Original Article

DOI: 10.7860/JCDR/2016/21980.9047

Dentistry Section

Comparative Evaluation of Fluoride Releasing Ability of Various Restorative Materials after the Application of Surface Coating Agents – An In-vitro Study

GVS KISHORE[1], AJ SAI-SANKAR[2], MJS PRATAP-GOWD[3], M SRIDHAR[4], KAKARLA PRANITHA[5], VS SAI-KRISHNA[6]

ABSTRACT

Introduction: Fluoride plays a key role in prevention of dental caries and is also an essential element for oral health promotion both in children and adults.

Aim: The aim of the present study was to evaluate the effect of surface coating (petroleum jelly, G-Coat Plus) on the fluoride releasing property of conventional Glass Ionomer Cement (GIC) and Zirconomer.

Materials and Methods: A total of 30 disk shaped brass mold specimens (6±0.1mm in diameter and 2±0.1mm thickness) for each test group were fabricated with conventional GIC (Group A) and Zirconomer (Group B). These test groups were further divided into three subgroups of 10 each. The unprotected specimens act as control (Group A1 and B1), G-Coat Plus specimens as (Group A2 and B2) and for the remaining specimens petroleum jelly was applied (Group A3 and B3). Fluoride ion concentration was measured with a combination of fluoride ion specific electrode and ion analyzer for every 24 hours for 15 days. The data was statistically analyzed using Kruskal Wallis and Mann-Whitney U test.

Results: The Group B released significantly more fluoride than Group A. Among all the subgroups the greatest amount of fluoride was released from Group B1, in the first 24 hours followed by A1 and B2. The least was observed on 15th day with Group B3 and A3.

Conclusion: Both the tested materials (GIC and Zirconomer) used in the study exhibited fluoride release whether protected or unprotected with surface coating. Though there was a difference between the groups, the pattern of fluoride release was similar and continuous throughout the study period i.e., first the initial burst followed by sustained release. The results revealed Zirconomer released more fluoride and is comparable to conventional GIC.

Keywords: Glass ionomer cement, G-Coat plus, Petroleum jelly, Zirconomer

INTRODUCTION

Dental caries is one of the most prevalent chronic diseases affecting mankind. It is still a major health issue in most industrialized countries affecting almost 60–90% of school-aged children and the majority of adults [1]. In most developing countries, the levels of dental caries was low until recently but the prevalence rate and experience of carious teeth are now on an increasing trend which is largely due to the change in dietary habits and inadequate fluoride exposure. In contrast, a decline in caries has been observed in most industrialized countries over the past two decades due to better public health measures which include effective use of fluorides, changing lifestyles and introduction of newer restorative materials [1].

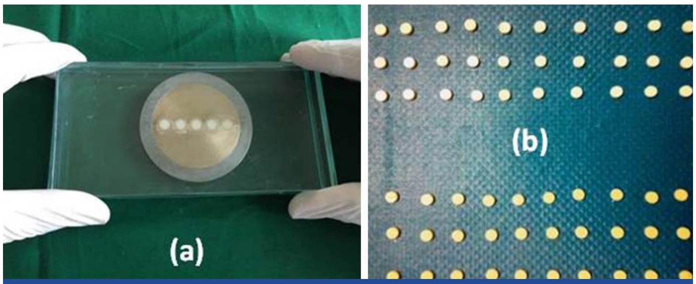
The desirable characters of these latest tooth colored restorative materials include remineralization and release of fluoride ions resulting in cariostatic activity. One such material is Glass Ionomer Cement (GIC) which was developed by Wilson and Kent (1972) and widely employed in modern restorative dentistry [2]. The ideal restorative material used in paediatric operative dentistry is GIC because of its favorable properties like adhesion to tooth structure and ability to release fluoride over a prolonged period of time [3]. On the other hand; there are certain shortcomings like early moisture sensitivity, poor aesthetics, prolonged setting reaction, compromised mechanical properties and weak bond strength [3]. To overcome these disadvantages, the zirconia fillers are incorporated in the glass component of GIC thereby reinforcing the structural integrity and mechanical properties of the restoration. The combination of durability, outstanding strength and sustained fluoride protection renders Zirconomer (Zirconia reinforced Glass ionomer) as an ideal posterior restorative material in patients with high caries incidence [4].

The GIC is the most popular in the literature and is a moisture sensitive (hydrophilic) material with the presence of a high proportion of loosely bound water [5]. In the initial stages of setting reaction, due to dehydration or contamination of the material with water or saliva, the cement forming ions-calcium, aluminum and silicate will be washed out resulting in loss of translucency, reduction in physical strength and susceptibility to disintegration. In order to protect the restorative material from these mishaps, immediate application of surface coating agent is recommended [2]. These include solvent-based and light-cured bonding resins, varnishes, and emollients such as petroleum jelly. There is little published research available in literature about the effect of bathing solutions and surface coatings on the release of fluoride ions from various glass ionomer restorations. So the present in-vitro study was aimed to evaluate and compare the fluoride releasing ability of conventional GIC, Fuji II (GC Corporation, Tokyo, Japan)- Group A and Zirconomer cement (Shofu Inc., Kyoto, Japan) - Group B with and without surface coatings (petroleum jelly and G-Coat plus).

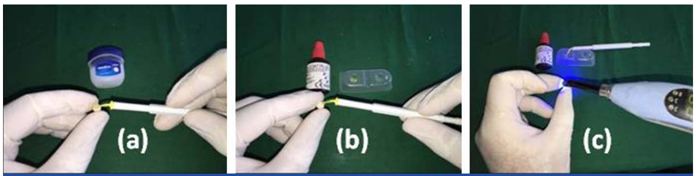
MATERIALS AND METHODS

The present in-vitro study was conducted at Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India in collaboration with Water Technology Center, Hyderabad during April-July 2015.

Before starting the procedure the study design was approved by the Institutional Ethical Committee. A total of 30 disk shaped brass mold specimens (6±0.1mm in diameter and 2±0.1mm thickness) for each test group were fabricated according to the manufacturer's



[Table/Fig-1a,b]: Preparation of Pellets.



[Table/Fig-2]: (a,b) Application of petroleum jelly and G-Coat Plus; c) Light curing of G-Coat Plus samples.

[Table/Fig-3]: (a) Immersion of pellets in 50ml deionized distilled water; (b) Measurement of fluoride release using fluoride electrode.

Day	A1		A2		A3		p-value	Inference
	Mean	SD	Mean	SD	Mean	SD		
1	2.900	0.158	0.420	0.016	0.430	0.016	<0.01	HS
2	1.400	0.158	0.820	0.016	0.260	0.016	<0.01	HS
3	0.840	0.016	0.730	0.016	0.180	0.016	<0.01	HS
4	0.720	0.016	0.690	0.016	0.170	0.016	<0.01	HS
5	0.660	0.016	0.690	0.016	0.150	0.016	<0.01	HS
6	0.410	0.016	0.460	0.016	0.130	0.016	<0.01	HS
7	0.400	0.016	0.440	0.016	0.130	0.016	<0.01	HS
8	0.400	0.016	0.440	0.016	0.120	0.016	<0.01	HS
9	0.350	0.016	0.410	0.016	0.120	0.016	<0.01	HS
10	0.260	0.016	0.320	0.016	0.100	0.016	<0.01	HS
11	0.270	0.016	0.290	0.016	0.284	0.378	0.096	NS
12	0.220	0.016	0.280	0.016	0.094	0.002	<0.01	HS
13	0.220	0.016	0.270	0.016	0.088	0.002	<0.01	HS
14	0.220	0.016	0.240	0.016	0.091	0.002	<0.01	HS
15	0.220	0.016	0.250	0.016	0.087	0.001	<0.01	HS

[Table/Fig-4]: Intra-group comparison of mean fluoride release (ppm) for Group A.
Statistical analysis: Kruskal Wallis test.
Significant if p<0.05, NS: Not significant; S: Significant; HS: Highly significant

instructions and immediately covered with polyester strip. A glass slab was laid over the top and held under hand pressure to ensure proper flow of the material [Table/Fig-1a]. The specimens were protected from dehydration and moisture contamination within their molds for about 10 minutes (100% relative humidity at 37°C) and the excess material around the periphery was removed with the help of a scalpel. Following this the surfaces of the pellets were softly polished under water, with the help of wet carborundum paper. For standardization, all the specimens were premeasured with digital weighing machine and the mean weight of GIC specimens was 0.11±0.01 and 0.14±0.01 for Zirconomer specimens. Further, these pellets were randomized into three subgroups of 10 each, for both the test groups [Table/Fig-1b]. G-Coat Plus (GC corporation, Tokyo, Japan) was coated using a micro-tip applicator and light cured for 20 seconds (according to manufacturer's instructions) and denoted as A2 and B2; for another group, petroleum jelly (Vaseline, Hindustan Lever Ltd.) was applied with a brush and then gently air dried (A3 and B3); whereas the remaining 10 samples were left uncoated (A1 and B1) [Table/Fig-2a-c]. Immediately after polymerization, the disks were immersed in six individual sealable plastic bottles containing 50ml of deionized distilled water (test solution), left undisturbed in an incubator set at 37°C [3].

After 24 hours, the sample bottles containing the test solution was removed from the incubator and the specimens were grasped with clean metal forceps coated with nail varnish to prevent metal contamination. Then these were dried using absorbent paper for two minutes and transferred to new sample bottles containing 50ml deionized distilled water [Table/Fig-3a] [3]. The fluoride release was estimated by adding 5ml of TISAB II to the test solution. Fluoride electrode (Orion 9609BN, Orion Research Inc., USA) with a combination of ion analyzer (Orion EA 940, Orion Research Inc., USA) was immersed in the test solution and the measurements obtained were recorded in ppm [Table/Fig-3b] [3]. The test solution was changed every 24 hours and fluoride release from each test solution was measured every day for 15 days.

Day	B1		B2		B3		p-value	Inference
	Mean	SD	Mean	SD	Mean	SD		
1	6.700	0.158	0.560	0.016	0.830	0.016	<0.01	HS
2	2.116	0.135	1.500	0.158	0.290	0.016	<0.01	HS
3	1.200	0.158	1.116	0.135	0.180	0.016	<0.01	HS
4	1.050	0.098	0.830	0.016	0.180	0.016	<0.01	HS
5	0.880	0.016	0.680	0.016	0.160	0.016	<0.01	HS
6	0.580	0.016	0.390	0.016	0.160	0.016	<0.01	HS
7	0.530	0.016	0.320	0.016	0.150	0.016	<0.01	HS
8	0.540	0.016	0.320	0.016	0.140	0.016	<0.01	HS
9	0.490	0.016	0.280	0.016	0.140	0.016	<0.01	HS
10	0.390	0.016	0.210	0.016	0.120	0.016	<0.01	HS
11	0.360	0.016	0.210	0.016	0.112	0.014	<0.01	HS
12	0.350	0.016	0.180	0.016	0.111	0.014	<0.01	HS
13	0.330	0.016	0.180	0.016	0.095	0.002	<0.01	HS
14	0.320	0.016	0.180	0.016	0.094	0.002	<0.01	HS
15	0.290	0.016	0.170	0.016	0.087	0.002	<0.01	HS

[Table/Fig-5]: Intra-group comparison of mean fluoride release (ppm) for Group B.
Statistical analysis: Kruskal Wallis test
Statistically significant if p<0.05, NS: Not significant; S: Significant; HS: Highly significant

Day	Control				p-value	Inference
	A1		B1			
	Mean	SD	Mean	SD		
1	2.900	0.158	6.700	0.158	<0.01	HS
2	1.400	0.158	2.116	0.135	<0.01	HS
3	0.840	0.016	1.200	0.158	<0.01	HS
4	0.720	0.016	1.050	0.098	<0.01	HS
5	0.660	0.016	0.880	0.016	<0.01	HS
6	0.410	0.016	0.580	0.016	<0.01	HS
7	0.400	0.016	0.530	0.016	<0.01	HS
8	0.400	0.016	0.540	0.016	<0.01	HS
9	0.350	0.016	0.490	0.016	<0.01	HS
10	0.260	0.016	0.390	0.016	<0.01	HS
11	0.270	0.016	0.360	0.016	<0.01	HS
12	0.220	0.016	0.350	0.016	<0.01	HS
13	0.220	0.016	0.330	0.016	<0.01	HS
14	0.220	0.016	0.320	0.016	<0.01	HS
15	0.220	0.016	0.290	0.016	<0.01	HS

[Table/Fig-6]: Inter-group comparison of mean fluoride release for A1 and B1.
Statistical analysis: Mann-Whitney U test
Statistically significant if p<0.05, NS: Not significant; S: Significant; HS: Highly significant

Data was statistically analyzed using - Kruskal Wallis and Mann-Whitney U test.

RESULTS

Depending upon the application of surface coatings the groups were divided for both the tested materials, conventional GIC (A1, A2, A3) and Zirconomer cement (B1, B2, B3). Both groups were evaluated for release of fluoride ion in parts per million [Table/Fig-4,5]. The highest amount of fluoride is released from Group B1 in the first 24 hours followed by A1 and B2. The least was observed on 15th day with Group B3 and A3. Though there was a difference between the groups, the pattern of fluoride release was similar and continuous throughout the study period. The highest amount of fluoride was released in the first 24 hours followed by a decrease on the consequent days. On analyzing the results it was noticed that the mean amount of fluoride released for both the groups in each time period was significant.

On comparison, the interpreted values of Group A1 and B1 were statistically significant ($p<0.05$). Except on day 5 the values of group A2 and B2 were significant [Table/Fig-6,7]. However, significant values were noticed with Group A3 and B3 on day 1,2,6,12-14 [Table/Fig-8].

Day	G- Coat Plus				p-value	Inference
	A2		B2			
	Mean	SD	Mean	SD		
1	0.420	0.016	0.560	0.016	<0.01	HS
2	0.820	0.016	1.500	0.158	<0.01	HS
3	0.730	0.016	1.116	0.135	<0.01	HS
4	0.690	0.016	0.830	0.016	<0.01	HS
5	0.690	0.016	0.680	0.016	0.42	NS
6	0.460	0.016	0.390	0.016	<0.01	HS
7	0.440	0.016	0.320	0.016	<0.01	HS
8	0.440	0.016	0.320	0.016	<0.01	HS
9	0.410	0.016	0.280	0.016	<0.01	HS
10	0.320	0.016	0.210	0.016	<0.01	HS
11	0.290	0.016	0.210	0.016	<0.01	HS
12	0.280	0.016	0.180	0.016	<0.01	HS
13	0.270	0.016	0.180	0.016	<0.01	HS
14	0.240	0.016	0.180	0.016	<0.01	HS
15	0.250	0.016	0.170	0.016	<0.01	HS

[Table/Fig-7]: Inter-group comparison of mean fluoride release for A2 and B2.
Statistical analysis: Mann-Whitney U test
Statistically significant if p<0.05, NS: Not significant; S: Significant; HS- Highly significant

Day	Petroleum Jelly				p-value	Inference
	A3		B3			
	Mean	SD	Mean	SD		
1	0.430	0.016	0.830	0.016	<0.01	HS
2	0.260	0.016	0.290	0.016	0.03	S
3	0.180	0.016	0.180	0.016	1	NS
4	0.170	0.016	0.180	0.016	0.42	NS
5	0.150	0.016	0.160	0.016	0.42	NS
6	0.130	0.016	0.160	0.016	0.03	S
7	0.130	0.016	0.150	0.016	0.095	NS
8	0.120	0.016	0.140	0.016	0.095	NS
9	0.120	0.016	0.140	0.016	0.095	NS
10	0.100	0.016	0.120	0.016	0.095	NS
11	0.284	0.378	0.112	0.014	0.42	NS
12	0.094	0.002	0.111	0.014	<0.01	HS
13	0.088	0.002	0.095	0.002	<0.01	HS
14	0.091	0.002	0.094	0.002	0.03	S
15	0.087	0.001	0.087	0.002	0.69	NS

[Table/Fig-8]: Inter-group comparison of mean fluoride release for A3 and B3.
Statistical analysis: Mann-Whitney U test
Statistically significant if p<0.05, NS: Not significant; S: Significant; HS- Highly significant

DISCUSSION

Despite the advent of newer restorative materials and techniques, dental caries is still a major concern worldwide. Fluoride plays a pivotal role in oral health promotion and is the corner stone in prevention of dental caries; both in children and adults [6]. Delivery of fluoride is achieved by several means, dental restorations is one among them, which facilitate the delivery of fluoride directly to susceptible tooth surface. Fluoride may be released from dental restorative material as a part of setting reaction or it may be added to the formulation with the specific intention of fluoride release [7]. The fluoride elution is not a straight forward process and can be governed by various intrinsic and extrinsic factors. The intrinsic factors are composition, powder/liquid ratio, mixing time, temperature, specimen geometry, permeability, surface treatment and finishing. The extrinsic factors include type of storage medium, experimental design (volume of storage medium, frequency of medium change, stirring) and analytical methods [8]. Among fluoride releasing restorative materials; the most popular in the literature is the glass ionomer or glass silicate materials. Fluoride compounds are added to glass silicate during manufacturing process to act as flux and released from the glass on mixing with polyalkenoic acid. The release of fluoride from glass ionomer restorations has been proven to play a vital role in oral health such as prevention of secondary caries, affecting acidogenic bacteria and fluoride density in enamel and dentin [9]. Fluoride release pattern is different for various commercially available restorative materials. However, many resin modified glass ionomer are equally efficient as conventional GIC and even reported a better fluoride release [5]. The purpose of selecting Zirconomer in the study is that it has strength and durability comparable with amalgam and release of fluoride similar to GIC [4]. The setting chemistry of GIC continues slowly after the initial hardening is complete, and may extend to more than 24 hours. During this period, the water present within the restoration is still labile, and may be lost on exposure to dry air. This leads to the development of microcracks in the surface and a chalky appearance. Restorations are also susceptible to attack by saliva, with consequent washing out of matrix-forming ions resulting in the loss of translucency, dimensional changes and reduction in physical strength [2]. The application of different surface coatings (varnish, petroleum jelly, cocoa butter or light-cured resin) on glass ionomer restorations after initial set has been recommended to maintain the necessary water content and to overcome the problem of early moisture contamination [3].

Both the groups exhibited a specific pattern of flouride release. There was an initial burst of release in the first 24 hours except in the petroleum jelly coated group where it is more on day 2, which might be due to the dissolution of petroleum jelly. Studies by De Moor RJ et al., [10], Yip HK and Smales RJ [11] and Yap AU et al., [12] have demonstrated similar flouride release pattern. Due to variation in material composition and experimental methodology, it is difficult to compare results with exactly similar studies. The flouride release in the initial 24 hours was maximum due to surface wash off effect. During this phase, the acid dissolution of powder particle surfaces, a large amount of flouride becomes part of the reaction product matrix. This flouride diffuse quickly from the matrix exposed on the surface of the material and is slowly replaced by flouride diffusing from the matrix below the surface. This is responsible for high amount of fluoride release in the first 24 hours and the phenomenon is called as "burst effect" [13]. The initial burst is very beneficial and desired due to its proven effect in caries prevention and demineralization of dental hard tissues whereas, sustained release increases the resistance of enamel and dentin to new carious lesions [5]. This initial burst effect was observed with GICs and Zirconomer. This finding is consistent with studies conducted by Yap AU et al., [12], Verbeeck RM et al., [14], Forsten L [15] and Shaw AJ et al., [16]. The significant decrease in flouride release till 15th day in both the groups is due to diffusion through pores and cracks. This pattern of flouride release from surface coated groups was consistent with a study by McKnight-Hanes C [17], Castro GW et al., [18] and Mazzaoui SA et al., [19]. When the amount of flouride release is considered, application of either G-Coat Plus or petroleum jelly resulted in decline in flouride release. However, the decrease was dramatic in case of G-Coat Plus group. Thus, surface protection of GIC definitely impedes the flouride release property which might be due to the associated reduction in the movement of water. According to Tiwari S and Nandlal B [7] G-Coat Plus occludes the mechanism of superficial rinse and diffusion through pores; thus, impeding the flouride release. The flouride release in surface coated group was gradual for 1st week and then reduced to a consistent level for the next week. This decrease in release of fluoride restricts the ability of material to inhibit secondary caries around restorations since the low levels of flouride released in the long term may not have therapeutic effect [20]. However, it has been reported that GICs can replace flouride from the environment. It has been suggested that the potential for flouride recharge is more important than flouride release alone. Hence, further studies on the effect of G-Coat Plus application on the recharging ability of GICs are required.

As the life span of the primary teeth is limited with comparatively less biting forces, fluoride releasing property is more important. Further in-vitro studies and long term clinical studies have to be conducted to evaluate the effect of surface coating applications on strength, antimicrobial action and fluoride uptake properties of GIC and Zirconomer.

LIMITATION

The limitations of the present studywere that, the routine use of flouride incorporated into dentifrices and solutions could affect the amount of flouride uptake and release from the restorative materials and also tooth brushing, dietary habits and oral hygiene maintenance can also influence the retention of surface coating agents.

CONCLUSION

Both the tested materials (GIC and Zirconomer) used in the study exhibited fluoride release whether protected or unprotected with surface coating. Though there was a difference between the groups, the pattern of fluoride release was similar and continuous throughout the study period i.e., first the initial burst followed by sustained release. The results revealed Zirconomer released more fluoride and is comparable to conventional GIC.

REFERENCES

[1] Petersen PM, Bourgeois D, Ogawa H, Estupinan Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ*. 2005;83:661–69.

[2] Hattab FN, Amin WM. Fluoride release from GIC restorative materials and the effects of surface coating. *Biomaterials*. 2001;22:1449-58.

[3] Kamatham R, Reddy SJ. Surface coatings on GIC restorations in Pediatric dentistry-Worthy or not? *J Indian Soc Pedod Prev Dent*. 2013;31:229-33.

[4] Zirconia reinforced restorative. Available from: http:// www.shofu.com.sg/downloads/pdf/Zirconomer%20Brochure.pdf.

[5] Zafar MS. Effects of surface pre-reacted glass particles on fluoride release of dental restorative materials. *World App Sci J*. 2013;28:457-62.

[6] Madhyastha P, Kotian R, Pai V, Khader AMA. Fluoride release from GIC: Effect of temperature, time interval and storage condition. *Journal of Contemporary Dentistry.* 2013;3:68-73.

[7] Tiwari S, Nandlal B. Effect of nano-filled surface coating agent on fluoride release from conventional GIC: An in-vitro trial. *J Indian Soc Pedod Prev Dent*. 2013;2:91-95.

[8] Paschoal MA, Gurgel CV, Rios D, Magalhães AC, Buzalaf MA, Machado MA. Fluoride release profile of a nano-filled resin-modified GIC. *Braz Dent J*. 2011;22:275-79.

[9] A Wiegand, W Buchalla, T Attin. Review on fluoride-releasing restorative materials - Fluoride release and uptake characteristics, antibacterial activity and influence on caries formation. *Dent Mater*. 2007;23:343-62.

[10] De Moor RJ, Verbeeck RM, De Maeyer EA. Fluoride release profiles of restorative GIC formulations. *Dent Mater*. 1996;12:88-95.

[11] Yip HK, Smales RJ. Fluoride release from a polyacid-modified resin composite and 3 resin-modified glass-ionomer materials. *Quintessence Int*. 2000;31:261-66.

[12] Yap AU, Tham SY, Zhu LY, Lee HK. Short-term fluoride release from various aesthetic restorative materials. *Oper Dent*. 2002;27:259-65.

[13] Jingarwar MM, Pathak A, Bajwa NK, Sidhu HS. Quantitative assessment of fluoride release and recharge ability of different restorative materials in different media: An in-vitro study. *J Clin Diagn Res*. 2014;8:31-34.

[14] Verbeeck RM, de Moor RJ, Van Even DF, Martens LC. The short term fluoride release of a hand-mixed VS capsulated system of a restorative GIC. *Journal of Dental Research*. 1993;72:577-81

[15] Forsten L. Fluoride release and uptake by GICs and related materials and its clinical effect. *Biomaterials*. 1998;19:503-08.

[16] Shaw AJ, Carrick T, McCabe. Fluoride release from GIC and compomer restorative materials: Six month data. *Dent Mater.* 1998;26:355-59.

[17] Mc Knight-Hanes C, Whitford GM. Fluoride release from three GIC materials and the effects of varnishing with or without finishing. *Caries Res*. 1992;26:345-50.

[18] Castro GW, Gray SE, Buikema DJ, Reagan SE. The effect of various surface coatings on fluoride release from glass-ionomer cement. *Oper Dent*. 1994;19:194-98.

[19] Mazzaoui SA, Burrow MF, Tyas MJ. Fluoride release from GIC and resin composites coated with a dentin adhesive. *Dent Mater*. 2000;16:166-71.

[20] Behrend B, Geurtsen W. Long term effects of four extraction media on the fluoride release from four polyacid modified composite reins and one resins modified GIC. *J Biomed Mater Res*. 2001;58:631-37.

PARTICULARS OF CONTRIBUTORS:

1. Postgraduate Student, Department of Pedodontics and Preventive Dentistry, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India.
2. Professor and Head, Department of Pedodontics and Preventive Dentistry, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India.
3. Assistant Professor, Department of Pedodontics and Preventive Dentistry, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India.
4. Reader, Department of Pedodontics and Preventive Dentistry, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India.
5. Reader, Department of Pedodontics and Preventive Dentistry, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India.
6. Assistant Professor, Department of Pedodontics and Preventive Dentistry, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. MJS Pratap-Gowd,
Reader, Department of Pedodontics and Preventive Dentistry,
Sibar Institute of Dental Sciences, Guntur-522509, Andhra Pradesh, India.
E-mail: prathapmjs@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Jun 10, 2016**
Date of Peer Review: **Aug 11, 2016**
Date of Acceptance: **Sep 14, 2016**
Date of Publishing: **Dec 01, 2016**