Performance of Different Pit and Fissure Sealants After Thermal Aging

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Introduction

Caries is one of the most common chronic diseases in children (1). Pit and fissures have always been the earliest and most susceptible carious areas(2). According to evidence-based clinical recommendations, pit-and-fissure sealants on clinically sound and non-cavitated occlusal surfaces of primary and permanent molars in children and adolescents are highly recommended (3). Occlusal sealants play a critical role in preventing caries in both primary and permanent teeth (2). Bonded resin sealants are safe and effective in preventing pit and fissure caries on at-risk surfaces(2). When treating pediatric populations, time is of the essence. Eliminating the bonding process can offer ease of use and increase efficiency and improve the patient experience. The aim of this study is to evaluate several properties of commonly used pit and fissure sealants.

Material	Type of Composite	Composition and Filler	Manufacturer
Fit SA	Giomer-based sealant	TEGDMA, UDMA, S-PRG fillers (NA)	Sho-fu, Japan
Ultraseal XT plus hydrophobic	Resin-based filled fissure sealant	Triethylene Glycol Dimethacrylate, Diurethane Dimethacrylate, Aluminium Oxide, TMPTMA, Titanium Dioxide, Organophosphine Oxide	Ultradent, USA
Fuji Triage	Glass-ionomer based fissure sealant	Powder: alumina-fluoro-silicate glass (amorphous) Liquid: polyacrylic acid, Specific compound	GC , Japan

Table 1: Type and composition of examined fissure sealants

Methods

One hundred twenty newly extracted caries free posterior teeth were collected from the emergency clinic at the University of Nevada Las Vegas. Teeth were randomly divided into three groups (40 teeth for each material group with 4 as control and 36 as an active sample). The examined materials were as follows: Fit SA material group A, UltraSeal group B, or the Fuji Triage group C (Table 1). Materials were manipulated following the manufacturer instructions and the restored teeth were kept in artificial saliva. The teeth were examined for the fluoride release, after 24, 48, and 96 hours using the Thermo Scientific™ Orion™ Fluoride Electrodes.

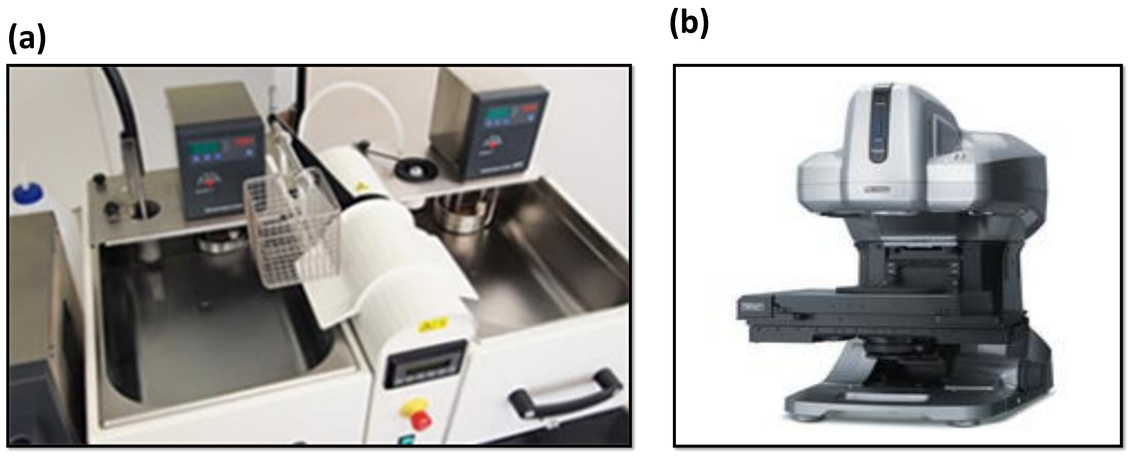

Figure 1: (a) Thermocycler machine (b) Keyence wide-area 3D Measurement System

The specimens were subjected to artificial aging using a thermocycling machine *(SD Mechatronik)* dwelling for 10,000 cycles (1 estimated clinical year) with temperatures of 5°C and 55°C. Prior to thermocycling, an initial reading was completed for each sealant surface profile *[Keyence wide-area 3D measurement] (Figure 1)*. The restorations' surface roughness, retention, and color stability were examined immediately and after 1, 3, 5 estimated clinical years.

Results

There was a significant difference in fluoride release with Fuji Triage having the highest amount of fluoride release compared to the other groups (figure 2). UltraSeal and Fit SA had a steady increase in their fluoride release during the three measuring intervals. There was no significant difference when measuring the surface roughness or color stability between the 3 materials. The retention rate was highest in the Ultraseal group in which the teeth went through the traditional etch and bond technique.

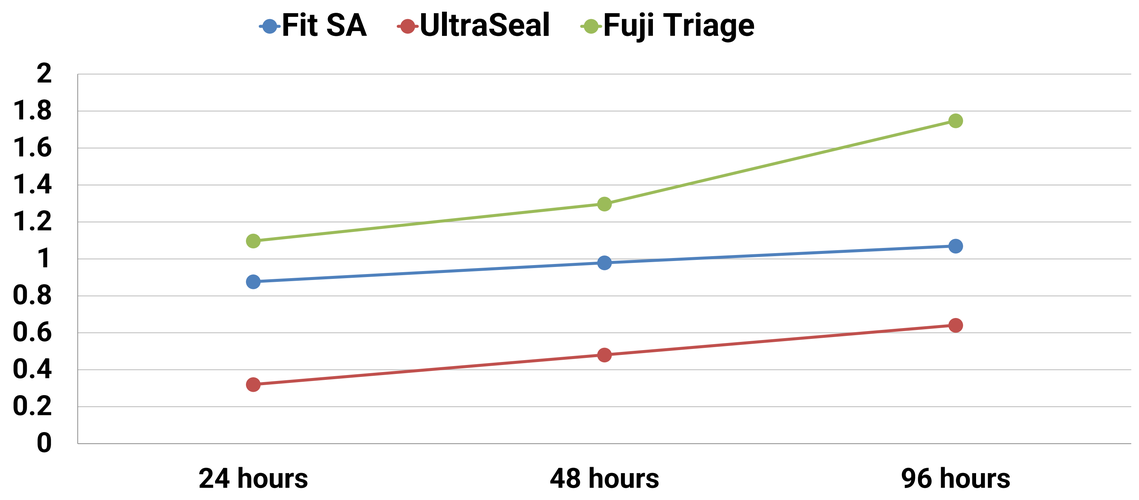

Figure 2: Fluoride release (ppm) after 24, 48 & 96 hours from all materials

After 5 clinical years, UltraSeal had 100% retention of the sealant material, compared to Fuji Triage with a 90% retention rate, and Fit SA had the least retention [62.5%] (Figure 3).

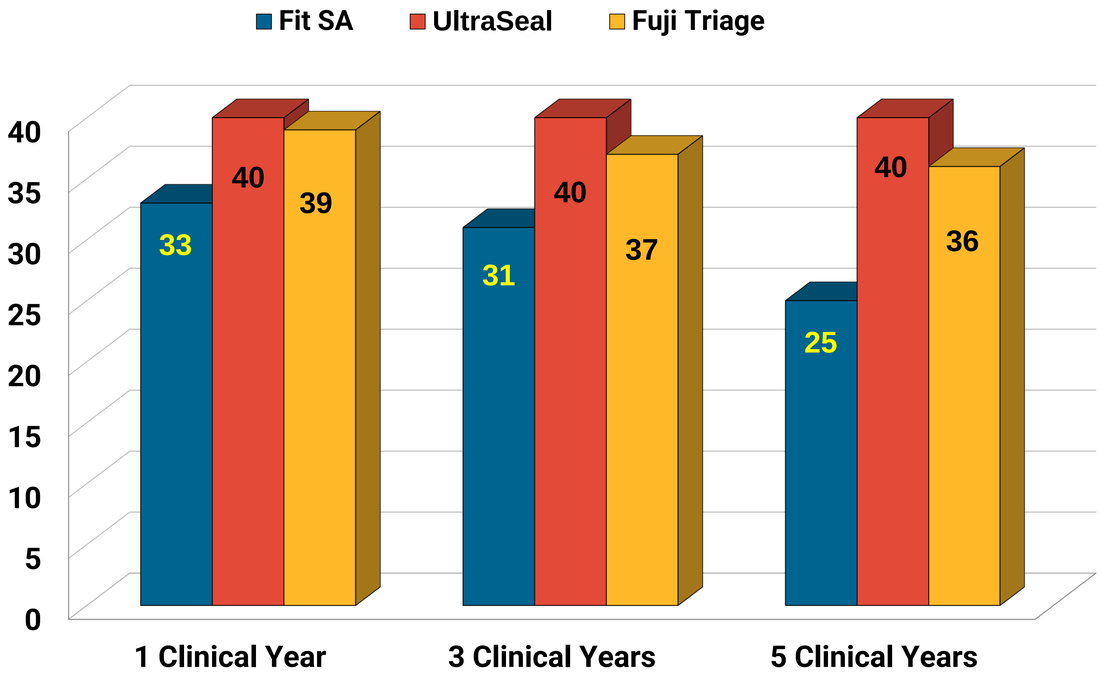

Figure 3: Retention of Fissure sealant for all examined materials after 5 clinical years

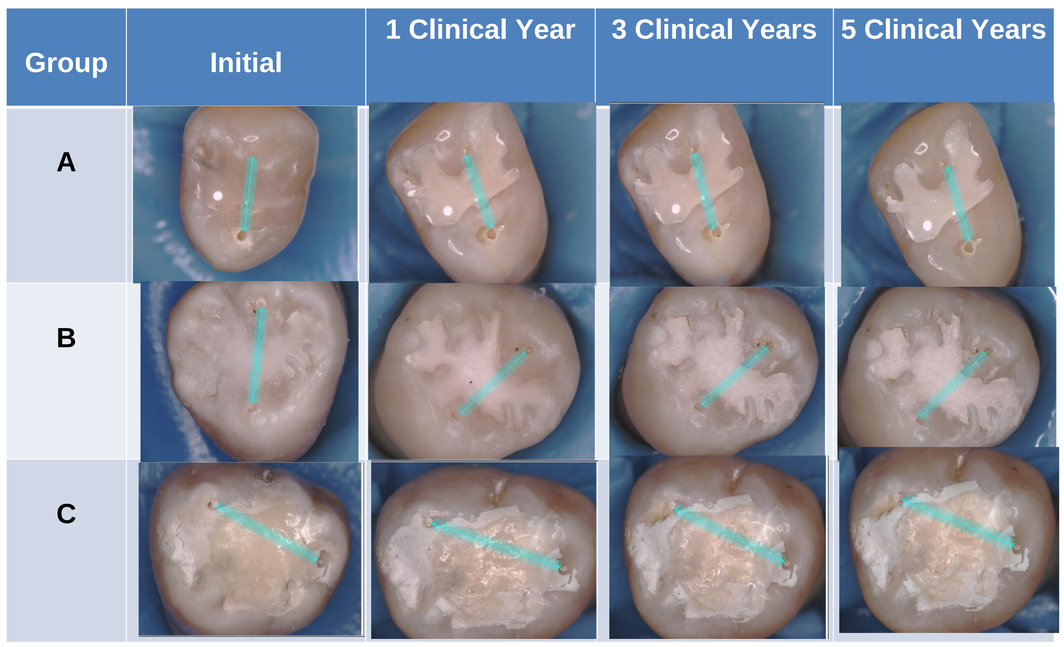

Figure 4: Group A, B, and C examined groups before and after 1, 3 and 5 clinical years.

Conclusion

Within the limitations of the present study, Fuji Triage performed better than other examined materials after 5 clinical years of aging overall, however, Ultraseal had the best retention. This concludes that etching and bonding can improve the performance and retention of the sealant material.

References

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