Tooth Micro-hardness Changes After Applying Bioactive Glass-containing, Anti-microbial Sealants
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INTRODUCTION

Orofacial conditions are the most common chronic disease in children. Sealants are one way of preventing bacteria from getting to the teeth and are effective in preventing pit and fissure caries. Children who receive sealants are 72% less likely to receive restorative treatment over the near 3 years than children who do not. These sealants protect the grooved surfaces of the teeth, and the chewing surfaces of back teeth. While most sealants are placed when a child is young and can be left in for up to 3 years if properly cared for but can wear off and leave teeth vulnerable. Research has confirmed that within 26 months, most sealants fail clinically.

This project developed a new type of sealant that releases fluoride, calcium, and phosphorus ions. These ions strengthen the tooth and fill bacteria. This new type of sealant is prepared by combining Sol-Gel Bioactive Glass (BAG) with an adhesive monomer. The new BAG sealant will not only protect the tooth for an extended period of time, it will also help to prevent demineralization before they can attach to the tooth surface. BAG is a three-dimensional network of silica, calcium, phosphorus, and fluoride. In addition to serving as an antibacterial agent, it also strengthens teeth and enhances remineralization of tooth structures. This sealant was evaluated in different BAG formulations, all of which have a strong bonding and BAG62 in its higher concentration of calcium and phosphorus. Both compositions contain releasable fluoride.

Sealants that are currently in use do not have this beneficial ion-release, particularly the anti-mercury. This research was funded by an outside source: NIH/NIDCR R01 DE021372. Additional funding was provided by the OHSU Pediatric Dentistry Fund. Ultradent (South Jordan, UT) provided the resin materials, between areas and between depth for chemical and bacteria treatments, respectively. Overall, the BAG81-sealant samples were significantly harder than the BAG1-sealant or USXT samples. Materials, between areas and between depth for chemical and bacteria treatments, respectively. Overall, the BAG81-sealant samples were significantly harder than the BAG61-sealant or USXT samples. Materials, between areas and between depth for chemical and bacteria treatments, respectively. Overall, the BAG81-sealant samples were significantly harder than the BAG61-sealant or USXT samples.

RESULTS

Release of fluoride has benefits as it has antibacterial properties and increases the acid resistance of enamel due to the formation of hydroxyapatite. The chemical composition of BAG-containing sealants allows the release of high concentrations of calcium, phosphate, and fluoride potentially inhibiting enamel demineralization. USXT does not release ions that inhibit demineralization. As expected, samples sealed with USXT had the most demineralization and visually showed the most apparent white spot lesions, with both bacterial and chemical challenge. BAG-61 sealant showed significantly less demineralization than USXT at 177 infection sites. Samples sealed with fluoride and calcium-releasing BAG2 Had the least demineralization and visually showed the least apparent white spot lesions. In detail, below the sealant containing sealants demonstrated an increase in remineralization compared to control areas.

Ideal sealant materials should have sustained ion release to aid in the protection against demineralization while supplementing sufficient bond strength to protect the underlying tooth surface. These new bioactive sealants may be most advantageous in patients with poor oral hygiene, as they may show unpredictable compliance with topical fluoride or fluoride mouth rinses and therefore would benefit from the intrinsic ion release.

CONCLUSIONS

• BAG-containing sealants were associated with significantly lower superficial demineralization than USXT.
• BAG81 sealant samples where harder than the BAG1 sealant or the Ultradent XT samples, indicating the BAG81 bond was significantly higher than the control materials.

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