

Comparison Between Erosive Potential of a Chemical and a Herbal Mouthwash on the Surface Roughness of Resin Modified Glass Ionomer Restorative Materials: An In Vitro Study

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ABSTRACT

Aim: The aim of this study was to comparatively evaluate the erosive potential of Herbal Mouthwash and Chlorhexidine on the surface roughness of the restorative materials.

Materials and Method: A sample size of 60 restorative pellets was taken out of which 20 pellets of Giomer, 20 of Compomer & 20 of LC GIC were made. The base line surface roughness values were evaluated with an optical profilometer. The restorative pellets were subjected to tooth brushing twice a day for 1 minute with a tooth paste. Same electronic brush was used for brushing all the restorative pellets. All the pellets were immersed in Herbal mouthwash and Chlorhexidine mouthwashes according to manufacturer's instruction. The process was repeated for 30 days. Post immersion surface roughness was evaluated by profilometer after 30 days and these values were compared with the base line values and statistically analysed.

Result: The mean percentage increase of surface roughness with Herbal Mouthwash in group A (Giomer) was 129.66%, in Group B (Compomer) 204.79% and in Group C (LC GIC) 272.24%. The mean percentage increase of surface roughness with Chlorhexidine in group A (Giomer) was 98.63%, in Group B (Compomer) 141.38% and in Group C (LC GIC) 164.96%. Among the restorative materials the increase in surface roughness was least in Giomer followed by Compomer and LC GIC.

Conclusion: The maximum erosive potential was seen with Herbal mouthwash mouthwash followed by Chlorhexidine. All the restorative materials Giomer, Compomer and LC GIC used in this study showed an increase in the surface roughness after treating with mouthwashes wherein LC GIC showed the maximum increase in surface roughness followed by Compomer and Giomer.

Keywords: Compomer, giomer, surface roughness, LC GIC.

INTRODUCTION

Oral health is very important to the appearance and sense of well being. Emerging evidence has shown a strong link between the effects of oral health on the general health. Good oral hygiene can be maintained on a regular basis by using different plaque control

methods which include mechanical and chemical methods¹. Chemical methods include the use of mouthwashes. These mouthwashes can be alcohol containing, peroxide containing and fluoride containing. The most commonly used mouthwash is

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Chlorhexidine. It is antiseptic in nature and has immediate bactericidal action and prolonged bacteriostatic action due to absorption onto pellicle-coated enamel surface however it has certain disadvantages like unpleasant taste and staining of teeth. Ayurvedic mouthwashes are alcohol-free and chemical-free and contain time-tested herbal oils and extracts - like neem oil, clove and peelu - that actually promote oral health. Hence they can be a viable alternative to the chemical mouthwashes. However, frequent mouthrinse use may exert detrimental effects on oral and dental tissues as well as dental restorative materials. The mouthrinses can alter the surface roughness of dental materials which is very important for plaque retention, staining and patient comfort. Thus, the present study was conducted to check the effect of commonly used chemical mouthrinses like Chlorhexidine and compare it with Herbal mouthwash and to comparatively evaluate their erosive potential on various restorative materials.

METHOD AND MATERIALS

Sixty autoclavable moulds measuring 9mm X 3mm in dimension were selected for the study. Out of sixty, twenty pellets of Giomer (Group A) (Dentsply), twenty of Compomer (Dentsply). (Group B) & twenty of LC GIC (Group C) were made. The composition of various materials used is depicted in Table: 1. For Giomer – the material was filled in an incremental pattern and cured for 40secs with the help of LED(LA500Blue light) curing light Similarly twenty moulds were filled with Compomer and 20 with LC GIC. The moulds were split into two with metal disc and the restorative pellets were taken out. All the groups were further divided into two sub groups each (i) and (ii). Subgroup A(i) was treated with Herbal Mouthwash and Group A(ii) with Chlorhexidine. Similarly Group B and Group C were divided in subgroups (i) and (ii). The composition of the mouthwashes is shown in Table: 2. The pH evaluation of each mouthwash was done with the help of electronic pH meter (Ultra Watech System). The restorative pellets were stored in distilled water for 24 hours. The baseline surface roughness values of the restorative pellets were recorded with help of optical profilometer (Wyko, NT Series Optical Profiler). The pellets were brushed with electronic brush (Colgate) using Colgate toothpaste for 1min in the morning and 1min in the evening.

After brushing the restorative pellets were treated with mouthwashes twice a day according to the manufacturer's instruction. The procedure was repeated for 30 days. The restorative pellets were checked for post immersion surfaces roughness by profilometer at the end of 30 days and were then compared to the baseline values. The data was tabulated and subjected to statistical analysis.

Table 1: Composition of Restorative Materials.

S. No.	Material	Composition	Filler Particle Size	Filler Content
1:	Giomer (Beautifil II ,Shofu, Japan)	Surface reaction type pre reacted GIC (S-PRG); multi functional glass fillers based on fluoroboroaluminosilicate glass; Bis-GMA; TEGDMA; UDA	0.1-4.0 Micrometer	68.6%by volume
2:	Compomer (Dyract-XP, Dentsply)	Strontium-Aluminium-Sodium-fluoro-P-silicate glass; strontium Fluoride; UDMA; TCB Resin; highly cross linking methacrylate-monomer	0.8 Micrometer	47% by volume
3:	Light Cure GIC (GC Fuji II)	Aluminium, fluorosilicate glass; HEMA; tartaric acid; polyacrylic acid; water	0.1-25 micrometer	60% by volume

Table 2: Composition of Mouthwashes.

S. No.	Mouthwash	Ingredients	Ph
1:	Chlorhexidine (Rexidine)	Diluted chlorhexidine gluconate 0.2% w/v.	5.3
2:	Herbal mouthwash	Extracts: Bibhitaka 10mg, Nagavalli 10mg, Pilu 5mg Powder: Peppermint satva 1.6mg, Yavanisatva 0.4mg Oils: Gandhapurataila 1.2mg, Ela 0.2mg	4.7

RESULTS

The mean percentage increase in surface roughness amongst various groups was more with Hiora than Chlorhexidine as shown in Table: 3 and Graph: 1, 2. Further on applying one way ANOVA it was found, that the increase in the surface roughness in all the groups, when treated with various mouthwashes had significant difference with p value 0.000 ($p < 0.001$) at 95% Confidence level (Table: 4). However, when the inter group comparison was done using the Dunnett test, LC GIC showed the maximum increase in mean percentage increase of surface

roughness followed by Compomer and least was seen in Giomer as shown in Table: 5.

Table 3: Mean percentage increase in surface roughness with Herbal Mouthwash and Chlorhexidine.

Surface Roughness	GROUP	N	Mean % Increase	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Percentage Increase with herbal mouthwash	Group A (Giomer)	10	129.66	9.59364	4.29041	117.7480	141.5721	117.00	141.34
	Group B (Compomer)	10	204.79	13.81526	6.17837	187.6394	221.9472	192.82	221.20
	Group C (LC GIC)	10	272.24	24.67063	11.03304	241.6031	302.8683	234.50	299.71
Percentage Increase With Chlorhexidine	Group A (Giomer)	10	98.6359	15.45459	6.91150	79.4465	117.8253	80.02	118.40
	Group B (Compomer)	10	141.38	10.70472	4.78730	128.0928	154.6761	134.97	160.25
	Group C (LC GIC)	10	164.96	3.56882	1.59603	160.5241	169.3866	160.39	170.27

Table 4: Distribution of variance between and within groups using ANOVA test.

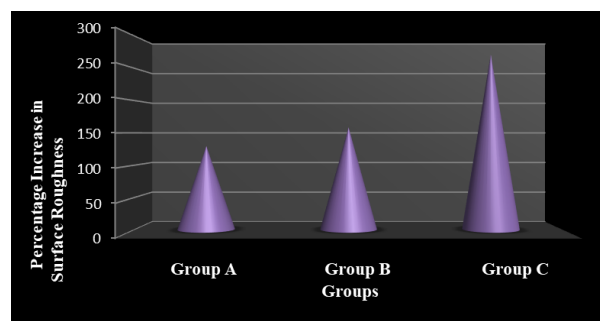
ANOVA						
Surface Roughness	Various Groups	Sum of Squares	Df (degree of freedom)	Mean Square	F (Variance Ratio)	P value
Percentage increase in HERBAL MOUTHWASH	Between Groups	50868.822	2	25434.411	85.586	00.000
	Within Groups	3566.157	12	297.180		
	Total	54434.980	14			
Percentage increase in CHLORHEXIDINE	Between Groups	11302.181	2	5651.090	46.299	00.000
	Within Groups	1464.687	12	122.057		
	Total	12766.868	14			

Table 5: Inter comparison of mean percentage increase in surface roughness among various groups

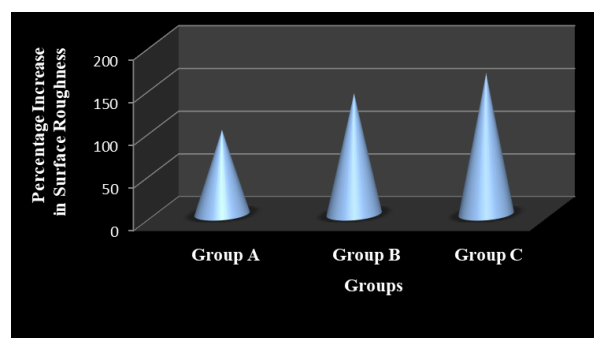
Percentage increase in surface roughness	I group	J group	Mean Difference (I-J)	Std Error	95% Confidence Interval		P value
					Lower Bound	Upper Bound	
Percentage increase in Herbal Mouthwash	Group A (Giomer)	Group B	-28.96	10.90284	-98.8885	-51.3780	00.000
		Group C	-142.57	10.90284	-166.3309	-118.8204	00.000
	Group B (Compomer)	Group A	28.96	10.90284	51.3780	98.8885	00.000
		Group C	-113.62	10.90284	-91.1976	-43.6871	00.000
	Group C (LC GIC)	Group A	142.57	10.90284	118.8204	166.3309	00.000
Percentage increase in Chlorhexidine	Group A (Giomer)	Group B	-42.74862*	6.98734	-57.9727	-27.5245	00.000
		Group C	-66.31951*	6.98734	-81.5436	-51.0954	00.000
	Group B (Compomer)	Group A	42.74862*	6.98734	27.5245	57.9727	00.000
		Group C	-23.57088*	6.98734	-38.7950	-8.3468	00.006
	Group C (LC GIC)	Group A	66.31951*	6.98734	51.0954	81.5436	00.000
		Group B	23.57088*	6.98734	8.3468	38.7950	00.006

The mean difference is significant at the 0.05 level

Graph: 1 Mean Percentage increase in surface roughness among various groups when treated with Herbal Mouthwash.



Graph 2: Mean Percentage increase in surface roughness among various groups when treated with Chlorhexidine.



DISCUSSION

The present in vitro study was designed to check the effect of a chemical mouthwash and a herbal mouthwash on the surface of various restorative materials used in pediatric dentistry. Frequent use of mouthrinses can affect the surface roughness of resin based restorative materials. In the present study there was increase in the surface roughness in various restorative materials and it was seen more with Herbal Mouthwash than Chlorhexidine. The ph of Herbal mouthwash is 4.7 and that of Chlorhexidine is 5.7. The ph of the mouthrinses is a possible preponderant factor for restorative material degradation.

Jyothi KN et al (2012)² did an in vitro study to check the effect of various mouthrinses on the micro hardness of restorative materials. It was concluded that mouthrinses with lowest ph showed significant reduction in the micro hardness. Similarly, Sadaghiani L et al (2007)¹ did an in vitro study to check the effect of different mouthrinses on the

surface roughness of resin modified restorative materials and concluded that the mouthwashes with lowest ph resulted in the greatest increase in the surface roughness.

The higher acidity with lower ph, may have altered the polymeric matrixes of the resin based restorative materials by catalysis of the ester groups from dimethacrylate monomers present in their compositions (Bis – GMA, TEGDMA, etc). The hydrolysis of these ester groups may have formed alcohol and carboxylic acid molecules, which accelerate the degradation of the resin composites, due to the decrease of ph inside resin matrix³. Also, the low ph of solutions may induce phenomena of sorption and hygroscopic expansion, due to the production of methacrylic acid, the result of the degradation process of the enzymatic hydrolysis^{4,10}.

Naga A et al (2012)⁵ did an in vitro study to evaluate the different restorative materials after exposure of Chlorhexidine and concluded that exposure to Chlorhexidine for one month showed increase in the mean surface roughness values in the restorative materials.

Inter group comparison revealed that LC GIC showed the maximum increase in surface roughness both with Herbal Mouthwash and Chlorhexidine. Reason can be that fillers of the resin based restorative materials contain alkaline earth metals like barium-aluminium-silicate, which are more sensitive to stress corrosion especially under hydrogen ion influences resulting in leaching of filler components and facilitate filler plug out under abrasive conditions⁶.

In the present study the surface roughness of Giomer was comparatively less than that of Compomer and LC GIC. Where in like all traditional methacrylate-based composite, the chemical composition of Giomer chemical composition comprises inorganic filler particles and organic resin matrix. Instead of using purely glass or quartz as the typical fillers, Giomer incorporates inorganic fillers that are derived from the complete or partial reaction of ion leachable glasses with polyalkenoic acids in water before being interfaced with organic matrix⁷. Therefore no absorption of moisture is required into the matrix. Thus glass ionomer phase

in Giomers is not affected by water uptake in the restoration whereas it was significantly affected by water uptake in conventional GIC, resin modified GIC and Compomer⁸. So Gomer is more stable restorative material than Compomer and LC GIC.

Tanthanuch S et al (2009)⁹ investigated the effect of acidic rinses on surface roughness and erosion of various tooth colored restorative materials: namely Glass ionomer cement, resin modified glass ionomer cement, giomer, compomer and resin composites. The study showed that the maximum increase in surface roughness was seen in conventional glass ionomer cement followed by resin modified glass ionomer, Compomer, Giomer and least in resin composites. The results are in accordance with the present study. Further the volume of holes and peaks were evaluated on the surface of restorative materials and seen that maximum holes were seen on the surface of resin modified glass ionomer cement followed by conventional glass ionomer cement and by compomer and a similar volume was observed between the Giomer and resin composites being the least.

Herbal Mouthwash showed an increase in the surface roughness of restorative materials more than Chlorhexidine. It is an alcohol free ayurvedic mouthwash which has been recently introduced. The increase in the surface roughness can be attributed to the low ph of the mouthwash and secondly the hygroscopic nature of the resin based restorative materials².

But very few studies are done on Herbal Mouthwash, checking its effect on restorative materials, so further studies are required to authenticate the results. At the same time the results of this in vitro study may not be directly related to the clinical situation where saliva may dilute or buffer the mouthrinses. Hence further in vivo studies are recommended.

CONCLUSION

All the restorative materials Giomer, Compomer and LC GIC used in this study showed an increase in the surface roughness after treating with mouthwashes. The maximum erosive potential was seen with Herbal Mouthwash mouthwash followed by Chlorhexidine.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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