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ORIGINAL ARTICLE

Comparison of the Postoperative Sensitivity using Two Flowable Composites in Noncarious Cervical Lesions: A Randomized Blinded Clinical Trial

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ABSTRACT

Aim: The aim of this study was to compare the postoperative sensitivity using two flowable composites in noncarious cervical lesions (NCCLs).

Materials and methods: A total of 136 teeth were randomly divided into two groups. In group I, 68 restorations were done using Filtek Z350 XT and in group II, 68 restorations were done using G-aenial GC Universal Flo. Sensitivity was evaluated using air blast, cold water, and cold ice stick. Visual analog scale (VAS) was used to record the sensitivity scores at baseline and at 2 days, 1 week, and 4 weeks after the treatment.

Results: When compared between Filtek and G-aenial groups in each test and at each time point, there was no significant difference in the reduction of postoperative sensitivity.

Conclusion: Within the limitations of this study, it can be concluded that there was no statistical difference in the reduction of postoperative sensitivity between group I (Filtek Z350XT) and group II (G-aenial universal flow) when used in NCCLs.

Clinical significance: There was no statistical difference in the reduction of postoperative sensitivity between two flowable composites when used in NCCLs.

Keywords: Flowable composites, Noncarious cervical lesions, Postoperative sensitivity, Randomized clinical trial, Self-etch.

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INTRODUCTION

Noncarious cervical lesion is defined as loss of dental hard tissue in the cervical part of the tooth, not caused by caries, which is multicausal and insufficiently clarified etiology.[1] These lesions include abrasion, corrosion, and (possibly) abfraction, acting independently or in combination. Detailed case history and extension of cavity depth should be taken into consideration before restoring the NCCLs.

Various restorative materials, such as conventional glass ionomers, resin-modified glass ionomers, compomers, and several types of resin composites have been used for treating cervical restorations. At present, resin composites have gained popularity over other restorative materials due to their excellent esthetic property and high wear resistence.[2]

In 1996, flowable composites were introduced into practice holding special handling properties. These composites contain particle sizes same as traditional hybrid composites with reduced filler content allowing the increased resin to reduce the viscosity. In order to overcome the problem of debonding in abfraction, flowable composites can be used as a restorative option due to its low modulus of elasticity.

In 2006, James Summit stated that postoperative sensitivity after composite restoration occurs due to polymerization shrinkage as a result of which gap is formed beneath the restoration, which is then accumulated with dentinal fluid in 24 to 36 hours. Thus, when the affected tooth is exposed to heat or stimuli, it results in expansion and contraction of dentinal fluids in the gap formed, which causes fluid movement in the dentinal tubules leading to postoperative sensitivity.[3]

AIM

The aim of this study was to compare the postoperative sensitivity using two flowable composites in NCCLs.

OBJECTIVES

- To evaluate postoperative sensitivity using cold ice stick, cold water, and air blast
- Measuring postoperative sensitivity using VAS score at baseline, 2 days, 1 week, and 4 weeks

MATERIALS AND METHODS

This study was a randomized split mouth clinical trial. Twenty-two patients were screened and eight patients

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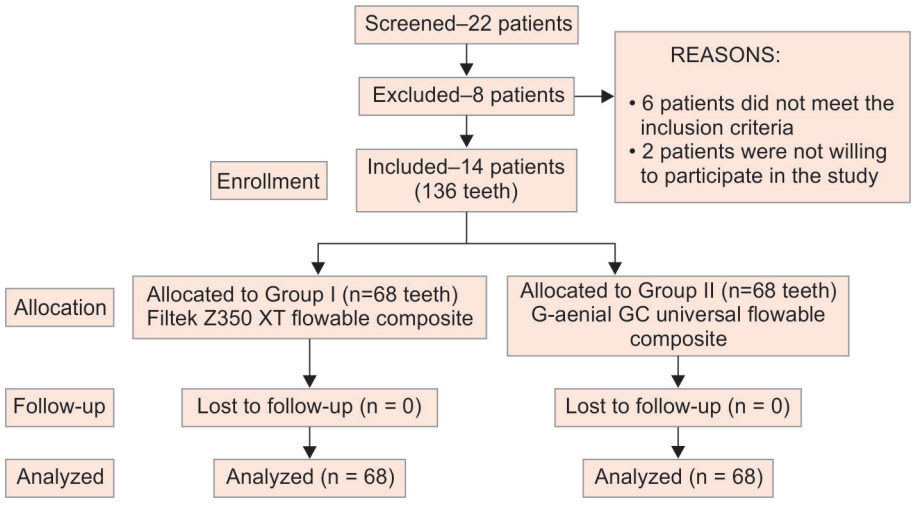
Flow Chart 1: Participants flow chart



were excluded. Finally, 14 volunteer patients with 136 teeth fitting the inclusion criteria described below were included in the study.

Approval for the project was obtained from the Institution of Human Ethical Committee (IHEC No: IHEC/SDMDS13ODS6).

The sample size was determined *a priori* by G* power 3.1.2 software version. The minimum sample size of each group was calculated, following the input conditions: Power of 0.80 and $p \leq 0.05$ and sample size arrived was 62 per group. Keeping a dropout of 10%, 6 were added to the group and final sample was 68 per group (62 + 6 = 68) (Flow Chart 1).

Inclusion Criteria

Patients in the age group of 18 to 65 years who signed the informed consent, patients with at least two contralateral teeth with NCCLs, wedge or saucer-shaped lesions, patients having good periodontal health, and patients suffering from tooth sensitivity and who were concerned about esthetics were included in the study.

Exclusion Criteria

Medically compromised patients, patients with severe periodontitis, high caries risk, heavy bruxism, xerostomia, fractured or crack tooth, pregnant or breast-feeding mothers were excluded.

Randomization

Randomization was done by a third person who was not related to the study. Split mouth clinical trial design and randomization was done using coin toss method in order to eliminate bias. Initially, head was assigned to group I—Filtek Z 350 XT (3M ESPE flowable composite; 3M India Limited, Bengaluru, India) right quadrant (upper and lower arch) and tail was assigned to group II—G-aenial universal flow (GC India, Telangana, India) left quadrant (upper and lower arch). For the next patient, the groups was swapped for quadrant in such a way that head was assigned to group I—Filtek Z 350 XT (3M ESPE flowable composite) left quadrant (upper and lower arch) and tail was assigned to group II—G-aenial universal flow right quadrant (upper and lower arch). The coin toss method is random and had an equal chance of occupying the position. Therefore, based on the coin toss result, a group was assigned.

Blinding

Although the patients were explained about the study design and the flowable composites that were used in the study, they were unaware about which system was used for the particular treatment. The evaluator was blinded from knowing to which group the teeth involved belonged to. Thus, this is a double-blinded study.

Treatment Procedure

Prior to the treatment, a careful medical and dental history of the included patients was taken. The treatment and the study design were explained to the qualifying patients and informed consent was obtained from the voluntary patients who were willing to participate in the study. Randomization was done using split mouth technique. The severity of postoperative sensitivity was measured by the VAS (Torabinejad et al).[4]

All the treatments were carried out by a single operator. All the patients received a topical anesthesia. Each tooth was isolated using retraction cords and cotton rolls and the cavity was surface roughened with sterile diamond bur. No enamel beveling and additional enamel etching was done in this study. Self-etching adhesive was applied on the roughened tooth surface and curing was

done for 20 seconds, and restoration was done using either of the two flowable composites Filtek Z 350 XT or G-aenial Universal Flow using incremental technique, and constant curing was done for 40 seconds using the light curing unit. Finally, finishing and polishing of the restoration were performed with finishing abrasive and Shofu polishing kit.

TEST FOR EVALUATING POSTOPERATIVE SENSITIVITY

Air Blast

Sensitivity scores before restoration and after restoration were recorded using VAS by blowing a compressed air (40 psi) from three-way syringe for 3 seconds at a distance of 2 to 3 cm.

Cold Water

Similarly cold water was filled in 2 mL syringe and was injected over the noncarious lesion both before and after restoration, and the scores were recorded using VAS.

Cold Ice Stick

The third test for evaluating postoperative sensitivity was using cold ice stick. An ice stick of standard diameter and length, which was prepared using freezed water in a local anesthetic syringe, was placed against the noncarious lesion both before and after restoration and the scores were recorded.

A data collection sheet containing the VAS was given to each patient to record the intensity of sensitivity felt preoperatively, at baseline and during their follow-up of 2 days, 1 week, and 4 weeks.

The normality test, Kolmogorov–Smirnov test, and Shapiro–Wilks test results show that the variables do not follow normal distribution. Therefore, to analyze the data, nonparametric tests were applied (Table 1). Software used was Statistical Package for the Social Sciences, version 17, and to compare between groups, Mann–Whitney U-test was applied (Table 2).

RESULTS

There was no statistical difference in the reduction of postoperative sensitivity between group I (Filtek Z350XT) and group II (G-aenial universal flow) when evaluated using different tests at various time periods.

DISCUSSION

The choice of restorative material for NCCLs depends on the amount of tooth structure to be replaced, esthetics concern, remaining dentin thickness as well as the buccolingual and occlusogingival dimensions. Over the years, resin composites used with dentin bonding agents are considered the best for the restoration of cervical lesions.[5-7]

The first adhesive system that became clinically acceptable was etch and rinse type, which was based on smear layer removal. At present, self-etching adhesives have gained popularity that retains and modifies the smear layer.[8]

These self-etch adhesives simultaneously condition and prime dentin. Regarding user-friendliness and technique sensitivity, this approach seems clinically most promising. This approach eliminates the rinsing phase, which not only lessens the clinical application time but also significantly reduces the technique sensitivity or the risk of making errors during application.

Table 1: Descriptive statistics to compare two group in each test and at each time-points

		Group											
		Filtek						G-aenial					
Test	Time-point	n	Mean	SD	1st quartile	Median	3rd quartile	n	Mean	SD	1st quartile	Median	3rd quartile
Cold ice stick	Preoperative	68	3.16	3.45	0.00	2.00	5.50	68	3.81	3.37	0.00	4.00	7.50
	Baseline	68	1.54	1.81	0.00	1.00	2.00	68	1.82	1.84	0.00	1.50	4.00
	Day 2	68	1.06	1.34	0.00	0.50	2.00	68	1.50	1.59	0.00	1.00	2.00
	Week 1	68	0.68	1.09	0.00	0.00	1.50	68	0.91	1.22	0.00	0.00	2.00
	Week 4	68	1.00	1.41	0.00	0.00	2.00	68	1.24	1.38	0.00	1.00	2.00
Cold water	Preoperative	68	2.03	2.64	0.00	1.00	4.00	68	2.68	2.75	0.00	2.00	5.00
	Baseline	68	0.96	1.23	0.00	0.00	2.00	68	1.38	1.52	0.00	1.00	2.00
	Day 2	68	0.97	1.26	0.00	0.00	2.00	68	1.07	1.21	0.00	1.00	2.00
	Week 1	68	0.51	0.86	0.00	0.00	1.00	68	0.62	0.98	0.00	0.00	1.50
	Week 4	68	0.59	0.88	0.00	0.00	1.00	68	0.82	1.04	0.00	0.00	2.00
Air blast	Preoperative	68	2.62	2.98	0.00	2.00	5.00	68	2.54	2.94	0.00	2.00	4.00
	Baseline	68	0.71	1.19	0.00	0.00	1.00	68	1.00	1.23	0.00	0.50	2.00
	Day 2	68	0.75	1.47	0.00	0.00	1.00	68	0.94	1.70	0.00	0.00	1.00
	Week 1	68	0.54	1.27	0.00	0.00	0.00	68	0.63	1.23	0.00	0.00	1.00
	Week 4	68	0.63	1.13	0.00	0.00	1.00	68	0.66	1.17	0.00	0.00	1.00

SD: Standard deviation

Table 2: Mann–Whitney U-test to compare between Filtek and G-aenial groups in each test and at each time-point

Tests	*Time-points*	*Group*	*n*	*Mean rank*	*Z-value*	*p-value*
Cold ice stick	Preoperative	Filtek	68	65.06	1.035	0.300
		G-aenial	68	71.94		
	Baseline	Filtek	68	65.85	0.819	0.413
		G-aenial	68	71.15		
	Day 2	Filtek	68	63.35	1.618	0.106
		G-aenial	68	73.65		
	Week 1	Filtek	68	64.85	1.236	0.216
		G-aenial	68	72.15		
	Week 4	Filtek	68	64.72	1.223	0.221
		G-aenial	68	72.28		
Cold water	Preoperative	Filtek	68	63.64	1.505	0.132
		G-aenial	68	73.36		
	Baseline	Filtek	68	63.82	1.496	0.135
		G-aenial	68	73.18		
	Day 2	Filtek	68	66.25	0.729	0.466
		G-aenial	68	70.75		
	Week 1	Filtek	68	67.18	0.482	0.630
		G-aenial	68	69.82		
	Week 4	Filtek	68	64.46	1.370	0.171
		G-aenial	68	72.54		
Air blast	Preoperative	Filtek	68	68.35	0.048	0.962
		G-aenial	68	68.65		
	Baseline	Filtek	68	63.14	1.780	0.075
		G-aenial	68	73.86		
	Day 2	Filtek	68	67.11	0.503	0.615
		G-aenial	68	69.89		
	Week 1	Filtek	68	66.88	0.627	0.531
		G-aenial	68	70.13		
	Week 4	Filtek	68	68.57	0.026	0.979
		G-aenial	68	68.43		

There was no statistical difference in the reduction of postoperative sensitivity between group I (Filtek Z350XT) and group II (G-aenial universal flow) when evaluated using different tests at various time periods

Self-etchants ensure maximum adhesion by improving monomer penetration into tooth surface as well as wettability of tooth surface. Add-on benefit is that the removal of smear layer or smear plug is not required. In this manner, potential for postoperative sensitivity is reduced, and similarly the problems associated with transduction of dentinal fluid through patent dentinal tubules are also reduced.[9]

So owing to the advantages, self-etch adhesive system was used in this study. The composition of Single Bond Universal includes 10-methacryloyloxydecyl dihydrogen phosphate (MDP) monomer, dimethacrylate resins, 2-hydroxy-ethylmethacrylate, Vitrebond copolymer, filler, ethanol, water, initiators, and silane. The Vitrebond copolymer provides more consistent bonding to dentin under moist or dry conditions. The MDP monomer optimizes self-etch performance, provides good chemical bonding, and increases shelf stability.

Flowable composites came into practice to restore the NCCLs. These flowable resins tend to absorb the stresses created during polymerization shrinkage. Because of this fact, flowable composites are suggested as a liner on the cavity walls, completing the final restoration with highly filled, high elastic modulus materials.[10]

Another important aspect of the NCCL restoration is the negative effects of tooth flexure. As occlusal stresses concentrate in cervical areas, materials with low elastic modulus are suggested for restoration as they are more flexible. The reason for choosing low-modulus material is that high-modulus materials are unable to flex when the tooth structure is deformed under load, leading therefore, to displacement from the cavity.[11,12]

Thus, in this study, two flowable composites were used. The first flowable composite used in the study was Filtek Z 350XT. They provide their unique properties due to the unique nanotechnology that offers excellent esthetics, low wear, and improved polish retention. Manufacturer claims that because of reduced shrinkage by almost 20%, this material results in lesser sensitivity.

The second flowable composite used in the study was G-aenial universal flow. A new formulation of strontium glass was developed, which is highly translucent,

acid-resistant, and radiopaque. This new glass formulation is milled down to an incredibly fine 200-nm particle size, half the size of previous generations of glass fillers used in microhybrid composites. A revolutionary new silane treatment method is used on the surface of nano-sized glass, in order to strengthen the adhesion between glass particles and resin matrix, to improve the hydrolytic stability and durability of composite structure. They tend to exhibit lower polymerization shrinkage stress of about 1.3 MPa, which can lead to lesser postoperative sensitivity.

The results obtained in our study showed that when compared between Filtek and G-aenial groups in each test and at each time points, there was no significant difference in the reduction of postoperative sensitivity, which was similar to a study done by Peumans et al.[13] They compared two-, three-step etch and rinse adhesive in combination with hybrid *vs* microfilled composites. The results revealed that there was a reduction in sensitivity with time and the stiffness of composites did not affect the clinical longevity of the cervical composite restoration.

As discussed earlier, self-etch adhesive proves to result in lesser sensitivity than the multistep approach. Single bond (self-etch adhesive) was used in our study and the reduction in sensitivity could be because they use smear layer as bonding substrate, leaving residual smear plugs that cause less dentinal fluid flow.

There are no previous clinical trials comparing flowable composites for postoperative sensitivity. Reduction in sensitivity from preoperative value till 4 weeks was noted in both the groups. However, we found that there is no significant difference between the two flowable composites used. This could be attributed to the fact that both materials have less polymerization shrinkage and stress as claimed by the manufacturer. These two factors can lead to the reduction in postoperative sensitivity.

At certain time periods, postoperative sensitivity was noted, which may be due to the fluid movement in dentinal tubules that are exposed to the oral environment and also may be that the composite restoration did not cover all the sensitive dentin.[14]

In majority of the cases, there was no difference in sensitivity at 4 weeks. The possible reason may be due to the formation of a hypermineralized layer and obliteration of exposed dentinal tubules. But there are no clinical trials to prove this.[15]

There are previous studies that show various factors affecting postoperative sensitivity, such as isolation techniques,[16] curing modes,[17] enamel beveling,[18,19] placement technique,[20] and additional enamel etching.[21] No significant difference in postoperative sensitivity was noted, which was similar to our study.

Therefore, more randomized clinical trials are needed to compare the postoperative sensitivity as a primary parameter using different composite materials in NCCLs.

CONCLUSION

Within the limitations of this study, it can be concluded that there was no statistical difference in the reduction of postoperative sensitivity between group I (Filtek Z350XT) and group II (G-aenial universal flow) when evaluated using different tests at various time periods when used in NCCLs. Further research is required to compare the postoperative sensitivity between different composite restorative materials used in NCCLs.

CLINICAL SIGNIFICANCE

There was no statistical difference in the reduction of postoperative sensitivity between two flowable composites when used in NCCLs.

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