vitapex and Endoflas FS. Four clinical isolate (Enterococcus faecalis, Pseudomonas aeruginosa, Staphylococcus aureus and Escherichia coli, were obtained from department of microbiology, in Mansoura University. The method used to investigate the antibacterial efficacy of the filling materials was Agar diffusion method. All microorganisms were sub-cultured in culture media to confirm their purity. The study was conducted on Mueller Hinton agar plates. The filling materials were mixed

according to manufacturer's instructions using a sterile glass slab and spatula under a septic conditions.

The agar plates were left at room temperature for two hours for pre diffusion of filling materials and then incubated at 37°C under for 24 hours. After incubation, the diameters of zones of inhibition around the each filling materials were measured using endodontic ruler.

Preparation of teeth specimens:

Thirty extracted primary molars were sectioned longitudinally into two roots and endodontically treated. Subsequently, the roots were incubated in mixed-species suspension for 30days, then randomly divided into four groups (n=15) and obturated with four materials. The roots were filled with different materials by the endodontic plugger technique and stored for 7 days at 100% humidity and 37°C. Cross-sections were prepared from the cervical, middle and apical sections of the roots. After blood agar plates were incubated at 37°C for 24 hrs, colony-forming units (CFU) per 1ml were enumerated.

Results

Antimicrobial susceptibility testing:

Endoflas showed a statistically significant difference ($P < 0.046$) in inhibiting the growth of the four microorganism's; in which E. faecalis isolates were the most sensitive to it followed by E. coli, S. aureus and finally Pseudomonas aeruginosa. ZOE showed a statistically significant difference ($P < 0.047$) in killing the growth of the four microorganisms; in which E. faecalis isolates were the most sensitive to it

followed by *E. coli*, and both *S. aureus* and *Pseudomonas aeruginosa* reported similar sensitivity to it. Both Vitapex

and Iodoform were non-significant in affecting the growth of the four microorganisms which were resistant for them. **Table (1)**

Table (1): Comparison of different organisms regarding inhibition zone

inhibition zone	Enterococcus faecalis	Staphylococcus aureus	Echerichia coli	Peudomanas aeruginosa	ANOVA test	P - value
Zinc oxide eugenol	22.00±5.09	14.20±2.77 a	18.40±4.09	14.20±5.8 a	3.34	0.046*
Iodoform	0.0±0.0	0.0±0.0	1.60±3.5	0.0±0.0	1.00	0.418
Vitapex	2.00±4.47	0.0±0.0	0.0±0.0	0.0±0.0	1.00	0.418
Endoflas	24.80±5.06	18.60±3.51 a	21.40±4.7	17.0±4.6 a	2.84	0.047*

Counting the bacteria of contaminating roots:

Although group I & IV reported best results for bactericidal effect than the other two groups, there was no statistically significant difference between the antimicrobial efficacy of the four groups. **Table (2)**

Table (2): Comparison between different materials (Total) regarding microorganism count in obturating root canal.

Total	Mean ± SD	Median	Min-Max	Kruskal Wallis test	P - value
Zinc oxide eugenol	151.58±139	17.67	0.0-363.33	2.46	0.482
Iodoform	486.75±1127	28.0	0.0-3500		
Vitapex	339.72±996	25.83	10-3500		
Endoflas	123.22±208	15.0	0.0-602.6		

Discussion

The main objective of pulp therapy in pediatric dentistry is the maintenance of deciduous teeth until the correct eruption of the permanent teeth, under healthy conditions. Numerous obturating materials have been used for the management of endodontic infections in deciduous teeth.^{6,7}

The present results showed that Endoflas had a superior antimicrobial activity in inhibition the growth of the four

In the current study, ZOE paste was the second-best obturating material with antibacterial activity and showed a statistically significant difference ($P < 0.046$) in inhibiting the growth of the four bacterial species. *E. faecalis* isolates were the most sensitive to it, followed by *E. coli*, and both *S. aureus* and *Pseudomonas aeruginosa* have shown similar sensitivities. These results support the work of Hegde et al. (2012)¹⁰ who found that ZOE is an effective bactericidal agent against bacterial species like *E. coli*, *S. aureus*, *P. aeruginosa* and *E. faecalis*.

In the present study, both Iodoform paste and Vitapex had the lowest antimicrobial activity. These results disagreed with Katherine et al (2017)¹¹ who found that the pure Iodoform paste and Vitapex were the most effective materials against biofilms. The differences could be explained by some factors involved in the agar diffusion methodology, different species of bacteria tested, incubator period, media and culture conditions involved.

The present study results showed that there were no statistically significant differences four filling materials in terms of their effectiveness in inhibiting bacterial species in

microbial species, and the difference was statistically significant when compared with other materials ($P < 0.047$). *E. faecalis* isolates were the most sensitive to it, followed by *E. coli*, *S. aureus* and finally *Pseudomonas aeruginosa*. These results are in agreement with those reported by Sabyasachi et al (2010)⁸ Ruchi et al (2014).⁹

root specimen's in vitro study. On the other hand, there were statistically significant differences with regards to the inhibition of bacterial growth in the three parts of the root, the bacteria were most commonly observed in the cervical third and middle third and least in the apical third of the root. This result in agreement with Richardson et al. (2009)¹² who found that bacterial penetration of dentinal tubules was more pronounced cervically than apically

Conclusions

- 1- Endoflas has the strongest inhibitory properties followed by zinc oxide eugenol.
- 2- Materials containing eugenol were found to be more effective against the microorganisms compared to materials without eugenol.
- 3- Vitapex and pure iodoform paste showed the least antimicrobial activity.
- 4- Bacteria were mostly observed in the cervical third and middle third and least observed in the apical third of the root.

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