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Evaluation of Immediate and Delayed Fluoride Release of Alkasite Filling Materials with and without Bonding to Tooth Structure

Hussein A. Mohammed [1] *
Manal H. Abd-alla[2]

[1, 2] Department of Conservative Dentistry, College of Dentistry, Mustansiriyah University, Baghdad, Iraq.

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***Corresponding Author:**
Email:
harshed89@gmail.com

M. Sc. Student.Department of Conservative Dentistry, College of Dentistry, Mustansiriyah University, Baghdad, Iraq

Abstract

The effectiveness of fluoride-releasing materials in preventing caries is proportional to the concentration and duration of the fluoride ions they release. The goal of this study was to evaluate the fluoride ion release of two alkasite materials; Cention Forte and Cention-N in comparison to Glass Ionomer Cement (GIC) Riva at two time intervals (24 hours and 7 days) when they are bonded and non-bonded to tooth structures. Methodology: 72 samples were fabricated from the three types of fluoride releasing materials. 36 samples were bonded to teeth specimens (three bonded groups) and another 36 samples were constructed within a silicon mould (three non-bonded groups), each group consisted of 12 samples. The bonded groups were: BCF using Cention Forte, BCN using Cention N and BGI using GIC Riva. The non-bonded groups were: NBCF using Cention Forte, NBCN using Cention N and NBGI using GIC Riva. 5ml of deionized water was used as the storage media for all the samples. Fluoride ions measurements were performed by fluoride ion selective electrode at two time intervals; after 24 hours (immediate) and after 7 days (delayed) for all the groups. The mean values of the data were analyzed statistically using one-way ANOVA, Post hoc Tukey's HSD test and paired t-test at $p \leq 0.05$. Results: For both bonded and non-bonded groups, at 24h the initial fluoride release of GIC Riva was significantly higher ($p=0.00$) than both Alkasite groups. While after 7 days, the highest amount of fluoride ion release was recorded for BCF with significant difference with BCN ($p=0.016$) and BGI ($p=0.006$), respectively. Similarly, NBCF released significantly higher amount of fluoride ions than NBCN and NBGI ($p=0.00$). The results of paired t-test showed that the mean values of fluoride ions release was significantly increased from the first 24 to 7 days for all the groups ($p \leq 0.05$). Conclusion: The immediate fluoride ions release was highest from GIC Riva. While the delayed fluoride ions release was highest from both Alkasite filling materials for both the bonded and non-bonded groups.

Introduction:

There are many different direct filling materials, including amalgam, glass ionomer cement (GIC), and composites that are used in contemporary dental practice. Each of these materials has its cons and pros that identify their specificity in use. Because of their remarkable fluoride-releasing potential, GICs are of great value in avoiding dental cavities by protecting enamel from demineralization, encouraging remineralization, slowing the buildup of plaque, and generally improving oral hygiene [(1)]. The effectiveness of fluoride-releasing materials in preventing caries, especially at a pH of 5.5, is proportional to the concentration and duration of the fluoride ions they release. A "burst" of fluoride release immedialty after setting of the restoration is desirable because it reduces the survival of bacteria that may have been left in the inner carious dentin and helps the enamel and dentin to remineralize [(2, 3)]. On the other hand, delayed continuous fluoride release is helpful to prevent caries by creating an environment that is unfavorable to the growth of microorganisms present in the inner layer of decayed dentin, and it also aids in remineralization of the susceptible tooth surfaces. New carious lesions in enamel and dentin can be better defended against when fluoride ions are sustained released over time [(4)]. However, despite the fact that GIC possesses a number of beneficial features, it is not suitable for use in load-bearing regions because it possesses poor mechanical properties [(5)]. Alkasite is a new type of restorative material that is similar to ormocer and compomer materials in that it is a subgroup of composite materials. This material that contains no metal, has similar colors to teeth. It has been introduced as a subgroup of composites combining the best features of amalgam and GIC. Cention N (Ivoclar Vivadent, Liechtenstein) is a novel alternative esthetic restorative material for direct restorations in posterior teeth. Cention N is an alkasite material made with alkaline filler that can release a lot of fluoride ions hence neutralizing acid [(6)]. After mixing, Cention N contains 78.4% of inorganic filler by weight. The alkaline glass makes up of 24.6% of the final material by weight, and it gives off a lot of fluoride (F-) ions, which is comparable to what traditional glass ionomers do. The alkaline glass also gives off hydroxide and calcium ions, which help stop the tooth substrate from becoming less mineralized [(3, 6)]. Recently in 2021, a new alkasite material, Cention Forte, was introduced into the market. It is a self-curing, radiopaque filling material that can also be cured with light. It is used to directly restore the occlusal surfaces of both anterior and posterior teeth. The manufacturer claimed that, Cention Forte releases fluoride, calcium, and hydroxide ions that can be used to fill class I, II, and V cavities in permanent and primary teeth as a volume replacement material. Cention Forte is used with a prime as recommended by the manufacturer. However, it has been observed that a material that needs an adhesive in order to be bonded to the tooth structure could minimize the ion diffusion that is necessary to promote remineralization [(7)]. Several researchers have evaluated the fluoride release of Alkasite fillings at different time intervals and pH, however, up to date little evidence was reported on the effect of bonding of bioactive materials to tooth structures on their fluoride ion release. Therefore, this study was conducted to evaluate and compare the fluoride release of bonded and non-bonded Cention Forte, Cention-N, and GIC Riva at two time intervals (24 hours and 7 days).The null hypotheses of this study were: (1) There is no difference in the fluoride ions release between the materials used at 24 hours as well as after 7 days when they are bonded to tooth structure and without bonding to tooth structure and (2) There is no difference in the fluoride ions release between the two time intervals for all the materials used.

Materials and Methods:

Sample Grouping

The restorative materials that were used in this study; Cention Forte (IvoclarV ivadent, Schaan, Liechtenstein), Cention N

(Ivoclar Vivadent, Schaan, Liechtenstein), and GIC Riva (SDI, Australia) with their manufacturing details are listed in Table (1). Seventy two samples were fabricated from these types of fluoride releasing materials. Thirty sex samples were bonded to teeth specimens (three bonded groups) and another 36 samples were constructed within a silicon mould (three non-bonded groups), each group consisted from 12 samples. The bonded groups were: BCF using Cention Forte, BCN using Cention N and BGI using GIC Riva. The non-bonded groups were: NBCF using Cention Forte, NBCN using Cention N and NBGI using GIC Riva as shown in Fig.(1).

Teeth Selection for the Bonded Groups

Eighteen freshly extracted human permanent premolars, from patients with an age range from 14-24 years, were collected for this study. The teeth selected were non-carious with no crown fracture or cracks and without hypoplasia or hypomineralization [(8)]. The selected teeth were then cleaned from plaque and other forms of organic material with the use of an ultrasonic scaler (DTE, China). After that, they were soaked into a 0.1% thymol solution for disinfection for one hour. Then, to exclude any fluoride release from the teeth, each tooth was stored in a container with 5 ml of deionized water for 24 hours and the fluoride ions in the storage medium were measured by fluoride ion selective electrode (CRISON INSTRUMENTS, S.A. E-08328 ALELLA- Barcelona). To restore the teeth with the three materials, the teeth were divided into three groups, 6 teeth for each group. For the cavity preparation, under magnification with zumax loop x5, an indelible pen with ultrafine head was used to draw the outline of the cavities with a 2x3x1.5 mm in dimensions [(8)] on the middle parts of the buccal and lingual surfaces of each crown. A flat-ended cylinder diamond bur (CD-58F, MANI) was used at 300,000 rpm under a constant flow of air and water to prepare the cavities. Graduated periodontal probe was continuously used for confirmation the dimensions and depth of the cavities as shown in Fig. (2).

Sample Fabrication for Bonded Specimen

After cavity preparation, all of the cavities were filled and manipulated in accordance with the materials manufacturers' guidelines. For Group BCF: Cention Forte was used to restore the teeth samples. The cavity was first washed with air-water sprayed and dried for 5 seconds. Then, a self-curing Cention primer (Ivoclar Vivadent, Schaan, Liechtenstein) was adapted at the enamel and dentin by a disposable prime brush, and scrubbed for ten seconds. For Groups BCN and BGI and according to the manufacturer's instructions for Cention-N and GIC Riva, no priming was applied into the cavities before the application of the restorations. For all the groups, the respective material was packed and condensed with the aid of a Dental contactsculpt modelling tool. The top surface was then covered by a celluloid strip and allowed to set at room temperature for 15 minutes [(3)].The restorative material was set without any light cure device. After the restoration of the cavities, the teeth were sectioned at the level of the cementoenamel junction by a disc shape bur and the root portion was removed. Each sample was then sectioned into two equal sections mesiodistally [(8)]. After that, each sample was kept in the incubator with a relative humidity of 95% and a temperature of 37 °C until the time of the tests [(3, 9)]. Each specimen was coated with two layers of nail varnish all over the surfaces leaving a margin of one millimeter around the cavity before immersion in the deionized water [(10)].

Fabrication of Non-bonded Samples

For fabricating the samples for the three non-bonded groups, a cuboidal shaped mould with 2x3x1.5 mm in dimensions was constructed using a silicon material. Three non-bonded groups were constricted from the three materials (n=12); NBCF using Cention Forte, NBCN using Cention N, and NBGI using GIC. The material of each group was mixed according to the manufacturers' instructions and packed into the mould as previously described for the bonded groups as shown in Fig.(3).

Sample Storage

Deionized water was used as the storage media for all the samples [5]. One hundred and forty four plastic containers with 5 ml of deionized water were prepared and marked for each group [11]. After that, the samples for each group were stored in their containers and stored in the incubator at 37°C until the time for fluoride ion measurements.

Fluoride Ions Measurement Test

Fluoride ions measurements were performed at two time intervals; after 24 hours (immediate) and after 7 days (delayed) for all the groups. After 24 hours, the containers were thoroughly shaken, and then the samples of each group were removed from their containers and dried. The fluoride ions in the storage medium was measured [3, 12]. The samples were re-immersion in new plastic containers with a fresh 5 ml of deionized water and stored in the incubator at 37°C for another 7 days. The same procedure was repeated after 7days for each group. The fluoride ions concentration in the deionized water containers was measured by fluoride ion selective electrode at 24 hours and after 7 days [3, 8, 12].

Statistical analysis

In this study, the data for the fluoride ions release was analyzed using Statistical Package for social Science (SPSS version -22, Chicago, Illionis, USA), One-way ANOVA and Tukey post-hoc test were then performed for comparison between groups. Paired-t test was performed for analyzing the difference for fluoride release between the two time intervals for all the groups. All the statistical tests were adopted at a level of significance at $p \leq 0.05$.

Results:

For the Bonded Status Groups

The mean, SD, minimum & maximum values of fluoride ion release in bonded status for the three bonded groups at the two time intervals are shown in Table (2). Findings showed that, in the period of 24h, the fluoride ion release was higher in the following order: BGI>BCN>BCF. While after 7 days, the highest amount of fluoride ion release was recorded for BCF followed by BCN and the least amount was for BGI as shown in Fig.(4). One Way ANOVA test showed that, there was a statistically significant difference between the three bonded groups ($p \leq 0.05$). The results of Post hoc Tukey's HSD test for multiple comparisons are presented in Table (3). Findings showed that, at the period of 24h, there were significant differences between BGI and both BCN and BCF ($p=0.000$). However, the difference was not significant between BCF and BCN ($p=0.157$). While after 7 days, BGI recorded a significant difference with BCF ($p=0.006$) but not with BCN ($p=0.934$). A significant difference was also recorded between BCF and BCN ($p=0.016$). Paired t test for the difference in fluoride ion release between the two time intervals for the three bonded groups are listed in Table (4). The results of paired t test showed that the fluoride ion release was significantly increased from 24 hours to 7 days for all the three bonded groups.

For the Non-bonded Status Groups

The mean, SD, minimum & maximum values of fluoride ion release in non-bonded status for the three non-bonded groups at the two time intervals are listed in Table (5). Findings showed that in the period of 24h, the fluoride ion release was higher in the following order NBGI>NBCF>NBCN. While after 7 days, the highest amount of fluoride ion release was recorded for NBCF followed by NBCN and the least amount was for NBGI as shown in Fig.(5). One Way Analysis of Variance test showed that there was a statistically significant difference between the three non-bonded groups ($p \leq 0.05$). The results of Tukey's HSD test for the non-bonded status are listed in Table (6). Findings showed that the results of multiple pairwise comparison between the three groups in both periods were statistically significantly different between each two groups.

Paired t test for analyzing the difference in fluoride ion release between the two time intervals for the three non-bonded groups are listed in Table (7). The results of paired t test showed that the fluoride ion release was significantly increased from 24 hours to 7 days for all the three non-bonded groups.

Discussion:

Fluoride levels in filling materials should be as much as feasible without having a negative impact on their mechanical and physical qualities. However, as different types of dental restorations have their own unique matrix and setting mechanisms, the pattern of fluoride release and fluoride uptake properties of these materials are affected by these variations [(13)]. Fluoride release is also affected by many factors like the storage medium, how often the storage solution is changed, saliva composition and pH level, plaque, and pellicle formation [(14)]. Alkasite's ability to remineralize artificial interproximal enamel caries showed it’s high ion release that could have clinical benefits [(15)]. Cention Forte is a new Alkasite restorative material that is both self-curing and light-curing. This means that the theoretical depth of treatment is unlimited. According to the manufacturer, it keeps releasing fluoride and hydroxyl ions when it gets wet. However, most of the in vitro studies that evaluated fluoride ions release from restorative materials used non-bonded samples. Few researches have focused on the fluoride ion release after bonding to tooth structures. Therefore, this study was performed to analyze the release of fluoride ions of Cention Forte at various time intervals, with and without bonding to tooth substrate and compare it with its predecessor Cention N and GIC. The results of this study showed that GIC released significantly higher amount of fluoride after 24h compared to Cention Forte and Cention N for both bonded and non-bonded samples. Therefore, the first null hypothesis was rejected. This phenomenon was also reported by other researchers showing that only GIC had an initial fluoride burst effect [(16-18).] The initial burst effect from GIC is possibly because of the initiation of the acid-base reaction and an attack of the fluoroaluminosilicate fillers by the acidity effect of the polyacrylic acid that result of ions release [(19-21)]. According to Wiegand et al., in 2007 [(13)] this effect may also due to the non-silanation of the FAS fillers of the GIC which makes them easily to be hydrolyzed [(7)]. Burst effect could be brought on by an initial, superficial rinsing effect [(18)], and may be related to the high water sorption and solubility of the material [(22)]. While after 7 days, the results showed that GIC released the lowest fluoride ions , which may be related to the depletion of ions, as the period increased, fluoride ions released in lower quantities [(8)]. Besides, with time the acid-base reaction forms a silicic gel on the surface of the partially reacted FAS fillers. This gel helps the fillers to stick well to the matrix and protects them from hydrolysis by making the cement much less soluble [(23, 24)]. Similar results were reported by Kiran and Hegde., in 2010 Neelakantan *et al*., in 2011 and Cardoso *et al*., in 2015 [(25-27)]. The results of the current study showed that in bonded samples Cention Forte released the lowest amounts of fluoride (significant with GIC and not significant with Cention N) at 24h time interval. This may be due to using the adhesive prime, which may enhance bonding of the free ions with the tooth structure, therefore less available ions in the storage media. Furthermore, the decrease of ion release with using the acidic primer which may have a chelation effect on the tooth structure, releasing of calcium and phosphate ions, which in turn have the binding ability to free fluoride ions [(28)]. In addition to that, Cention Forte and Cention N in both bonded and non-bonded groups had significantly lower fluoride release by the end of the first 24h than GIC. This could be due to the differences in the filler types and amount within each material. GIC Riva has a higher filler content which is about 90-95% [(29, 30)], while Cention-N has a number of different types of fillers, including barium aluminum-silicate glass filler, ytterbium trifluoride, an iso filler (Tetric N-Ceram technology), calcium barium aluminum fluorosilicate glass filler, and calcium fluorosilicate (alkaline) glass filler. Out of these 78.4% of the filler content, only 24.6% of the final material is responsible for fluoride ion emission [6]. Also, fillers in Cention N and Cention Forte are surface modified (silanized fillers) [31] thus becoming resistant to deterioration and may result in a decrease in the quantity of fluoride ions that are released into the environment. A 300 nm-thick layer of silica gel is present on the surface of GIC, and this layer's thickness increased as a result of water sorption. While Alkasite materials have a 0.5-nm thick surface layer that is resistant to being rinsed with deionized water because of the formation of calcium fluoride and calcium phosphate [6]. In addition to that, the setting reaction of the Alkasite is the same of that of the giomer and compomer by making a network of resin and forming covalent bonds with reactive and nonreactive silanized fillers that made it more resistance to hydrolysis [7]. Whereas, at the 7 days time interval, Alkasite materials have exhibited a high fluoride release. This demonstrates that Alkasite filling materials could release fluoride gradually over time. A greater ratio of powder to liquid and a significant amount of alkaline glass in the final product of the material may be the causes of the significantly higher fluoride ions release for a longer period of time [18]. On the seventh day, fluoride release from Alkasite materials in both groups spiked, which may have been caused by unreacted barium aluminum fluorosilicate glass and calcium fluorosilicate glass particles within the self-cured polymerized material [32]. Based on the findings of the present study, it appears that at 24h in non-bonded status, Cention Forte when compared to Cention N had significantly high releasing of fluoride ions. This result was also true after 7 days in both bonded and non-bonded samples. This could be due to the differences in alkaline glass fillers (did not mentioned by the manufacture) between the two materials. The excessive fluoride ion release seen in this study could not be definitively linked to any of Cention Forte's special features because of the composition's complexity of this material and information regarding their proprietary substances is insufficient.

Paired t-test results showed that all the tested restorative materials demonstrated fluoride ion increase from 24h to 7 days with significant change in each group in both bonded and non-bonded status. So, the second null hypothesis was also rejected. This result agreed with Tiwari et al., in 2016 [33] who compare fluoride release of many types of glass ionomer after 24h and 7 days by using non-bonded samples. Also the current result agreed with Banić Vidal et al., in 2022 [34] who evaluate short term release of fluoride ions of non-bonded samples of Cention Forte and GIC. In addition this study partially agreed with Singbal et al., in 2022, Singh et al., in 2020 [18, 32] as they used non-bonded specimens of Cention N and glass ionomer cement and evaluate their fluoride ions release after 24h and one week. However, the results disagreed with Gupta et al., in 2019 [8] who compared the release of fluoride between Cention N and conventional glass ionomer by using bonded samples and this may be due to there is no measuring of the initial burst phenomena after 24h and the first measurement was done after 7 days so the initial burst effect of GIC was incorporated within the first 7 days. Also disagreed with Paul et al., in 2020 [3] who made comparative evaluation of fluoride realease between Zirconomer and Cention N and this may be due to the different volume of the storage media, as the specimens were soaked in 20 ml deionized water while in the current study only 5 ml was used. Another disagreement with Aparajitha et al., 2021 [35] this may be due to using artificial saliva as the storage media and artificial saliva is highly viscous and contains ions. These ions may change how fluoride ions are released from the filling materials, which could lead to an incorrect estimate of the released fluoride ions [8]. There is disagreement also with Rai et al., in 2019 [11] who used non-bonded samples of Cention N, zirconomer and GIC and this may be due to the difference in the frequency of change of the storage solution which was changed every 24hs while in the current study the storage solution was changed only after the first 24hs. As with other in vitro studies, limitations in this study are presents and one of which is the storage media (deionized water) and the neutral pH (7) that differ from the natural human saliva. This may affect the chemical behavior of the tested restorative material and does not simulate the way they work in the oral cavity. The conditions in the oral environment are dynamic and distinct from those in in vitro. Furthermore, this study was carried out for a shorter duration of time. Therefore, a long term study on the fluoride release of these materials is required.

Conclusion:

1. The immediate fluoride ions release was the highest from GIC Riva. While the delayed fluoride ions release was highest from Cention Forte filling material in both bonded and non-bonded status.
2. The fluoride ions release from the Cention Forte was significantly higher than Cention N after 7 days for both bonded and non-bonded status.
3. Bonded and non-bonded status showed significant increase in fluoride ion release from 24 hours to 7 days.

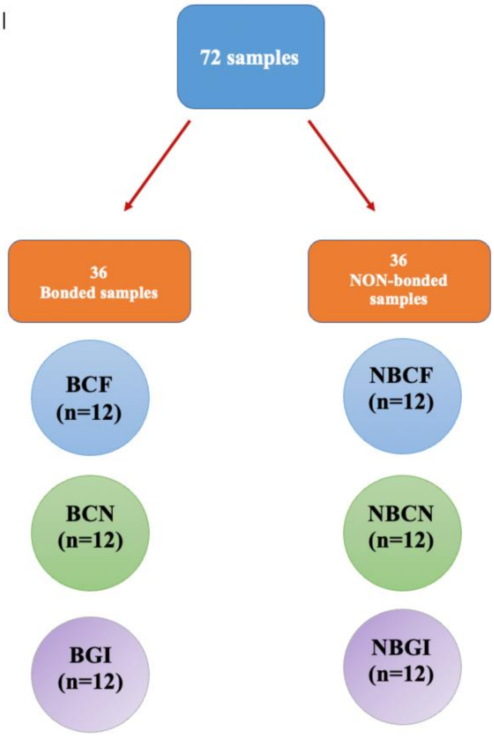

Fig. (1): A diagram showing sample grouping.

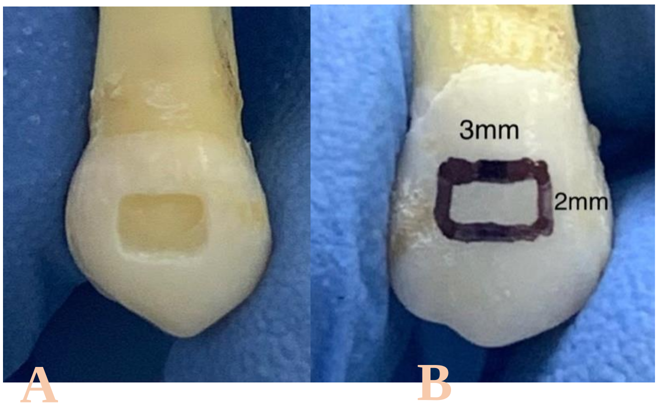

Fig. (2): Fabrication of the cavity. (A) Marking the dimensions of the cavity, (B) Preparation of the cavity.

Fig. (3): Fabrication of the Non-bonded samples

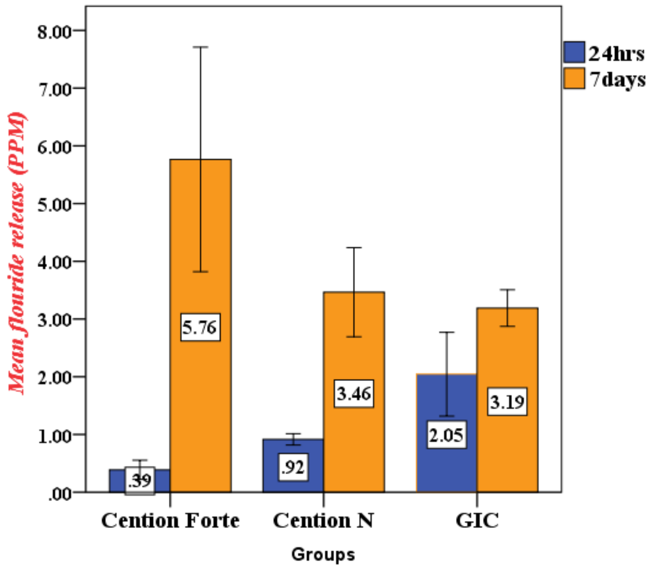

Fig. (4): Bar chart graph showing the mean values of fluoride ion release of the different experimental groups in bonded status.

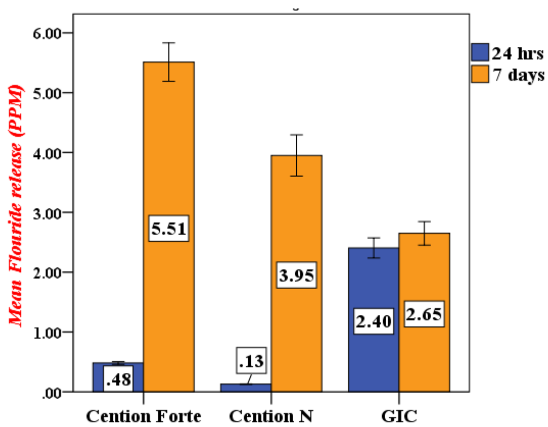

Fig. (5): Bar chart graph showing the mean values of fluoride ion release of the three non-bonded groups at 24 hours and &7 days time intervals.

Table (1): The restorative materials that were used and their composition

Restorative material	Manufacture	Composition
Cention Forte Cention Primer:	Ivoclar Vivadent, Schaan, Liechtenstein	Powder: inert barium alumino-boro-silicate glass, ytterbium fluoride, a calcium fluoro-alumino-silicate glass, and a reactive SiO_2-CaO-CaF_2-Na_2O glass Liquid: UDMA, aromatic aliphatic UDMA, DCP, and PEG-400-DMA Initiator system: hydroperoxide, Ivocerin, and acyl phosphine oxide Filler content: 58–59 vol% HEMA, MDP, Bis-GMA, D3MA, ethanol, methacrylate-modified polyacrylic acid, silicon dioxide, potassium hydroxide and campherquinone
Cention N	IvoclarVivadent, Schaan, Liechtenstein	Powder: inorganic fillers (Calcium fluoro-silicate glass Barium glass Calcium-barium-aluminiumfluoro-silicate glass, Iso-fillers, Ytterbium trifluoride, Initiators, and pigments Liquid: UDMA, tricyclodycan-dimethanoldimethacrylate, ployethelyne glycol dimethacrylate. 78.4 wt% inorganic fillers, alkaline glass accounts for 24.6%
GIC Riva	SDI, Australia	Powder: fluoro-alumino-silicate glass Liquid: Polybasic carboxylic acid (copolymer of acrylic and maleic acid), tartaric acid, water

Table (2): Mean, standard deviation, minimum and maximum of fluoride ion release (ppm) for the bonded groups at 24h and 7 days time intervals.

Period	Groups	Mean (ppm)	±SD	Min.	Max.
24h	Bonded Cention Forte	0.39	0.260	0.06	0.80
	Bonded Cention N	0.92	0.154	0.76	1.20
	Bonded GIC	2.05	1.142	0.56	3.98
7days	Bonded Cention Forte	5.77	3.061	1.52	11.24
	Bonded Cention N	3.47	1.213	1.62	5.29
	Bonded GIC	3.19	0.498	2.49	4.20

Table (3): Multiple intragroup comparison of mean fluoride ion release (ppm) for the three bonded groups at 24h and 7days using Tukey's HSD

Period	(I) Groups	(J) Groups	MD	p value	
24h	Bonded Cention Forte	Bonded Cention N	-0.53	0.157	NS
		Bonded GIC	-1.66	**0.000**	**Sig.**
	Bonded Cention N	Bonded GIC	-1.13	**0.000**	
7days	Bonded Cention Forte	Bonded Cention N	2.30	**0.016**	
		Bonded GIC	2.58	**0.006**	
	Bonded Cention N	Bonded GIC	0.28	0.934	NS

Table (4): Paired t-test of fluoride release change at 24h to 7 days intervals for the three bonded groups.

Groups		Paired Differences Mean	Paired t test	p value	
Bonded Cention Forte	24h - 7days	-5.38	6.469	**0.000 ***	*** Sig.**
Bonded Cention N	24h - 7days	-2.55	7.713	**0.000 ***	
Bonded GIC	24h - 7days	-1.14	2.710	**0.020 ***	

Table (5): Mean, standard deviation, minimum and maximum of fluoride ion release (ppm) for the non-bonded groups at 24h and 7 days time intervals.

Period	Groups	Mean(ppm)	±SD	Min.	Max.
24h	Non- bonded Cention Forte	0.48	0.037	0.42	0.53
	Non- bonded Cention N	0.13	0.009	0.11	0.14
	Non- bonded GIC	2.40	0.264	2.07	2.90
7days	Non- bonded Cention Forte	5.51	0.507	4.72	6.39
	Non- bonded Cention N	3.95	0.543	3.27	4.79
	Non- bonded GIC	2.65	0.310	2.27	3.30

Table (6): Multiple intragroup comparison of mean fluoride release for the three non-bonded groups at 24h and 7days

Period	(I) Groups	(J) Groups	MD	p value	
24h	Non- bonded Cention Forte	Non- bonded Cention N	0.35	**0.001**	**Sig.**
		Non- bonded GIC	-1.92	**0.000**	
	Non- bonded Cention N	Non- bonded GIC	-2.27	**0.000**	
7days	Non- bonded Cention Forte	Non- bonded Cention N	1.56	**0.000**	
		Non- bonded GIC	2.86	**0.000**	
	Non- bonded Cention N	Non- bonded GIC	1.30	**0.000**	

Table (7): Paired t-test results of fluoride ion release change from 24h to 7 days for the three non-bonded groups.

Groups	Time Intervals	Paired Differences	Paired t test	p value	
		Mean			
Non- bonded Cention Forte	24h-7days	-5.03	35.329	**0.000***	***Sig.**
Non- bonded Cention N	24h-7days	-3.82	24.291	**0.000***	
Non- bonded GIC	24h-7days	-0.25	3.964	**0.002***	

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