ORIGINAL RESEARCH

Comparative Evaluation of Postoperative Sensitivity Following Restoration of Class I Lesions with Different Restorative Materials: An *In Vivo* Study

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Abstract

Aim and objective: This study was undertaken to compare postoperative sensitivity in posterior class I restorations using etch-and-rinse and self-etch composite resins, GC Fuji IX, and Cention-N.

Materials and methods: The sample size consisted of 160 participants. After clinical and radiographic examination, the participants were randomly assigned to four groups consisting of 40 participants each according to the restorative materials used. Class I cavity was prepared and was restored on each patient and after restoration postoperative sensitivity was evaluated at 24 h, 48 h, and 7 days using the visual analog scale (VAS). The results were tabulated and statistically analyzed using analysis of variance (ANOVA) and post-hoc multiple comparison tests.

Results: There were significant differences present between the groups at 24 h, 48 h, and 7 days. We found that the materials causing least postoperative sensitivity are ranked according to superiority as GC Fuji IX > nano-hybrid composite using self-etch adhesive > Cention-N > nano-hybrid composite using etch-and-rinse adhesive.

Conclusion: Both GC Fuji IX and self-etch adhesive showed less postoperative sensitivity as compared to etch-and-rinse and Cention-N at 24 h. With GC Fuji IX and self-etch adhesive postoperative sensitivity was decreased while Cention-N also showed good results at 48 h and 7 days. Etch-and-rinse adhesive showed maximum postoperative sensitivity as compared to other groups at 24 h, 48 h, and 7 days.

Clinical significance: Teeth restored with resin composites are susceptible to sensitivity. The restorative material used and their handling can influence postoperative sensitivity.

Keywords: Class I cavity, Postoperative sensitivity, Restorative material, Visual analog scale.

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Introduction

Restorative dentistry deals with the treatment of tooth defects and restores the function and esthetics without compromising the biology.[1] To maintain pulp vitality, a restorative material should be non-toxic and should provide a long-term hermetic seal against bacterial penetration.[2] A good seal at tooth surface–restoration interface is very essential for an ideal restorative material to minimize the microleakage. Poor adaptation can lead to marginal discoloration, postoperative sensitivity, bacterial penetration, secondary caries, failure of restoration, and pulpal inflammation.[3]

Amalgam had always been the material of choice in clinical practice for many years due to its good mechanical properties and economics. However, there have been issues over the biocompatibility of amalgam because of mercury toxicity and unaesthetic appearance. These disadvantages lead to more research and development of restorative materials like composite resins and glass ionomers because of their esthetics, minimal tooth preparation needs, and good bonding properties to tooth structures.[1]

The research for ideal restorative materials has been multidirectional. On one hand, glass ionomer cements (GIC) bind to tooth structure but have limited strength, while composites on the other hand have better strength and esthetics. Despite the remarkable developments in the technology of resin composite restorative materials, clinical failures of composite restorations are still present because of polymerization shrinkage leading to microleakage and postoperative sensitivity.[4]

There are currently two available adhesive strategies for use with composite resin: etch-and-rinse and self-etch adhesives. In etch-and-rinse adhesives, phosphoric acid is used for conditioning before adhesive application. After phosphoric acid rinsing, dentin hydration should be adequately maintained otherwise, resin monomers cannot infiltrate into demineralized dentin and cannot seal dentin tubules increasing the chances of postoperative sensitivity. Self-etch adhesives do not require multiple steps for bonding. The simultaneous application of a primer and an acidic monomer in a single step results in a lower discrepancy between dentin demineralization and resin infiltration into the dentin, which may reduce postoperative sensitivity when compared to the etch-and-rinse.[5]

Glass ionomer cement was developed by Wilson and Kent in 1972. The advantages of GIC lie in their continuous fluoride release, their ability to bond to enamel and dentin, and prevent caries.[6] To improve the physical properties of the material the new generation

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of glass ionomer, GC Fuji IX GP, has been developed which may offer some benefits to the patients. It contains fluoride, adheres to tooth structure without the need of any additional bonding agent, has adequate strength, and can be finished and polished in one visit.[7]

Among the recently developed materials, Cention-N has gained popularity. Cention-N is an "alkasite" restorative material. This new category utilizes an alkaline filler, capable of releasing acid-neutralizing ions.[8] Cention-N, a new filling material offering these characteristics plus other advantages over both amalgams and GIC. It is a tooth-colored, dual-cured material for restoring deciduous teeth and for permanent restorations of a class I, II, or V nature.[8]

Therefore, despite the availability of these new restorative materials, postoperative sensitivity still remains an issue. So, this *in-vivo* study was undertaken to evaluate and compare clinically the postoperative sensitivity in class I lesions following restorations with etch-and-rinse and self-etch composite resins, high strength glass ionomer (GC Fuji IX), and alkasite filled composite (Cention-N).

Materials and Methods

This *in-vivo* study was conducted in the Department of Conservative Dentistry and Endodontics, Swami Devi Dyal Hospital and Dental College, Barwala, Haryana. Subjects were selected from the regular pool of patients referred to Postgraduate Conservative Dentistry and Endodontics Clinic for restorative treatment. A detailed medical history, dental history, and allergic reactions of all the patients were recorded. The patients were selected for the study based on the following criteria.

Inclusion Criteria

Only those patients willing for the proposed treatment procedure were included in the study and sufficient treatment time was given to properly complete the procedure. Patients above 18 years of age were included and class I cavities with a cavity depth of at least 3 mm were kept in mind. Vital maxillary and mandibular molars were included in the study and also teeth had occlusal contact with antagonist teeth.

Exclusion Criteria

Patients who failed to sign informed consent were excluded. Any pulpal, periodontal, and periapical pathology and patients taking analgesics and anti-inflammatory drugs were not included and those having pain or sensitivity, allergic to resin material and/or other material to be used in the study, undesired parafunctional habits (bruxism, clenching), and malocclusion were excluded from the study.

Sample Selection

The sample size consisted of 160 participants of both genders above 18 years of age. After clinical and radiographic examination, the participants were randomly assigned to four groups. Each group was having a sample size ($N = 40$) depending upon the restorative materials used as follows:

Group 1: Composite restoration bonded with etch-and-rinse Tetric-N-Bond.
Group 2: Composite restorations bonded with self-etch Tetric-N-Bond SE.
Group 3: High strength posterior restorative GIC (GC Fuji IX).
Group 4: Cention-N (Ivoclar)-alkasite restorative material.

Following anesthesia and rubber dam application, a class I cavity was prepared on the occlusal surface of tooth using a No. 245 carbide bur in a high-speed handpiece with water spray. Carious tooth structure was removed until sound tooth structure was detected by tactile examination using dental probe #5. Before restoration, the cavity was checked for any debris, then cleaned and dried. The teeth were then restored depending on the restoration group they were randomly allotted to.

Group 1: Composite restoration bonded with etch-and-rinse Tetric N-Bond was used. The surface of the cavity was etched with a 37.5% phosphoric acid gel. After 15 s it was rinsed with water for at least 5 s. Excess moisture was removed by a gentle stream of air using an air gun, leaving the dentin surface with a slightly glossy wet appearance.[5] A layer of bonding agent was applied using a micro brush and was brushed into the dentin for 10 s. Excess material was removed by a gentle stream of air so that the adhesive completely covers the enamel and dentin without pooling and was light-cured for 10 s.[5] The cavity was then restored with composite resin Tetra-N Ceram by the incremental method. Each increment was a maximum of 2 mm in thickness and was adapted by the elliptical condenser and each increment was light-cured for 20 s as per the manufacturer's instructions.[5] After completing the restoration rubber dam was removed. Occlusion was analyzed by articulating paper and occlusal adjustments were done using fine-grit diamond burs. Restorations were finished and polished with the sequential use of finishing and polishing burs, diamond discs, and rubber cups.

Group 2: Composite restorations bonded with self-etch Tetric N-Bond SE. A thick layer of bonding agent was applied using a micro brush. The material was brushed gently into the dentin for 30 s. Excess material was removed by a gentle stream of air so that adhesive covered enamel and dentin completely without pooling and was light-cured for 10 s. After that restoration was done in the same way as that of group 1.

Group 3: High strength posterior restorative GIC (GC Fuji IX). The standard powder to liquid ratio was taken according to the manufacture's instruction which is 3.6 g/1.0 g (1 level scoop of powder to 1 drop of liquid). Powder and liquid were dispensed onto the mixing pad and mixed for 15–20 s. Working time was 2 min from the start of mixing at 23°C. The material was then transferred into the cavity with the help of a plastic filling instrument and properly condensed avoiding air bubbles. Preliminary contouring of the surface was done. After the rubber dam removal, occlusion was analyzed by articulating paper, if any high-point was removed. Final finishing was done 6 min after starting the mix. The patient was instructed not to apply pressure for 1 h.

Group 4: Cention-N, standard powder:liquid ratio was taken which is 4.6:1, that is, one scoop of powder with one drop of liquid. Powder and liquid were dispensed on the mixing pad and mixed using a plastic spatula according to the manufacturer's instruction for 45–60 s. The material was inserted into the cavity and properly condensed. Preliminary contouring of the surface was done and was light-cured for 20 s. After the rubber dam removal, occlusion was analyzed by articulating paper and any high-point was removed using fine-grit diamond burs. Final finishing was done with the sequential use of finishing and polishing burs, diamond discs, and rubber cups.

Patients were given postoperative instructions including maintenance of oral hygiene.

Patients were asked to record any episode of sensitivity if experienced using a 0–10 visual analog scale (VAS scale) and to place a mark anywhere on the horizontal VAS scale depending

on the intensity of pain with 0 indicating "no pain" and 10 indicating "unbearable sensitivity" after 24 h, 48 h, and after 7 days postoperatively. Additionally, patients were instructed to record in a diary if the sensitivity was spontaneous or induced by mastication, air, heat, or cold stimuli. After 7 days record forms were collected from the patients. The results were tabulated and statistically analyzed.

Statistical Methods

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to the data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Data were expressed as mean ± SD. Analysis of variance (ANOVA) was employed for inter-group analysis of data and multiple comparisons, the least significant difference (LSD) test was applied. A *p*-value of less than 0.05 was considered statistically significant.

Results

A total of 160 samples were taken in this study. They were randomly divided into four groups with 40 samples each, namely group 1 (Composite restoration bonded with etch-and-rinse Tetric-N-Bond), group 2 (composite restorations bonded with self-etch Tetric-N-Bond SE), group 3 (high strength posterior restorative GIC (GC Fuji IX), and group 4 (Cention-N (Ivoclar)-alkasite restorative material. Postoperative sensitivity was evaluated by using a VAS scale after 24 h, 48 h, and 7 days. The results revealed significant differences between nano-hybrid composite using etch-and-rinse adhesive and GC Fuji IX.

The results of our study showed that postoperative sensitivity was minimum with (group 3) GC Fuji IX and maximum with (group 1) nano-hybrid composite using etch-and-rinse adhesive at 24 h. After 48 h postoperative sensitivity was maximum in (group 1) nano-hybrid composite using etch-and-rinse adhesive followed by (group 4) Cention-N and minimum in both group 2 nano-hybrid composite using self-etch adhesive and (group 3) GC Fuji IX. After 7 days postoperative sensitivity was seen in only (group 1) nano-hybrid composite using etch-and-rinse adhesive while other groups showed no sensitivity (Fig. 1). Figure 1 is showing mean at different intervals of time among various groups and VAS scores of different groups, in which group 1 showing highest mean and group 2 and 3 showing lowest mean.

We found that the materials causing the least postoperative sensitivity are ranked according to superiority as GC Fuji IX > nano-hybrid composite using self-etch adhesive > Cention-N > nano-hybrid composite using etch-and-rinse adhesive. Significant differences are seen in Tables 1 to 6 at 24 h, 48 h, and 7 days.

Table 1: VAS scores among different groups after 24 hours

Group	*N*	*Mean*	*SD*	*Min*	*Max*
Group 1	40	1.48	1.55	0	5
Group 2	40	0.25	0.63	0	2
Group 3	40	0.18	0.55	0	2
Group 4	40	0.75	0.90	0	2

Mean values of all the 4 groups after 24 h, in which group 1 is showing highest mean value depicting more postoperative sensitivity and group 3 showing least mean value depicting least postoperative sensitivity

Table 2: Intergroup comparison based on VAS score among various groups at 24 h

Group comparison	*Mean difference*	*p-value*
Group 1 vs group 2	1.23	<0.001*
Group 1 vs group 3	1.30	<0.001*
Group 1 vs group 4	0.73	0.001*
Group 2 vs group 3	0.07	0.735
Group 2 vs group 4	−0.50	0.025*
Group 3 vs group 4	−0.57	0.012*

*Statistically significant difference (*p*-value <0.05); mean difference and *p*-value among all four groups at 24 h, in which *p*-value is statistically significant in (group 1 vs group 2, 3, and 4), (group 2 vs group 4), (group 3 vs group4); *p*-value is statistically insignificant in (group 2 vs group 3)

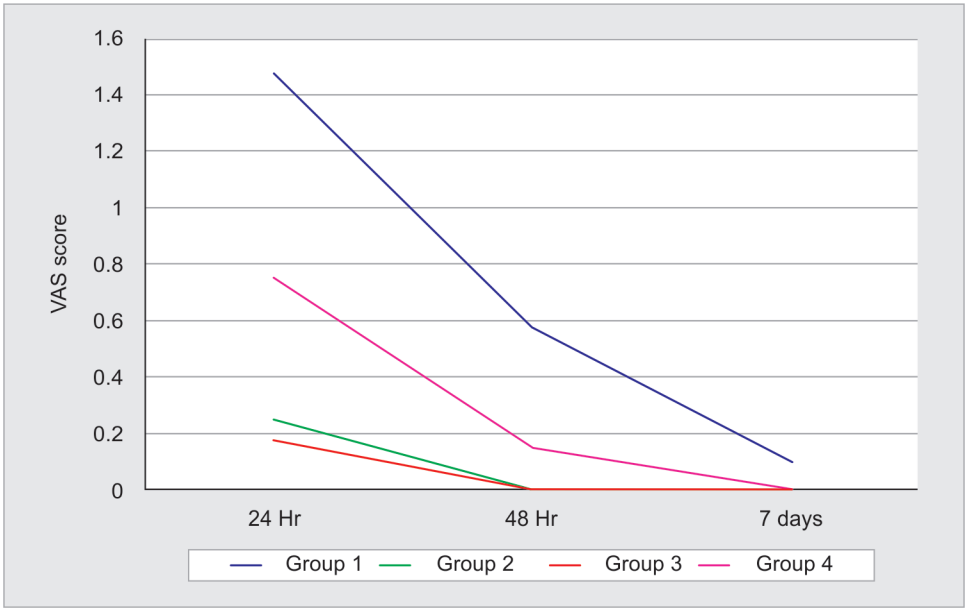

Fig. 1: Graph showing mean difference and *p*-value of all the four groups at 7 days. *p*-value is statistically significant in (group 1 vs groups 2, 3, and 4) and is statistically insignificant in (group 2 vs groups 3 and 4), (group 3 vs group 4)

Table 3: VAS scores among different groups at 48 h

Group	*N*	*Mean*	*SD*	*Min*	*Max*
Group 1	40	0.58	1.39	0	5
Group 2	40	0.00	0.00	0	0
Group 3	40	0.00	0.00	0	0
Group 4	40	0.15	0.48	0	2

Mean values and standard deviation of all four groups at 48 h, in which group 1 is showing highest mean value depicting more postoperative sensitivity followed by group 4. Group 2 and group 3 showing no postoperative sensitivity

Table 4: Intergroup comparison based on VAS score among various groups at 48 h

Group comparison	*Mean difference*	*p-value*
Group 1 vs group 2	0.58	0.001*
Group 1 vs group 3	0.58	0.001*
Group 1 vs group 4	0.43	0.011*
Group 2 vs group 3	0.00	1.000
Group 2 vs group 4	−0.15	0.365
Group 3 vs group 4	−0.15	0.365

*Statistically significant difference (*p*-value <0.05); mean difference and *p*-value of all the four groups at 48 h, in which *p*-value is statistically significant in (group 1 vs group 2, 3, and 4). *p*-value is statistically insignificant in (group 2 vs group 3 and 4), (group 3 vs group 4).

Table 5: VAS scores among different groups after 7 days

Group	*N*	*Mean*	*SD*	*Min*	Max
Group 1	40	0.1	0.44	0	2
Group 2	40	0.0	0.00	0	0
Group 3	40	0.0	0.00	0	0
Group 4	40	0.0	0.00	0	0

Mean values of all the four groups after 7 days, in which group 1 is showing highest mean value depicting more postoperative sensitivity and group 2, 3, and 4 showing no postoperative sensitivity

Table 6: Intergroup comparison based on VAS score among various groups after 7 days

Group comparison	*Mean difference*	*p-value*
Group 1 vs group 2	0.1	0.044*
Group 1 vs group 3	0.1	0.044*
Group 1 vs group 4	0.1	0.044*
Group 2 vs group 3	0.0	1.000
Group 2 vs group 4	0.0	1.000
Group 3 vs group 4	0.0	1.000

*Statistically significant difference (*p*-value <0.05)

Discussion

The advent of newer techniques and concepts in adhesive dentistry has increased the use of composite restorations and tooth-colored restorations. Over the past decade, the use of resin-based dental composite restorations has increased significantly and has become a well-established dental procedure for the direct restoration of anterior and posterior teeth.[9]

Despite recent scientific advances in formulations of resin composite restorative materials and dental adhesives, resin composite restorations may present marginal discoloration, microleakage, postoperative sensitivity, and result in secondary caries over time, which can lead to failure of restoration.[10]

GIC is still considered the only material with self-adherence to dental tissues. New formulations have been successively developed to overcome some clinical drawbacks of the previous ones, especially aiming at improving the physical properties.[2] One of this type is high strength posterior restorative material GC Fuji IX.[11]

Dentists have long sought a real alternative to amalgam or GIC—a cost-effective, fluoride-releasing product that is quick and easy to use without complicated equipment and that offers both strength and good esthetics. Cention-N, a new basic filling material offering these characteristics plus other advantages over both amalgams and GIC. It has good strength than GIC. It is a tooth-colored, dual-cured material for restoring deciduous teeth and for permanent restorations of a class I, II, or V nature. It may, however, be used with or without an adhesive.

Al-Omari et al. showed that short-term postoperative sensitivity was affected by lesion depth. Also, as concluded by Auschill et al. only cavity depth was significantly associated with the appearance of postoperative sensitivity, therefore in the present study cavity depth was taken into consideration and cavity depth of at least 3 mm was kept in all class I cavities.[12,13]

The results of our study showed that postoperative sensitivity was minimum with (group 3) GC Fuji IX and maximum with (group 1) nano-hybrid composite using etch-and-rinse adhesive at 24 h. After 48 h postoperative sensitivity was maximum in (group 1) nano-hybrid composite using etch-and-rinse adhesive followed by (group 4) Cention-N and minimum in both group 2 nano-hybrid composite using self-etch adhesive and (group 3) GC Fuji IX. After 7 days postoperative sensitivity was seen in only (group 1) nano-hybrid composite using etch-and-rinse adhesive while other groups showed no sensitivity.

The reason that GC Fuji IX showed minimum sensitivity might be the ability to form a bond with dentin, the dimensional stability of GIC, and its excellent adaptation with the tooth structure. Etch-and-rinse adhesive showed maximum sensitivity, which may be attributed to the fact that this system employs phosphoric acid to etch enamel and dentin before the application of adhesive. As a consequence, the smear layer is removed and the dentin tubules are opened, increasing the dentin permeability and hydraulic conductance of dentin.

The results of this study are in concurrence with Six et al. who also found that GC Fuji IX induces minimum pulp reactions and that is why postoperative sensitivity is less with this material.[2] They compared the GC Fuji IX group with two control groups, that were left unfilled.

Self-etch adhesives also showed less postoperative sensitivity than etch-and-rinse at 24 h, 48 h, and 7 days. The results of our study are in concurrence with Gordan and Mjor who also found that self-etch adhesive resulted in less postoperative sensitivity. They evaluated the postoperative sensitivity of posterior restorations restored with a resin-based restorative material and a self-etching primer. This may be due to the fact that self-etch adhesives do not remove, but incorporate the smear layer in the hybridized complex with the advantage of being less technique sensitive, and in self-etching, there is no rinsing step. Minerals that are solubilized during self-etching remain dissolved in the primer, so there is no loss of mass. This can substantially reduce the potential for postoperative sensitivity.[14]

The results of the present study are similar to those of Masih et al. who compared the microleakage of GC Fuji IX and GC Fuji II LC and found that GC Fuji IX resulted in less microleakage. The same results were found in a study conducted by Yassini et al. who found that GC Fuji IX showed better marginal integrity and less microleakage.[6,15]

The results of the present study are in concurrence with Samanta et al. who found that Cention-N exhibited the lowest microleakage as compared to the other two groups. They compared the microleakage in class V cavity filled with flowable composite resin, GIC, and Cention-N. Also, the present study is in accordance with Burgess et al. who found that Cention-N resulted in postoperative sensitivity and the results were largely similar to the amalgam when these two materials were compared.[16,17]

It can be concluded that the current adhesive systems and restorative materials can be used successfully in both enamel and dentin. It is important to notice that the success of restorative treatment relies not only on improvement of material properties and handling techniques but also on the skills and knowledge in regard to materials, properties, limitations, and correct use.[7] This study was conducted under ideal conditions by a single operator. Moisture control was done with rubber dam isolation, preventing contamination of the operating field.

Limitations

Small sample size was included in this study and only class I cavities and one filling technique (incremental) were used in this study. Follow-up was done for 7 days only.

Conclusion

Within the limitations of the present *in-vivo* study, it can be concluded that both GC Fuji IX and self-etch adhesive showed less postoperative sensitivity as compared to etch-and-rinse and Cention-N at 24 h. Etch-and-rinse adhesive showed maximum postoperative sensitivity as compared to other groups at 24 h, 48 h, and 7 days. So, in conclusion, GC Fuji IX and self-etch adhesive should be preferred over etch-and-rinse and Cention-N and more studies should be advocated to correlate the findings of the present study.

References

1. Nahlawi TA, Altaki Z, Abbood D. Post-operative sensitivity of class I, II amalgam and composite resin restoration: clinical evaluation in an undergraduate program. Int Dent Med J Adv Res 2015;1(1):1–4. DOI: 10.15713/ins.idmjar.17.
2. Six N, Lasfargues JJ, Goldberg M. In vivo study of pulp reaction to Fuji IX, a glass ionomer cement. J Dent 2000;28(6):413–422. DOI: 10.1016/s0300-5712(00)00015-4.
3. Diwanji A, Dhar V, Arora R, et al. Comparative evaluation of microleakage of three restorative glass ionomer cements: an in vitro study. J Nat Sci Biol Med 2014;5(2):373–377. DOI: 10.4103/0976-9668.136193.
4. Hegde MN, Vyapaka P, Shetty S. A comparative evaluation of microleakage of three different newer direct composite resins using a self-etching primer in class V cavities: an in-vitro study. J Conserv Dent 2009;12(4):160–163. DOI: 10.4103/0972-0707.58340.
5. Costa TR, Rezende M, Sakamoto A, et al. Influence of adhesive type and placement technique on postoperative sensitivity in posterior composite restorations. Oper Dent 2017;42(2):143–154. DOI: 10.2341/16-010-C.
6. Yassini E, Kermanshah H, Mirzaei M, et al. Effect of mechanical load cycling on class V glass-ionomer and composite restorations; a microleakage and scanning electron microscopic evaluation. J Isl Dent Assoc Iran 2012;24(3):69–78.
7. Singla T, Pandit IK, Srivastava N, et al. An evaluation of microleakage of various glass ionomer based restorative materials in deciduous and permanent teeth: an in vitro study. Saudi Dent J 2012;24(1):35–42. DOI: 10.1016/j.sdentj.2011.10.002.
8. Scientific Documentation Cention N. Product overview. Available from: www.ivoclarvivadent.in/en-in/p/all/centoin-n. [Last accessed on 25/10/17].
9. Strober B, Keenan AV, Barna JA, et al. Effectiveness of a resin-modified glass ionomer liner in reducing hypersensitivity in posterior restorations: a study from the practitioners engaged in applied research and learning network. J Am Dent Assoc 2013;144(8):886–897. DOI: 10.14219/jada.archive.2013.0206.
10. Ayar MK. Postoperative sensitivity after placement of bulk-fill posterior restoration. J Res Med Dent Sci 2017;5(53):53–58. DOI: 10.24896/jrmds.2017539.
11. Raju VG, Venumbaka NR, Mungara J, et al. Comparative evaluation of shear bond strength and microleakage of tricalcium silicate based restorative material and radioopaque posterior glass ionomer restorative cement in primary and permanent teeth: an in vitro study. J Indian Soc Pedod Prev Dent 2014;32(4):304–310. DOI: 10.4103/0970-4388.140952.
12. Al-Omari WM, Al-Omari QD, Omar R. Effect of cavity disinfection on postoperative sensitivity associated with amalgam restorations. Oper Dent 2006;31(2):165–170. DOI: 10.2341/05-8.
13. Auschill TM, Koch CA, Wolkewitz M, et al. Occurrence and causing stimuli of postoperative sensitivity in composite restorations. Oper Dent 2009;34(1):3–10. DOI: 10.2341/08-7.
14. Gordan V, Mjor IA. Short- and long-term clinical evaluation of post-operative sensitivity of a new resin-based restorative material and self-etching primer. Oper Dent 2002;27(6):543–548.
15. Masih S, Thomas AM, Koshy G, et al. Comparative evaluation of the microleakage of two modified glass ionomer cements on primary molars. An in vivo study. J Indian Soc Pedod Prev Dent 2011;29(2):135–139. DOI: 10.4103/0970-4388.84686.
16. Samanta S, Das UK, Mitra A. Comparison of microleakage in class V cavity restored with flowable composite resin, glass ionomer cement and cention N. Imp J Interdiscip Res 2017;3(8):180–183.
17. Burgess J. Clinical evaluation of an amalgam replacement dental filling material: 6-month recall. 2016. USA. Scientific documentation Cention N; May 2015. Available from: www.ivoclarvivadent.in/en-in/p/all/centoin-n. [Last accessed on 26/02/19].