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ADAPTATION OF SONIC-FILL VERSUS BULK-FILL RESIN COMPOSITE RESTORATIONS

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ABSTRACT

This study was performed to evaluate adaptation of sonic-fill versus bulk-fill resin composite restorations.

Materials and Methods: A total number of 80 standardized Class II cavities were prepared on both proximal walls of total number of 40 premolars. The teeth were randomly divided into two equal groups, of 20 teeth each, according to the material; either SonicFill or X-tra Fil resin composite in bulk (5mm). Each group was divided into two equal subgroups, of 10 teeth each, according to sonic vibration applied; either application of resin composite using sonic vibration or without sonic vibration. Each subgroup was divided into 2 classes, of five teeth each (with 10 proximal restorations), according to the aging duration; either after 24 hours or 12 months in artificial saliva at 37°C. The specimens were observed after tracing by caries detecting dye under 70X magnification.

Results: There was no statistically significant difference between Sonicfill and X-tra Fil resin composite materials either used with the use of sonic vibration or manual packing. Moreover, aging has no significant effect on voids formation in the composite/tooth interface.

Conclusion: Application techniques either using sonic application or manual packing. Moreover, aging revealed no difference for both materials regarding adaptation.

INTRODUCTION

Some of the main reasons for replacement of resin composite restorations are marginal discoloration, marginal degradation and color mismatch [1]. Thus, concern is directed towards the tooth-restoration interface and adaptation. Originally, resin-based composites had thick consistency, and this created difficulty in establishing proper adaptability. Many attempts were suggested to overcome this problem, including advances in adhesive systems and placement techniques [2].

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Recently, manufacturers have launched new bulk-fill composite materials that are claimed to override this obstacle, through the use of transparent fillers, new formulation of photo-initiators and/or incorporating stress relief technology. Currently marketed bulk-fill composites claims lower polymerization shrinkage and proper wetting to the cavity walls. This new technology allows bulk placement of resin composites, thus saving time for both the dentist and the patient, and decreasing the technique sensitivity of the procedure [3].

Moreover, sonic application technology was introduced to provide good rheological properties of the primitively high viscosity material, which is marketed for its good mechanical properties. The flowability is determined by using a sonic handpiece assisting in liquefaction of the material and drop of viscosity [4].

MATERIALS AND METHODS

A total number of 80 standardized Class II cavities were prepared on both mesial and distal wall of total number of 40 premolars. The teeth were randomly divided into two equal groups, of 20 teeth each, according to the material; either SonicFill resin or X-tra Fil resin composite. Each group was divided into two equal subgroups, of 10 teeth each, according to sonic vibration applied; either application of resin composite using sonic vibration or without sonic vibration using SonicFill handpiece (*Kerr Corporation, Orange CA 92867, U.S.A.)*. Each subgroup was divided into 2 classes, of five teeth each (with 10 proximal restorations), according to the aging duration; either after 24 hours or 12 months in artificial saliva at 37°C.

In all specimens Single Bond universal adhesive (3M ESPE) was applied following manufacturer's directions in selective-etch mode, followed by placement of SonicFill and X-tra Fil materials in bulk (5mm). The teeth were then sectioned using Isomet 4000 machine *(Buehler, Germany)*, then sequentially finished and polished, and ultrasonically cleaned.

For the assessment of adaptation, the pulp chambers were firstly blocked with wax, then a small amount of caries detecting dye was traced over the internal margins. The specimens were observed under Digital Microscope *(Celestron Handheld Digital Microscope Pro, Celestron, USA)* at 70X connected to computer with image analyzer software. The adaptation results were presented as surface area of voids related to interface per cavity wall.

RESULTS

Statistical analysis was performed with IBM® *(IBM Corporation, NY, USA)* SPSS® *(SPSS, Inc., an IBM Company)* Statistics Version 20 for Windows. The significance level was set at $P \leq 0.05$. Data were first explored for normality by checking data distribution using Kolmogorov-Smirnov and Shapiro-Wilk tests. Data showed non-parametric distribution. Mann-Whitney U test was used for the comparisons.

Mean and standard deviation (SD) for the voids at composite/tooth interface for both composite materials are presented in Table (1) and Figure (1). SonicFill, with vibration, has no statistically significant difference between at 24 hours and after 12 months at p=0.639. Also, without vibration, there was no statistically significant difference between at 24 hours and after 12 months at p=0.321. Moreover, X-tra Fil with vibration, has no statistically significant difference between at 24 hours and after 12 months at p=0.197. Also, without vibration, there was no statistically significant difference between at 24 hours and after 12 months at p=0.878.

TABLE (1): Mean, standard deviation (SD) values and results of comparison between surface area of voids related to interface of the two aging durations

Material	Vibration	24 hours		12 months		*P*-value
		Mean	SD	Mean	SD	
Sonic Fill	With vibration	0.14	0.25	0.13	0.21	0.639 NS
	Without vibration	0.20	0.30	0.11	0.18	0.321 NS
X-tra Fil	With vibration	0.39	0.38	0.17	0.21	0.197 NS
	Without vibration	0.56	0.39	0.60	0.65	0.878 NS

: Significant at P ≤ 0.05, NS= Non Significant

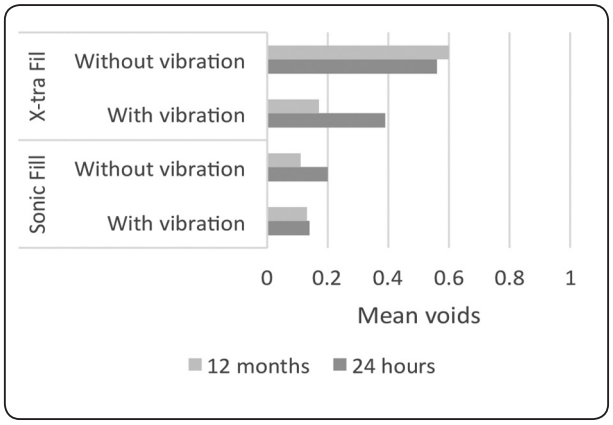

Fig. (1) Bar chart representing surface area of voids related to interface of the two aging durations

DISCUSSION

Two bulk fill composites were assessed in this study; the first was SonicFill; a bulk fill resin based composite used in combination with the SonicFill handpiece that offers sonically activated delivery of the material, and the second was X-tra fil; a bulk fill resin based composite. As claimed by manufacturer, Sonicfill contains a proprietary rheological modifier that reacts to sonic energy from the handpiece and causes the viscosity to drop 87% during extrusion [4,5].

Two placement techniques were investigated in this study for both resin composites; sonic packing in comparison to manual conventional application as Control, to detect whether or not sonic activation using SonicFill handpiece is material dependent, based on chemical modulators present in SonicFill composite as claimed by its manufacturer.

Sectioning of specimens was done using an automated linear precision diamond saw (Isomet saw) was used to ensure precise cutting and standardization of the cut surface. Tracing of the interface with a caries detecting dye solution was the selected technique because of its high penetration ability, in addition to ease of application and time saving approach [6].

The results of the present study revealed that, there was no significant effect on adaptation to axial and gingival walls with or without vibration. This finding denotes that despite the expected benefits of the sonic packing techniques used in this study with the highly-filled resin composite materials, yet sonic packing was not advantageous over manual packing technique. It was expected that sonic vibration would improve the adaptation as the sonic energy from the handpiece would cause drop in the viscosity during extrusion. This viscosity drop would allow the composite material to rapidly flow into the cavity, allowing intimate adaptation and better wetting to the cavity walls [4, 5]. However, it seems that the drop in viscosity obtained from sonic vibration didn't reach to that of the flowable consistency state, and therefore, offered no significant improvement in wetting for the cavity walls.

This result was in agreement with (Césped, M., & Aizencop [7]; Hassan & Ghulman [8]) parallel post spaces 5 mm in depth and 2 mm in diameter were prepared using Gates Glidden and diamond burs. A primer and a dentin bonding agent (Prime & Bond

NT who found that ultrasonic packing of densely filled resin composite was not advantageous over manual packing technique on adaptation to cavity wall. However, the results were in disagreement with Ben-Amar et al. [9] who combined the ultrasonic with manual packing for packable composites and found better adaptation to the gingival wall. That difference in application technique explains the disagreement with the current findings.

CONCLUSIONS

Application techniques either using sonic application or manual packing, moreover, aging revealed non-significant difference for both materials regarding adaptation.

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