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Original Research

Assessment of antimicrobial efficacy of hydrophilic sealants- An in vitro study

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ABSTRACT:

Background: Caries recurrence is one of the major causes of restoration failure and restoration replacement in the long term. The present study was conducted to assess antimicrobial efficacy of hydrophilic sealants. **Materials & Methods:** The antibacterial effect of both sealants was tested both through planktonic growth inhibition test – 96-well microtiter plates and agar disk diffusion assay containing light-cured Embrace™ and UltraSeal XT® against Streptococcus mutans and two oral probiotics (Streptococcus salivarius). **Results:** Embrace™ showed a stronger and broad activity against all the bacterial strains tested ($P < 0.05$) in planktonic growth inhibition test even at its lowest dose (10 µl), with inhibition rates higher than 90% in all cases. UltraSeal XT® does not show growth inhibition activity against Streptococcus spp. **Conclusion:** Prescribing oral probiotics first and putting off the Embrace™ sealant application to the end of probiotic treatment.

Key words: Embrace, Sealant, Probiotic

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INTRODUCTION

Caries recurrence is one of the major causes of restoration failure and restoration replacement in the long term.[1] The incorporation of antibacterial agents in restorative materials have been studied, aiming to develop therapeutic materials with improved biological properties. Resin sealants for pits and fissures, applied to prevent new caries lesions8 and to arrest non-cavitated lesions, wear and detach over time10 with consequent biofilm formation around the sealant/enamel interface, increasing the risk of recurrent caries.[2]

The most routinely microorganism perceived in endodontic failures is Enterococcus faecalis. E. faecalis is a Gram-positive, Group D streptococci, a facultative anaerobe. Due to their tendency to form biofilms, it can exist in extremely harsh environment. It has been shown to be highly invulnerable once demonstrated in the root canal system and is probably the species that can best adapt to and indulge the ecologically demanding conditions in the filled root

canal.[3] Adherence to host cells and extracellular matrix, tissue invasion, effect on immunomodulation, and toxin-mediated damage are caused by number of virulence factors of E. faecalis. Shaping and cleaning of the root canal space may abolish the majority of the bacteria found in the root canal system. Even after shaping and cleaning of the root canal system, microorganisms might still exist in these challenges due to the anatomical complexities such as dentinal tubules, ramification, deltas, and fins. E. faecalis is a recalcitrate candidate among the causative agents of failed endodontic treatment.[4]

From a primary prevention perspective, pits and fissures sealing is considered to be one of the most effective procedures and it is strongly recommended. In fact, deep and narrow groves and fissures on occlusal surfaces of permanent molar are likely to retain food and to promote the presence of bacterial biofilm, increasing the risk of caries development. These particular hydrophilic sealants are fluoride releasing, light-curing resin materials, which are able to adhere to tooth surface also in the presence of humidity and liquids, without the use of dental dam.[5] In fact, the polymer gets activated by water and it establishes a chemical bond with the tooth surface. The present study was conducted to assess antimicrobial efficacy of hydrophilic sealants.

MATERIALS & METHODS

The present invitro study was conducted in the department of Endodontics. ATCC25175 S. mutans strain M18 DSM 14865 S. salivarius strain, also known as BLIS M18 and a mixture of DSM17938 and ATCC PTA5289 strains of L. reuteri were used as test microorganisms. Brain hearth infusion broth (BHIB) was used as nonselective culture medium. Embrace™ WetBond™ Pit and Fissure Sealant (Pulpdent, USA) and UltraSeal XT® hydro™ were used as sealants.

We used four 96-well microtiter plates containing light-cured Embrace™ (10 µl) and UltraSeal XT® (20 µl), respectively. Inhibition of bacterial growth was observed by the formation of halos with no visible bacteria. Results thus found were assessed statistically, where p value less than 0.05 was considered significant.

RESULTS

Table I Embrace™ WetBond™ pit and fissure sealant optical density resulting Planktonic growth inhibition test

Sample	10µl	Inhibition rate (%)	P value
S. mutant + Sealant	0.091	97	0.02
S. mutans	0.723		
S. Salivarius+ Sealant	0.092	95	0.01
S. Salivarius	0.812		
BHIB+ Sealant	0.082	94	0.03
BHIB	0.061		

Table I shows that Embrace™ showed a stronger and broad activity against all the bacterial strains tested ($P < 0.05$) in planktonic growth inhibition test even at its lowest dose (10 µl), with inhibition rates higher than 90% in all cases.

Table II UltraSeal XT® Hydro™ optical density resulting from planktonic growth inhibition tests

Sample	20µl	Inhibition rate (%)	P value
S. mutant + Sealant	0.81	-6	0.01
S. mutans	0.74		
S. Salivarius+ Sealant	0.81	-7	0.03
S. Salivarius	0.76		
BHIB+ Sealant	0.099		0.02
BHIB	0.063		

Table II shows that UltraSeal XT® does not show growth inhibition activity against Streptococcus spp..

DISCUSSION

Preventive or early reparative strategies are based on remineralization and the best scientific evidence is currently supporting fluoride application. Whereas fluoridated water has proven to reduce the overall decay rate in population, the most effective form of fluoride application is either with toothpaste, gel, or varnish.[6] Several studies also support the anticaries effect of xylitol, especially in combination with fluoride strategies. In fact, xylitol has been found to potentiate even small amounts of fluoride.[7] Current remineralization research focuses on various forms of calcium phosphate such as casein phosphopeptides, amorphous calcium phosphate complexes, and nanoparticle hydroxyapatite, that is a biomimetic material which promotes natural blocks building of enamel and reduces biofilm formation.[8] Total canal disinfection and three-dimensional obturation are attained by proper root canal treatment. Microorganisms and their by-products have been responsible in dentinal, pulpal, and periapical pathology, which was observed by Miller in 1890.[9]

The typical polymicrobial flora of Gram-negative and Gram-positive bacteria is a endodontic microflora, which is controlled by obligate anaerobes. To seal all microchannels and dentinal tubules, various sealers have been applied along with gutta-percha obturating systems.[10] The present study was conducted to assess antimicrobial efficacy of hydrophilic sealants.

In present study we found that Embrace™ showed a stronger and broad activity against all the bacterial strains tested ($P < 0.05$) in planktonic growth inhibition test even at its lowest dose (10 µl), with inhibition rates higher than 90% in all cases. Vibha et al[11] evaluate antimicrobial efficacy of root canal sealers (bioceramic [BC] sealer, Epiphany self-etch sealer, AH-Plus sealer) on Enterococcus faecalis. An agar well diffusion assay method was used to determine the efficacy of the root canal sealer against E. faecalis (ATCC 29212). Root canal sealers were divided into three groups; BC sealer, Epiphany self-etch sealer, and AH-Plus sealer, and standard antibiotic disc of co-trimoxazole was kept as a control. The diameters of the growth inhibition zones against E. faecalis for each group were recorded and compared at 24 hours and 48 hours. AH-Plus sealer exhibited larger zone of inhibition than BC sealer and Epiphany self-etch sealer against E. faecalis at 24 and 48 h. Antibiotic disc of co-trimoxazole, which was used as control exhibited the highest antimicrobial activity against E. faecalis at 24 and 48 h. Epiphany self-etch sealer showed least antimicrobial activity.

We observed that UltraSeal XT® does not show growth inhibition activity against Streptococcus spp. Veneri et al[12] investigated the antibacterial activity of the Embrace™ WetBond™ Pit and Fissure Sealant (Pulpdent, USA) and UltraSeal XT® Hydro™ (Ultradent, USA) against selected oral bacteria and probiotics. The antibacterial effect of both sealants was tested both through planktonic growth inhibition test – 96-well microtiter plates and agar disk diffusion assay containing light-cured Embrace™ and UltraSeal XT® against *Streptococcus mutans* and two oral probiotics (*Streptococcus salivarius* and *Lactobacillus reuteri*). Embrace™ showed a stronger and broad activity against all the bacterial strains tested ($P < 0.05$) in planktonic growth inhibition test even at its lowest dose (10 µl), with inhibition rates higher than 90% in all cases. UltraSeal XT® Hydro™ showed a mild antibacterial activity against *L. reuteri*, with growth inhibition rates being 19% and 23% for 20 µl and 50 µl, respectively. Regarding agar disk diffusion test, both sealants showed exclusively an antibacterial activity by contact.

CONCLUSION

Authors found that prescribing oral probiotics first and putting off the Embrace™ sealant application to the end of probiotic treatment.

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