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Research Article

EFFECT OF NON ALCOHOLIC MOUTHWASH ON HARDNESS OF GLASS IONOMER CEMENT, RESIN MODIFIED GLASS IONOMER CEMENT AND COMPOSITE RESIN-AN INVITRO STUDY

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ABSTRACT

Aim: To evaluate the effect of non - alcoholic mouth rinses on microhardness of glass ionomer cement, resin modified glass ionomer cement and composite resin.

Materials and methods: Total 90 samples were prepared, each group comprised of 30 samples of each group. 30 Glass ionomer samples, 30 resin modified glass ionomer cement samples and 30 composite resin samples were prepared in molds of 3 mm in diameter and 3mm in thickness. All the prepared specimens were stored in artificial saliva for 24 hours to simulate oral environment. Then, 10 samples from each group were immersed in **Group I**: Miswak mouthrinse (alcohol free), **Group II:** Colgate plax (alcohol free) and **Group III:** Artificial saliva (control) for 24 hours at 37 degree celsius. Each specimen will be examined under a Nanointender for evaluating micro hardness.

Results: Statistical analysis was done using one-way ANOVA followed by Student 't' test. Group I showed statistically significant difference when compared to Group II and Group III.

Conclusion: Group I Alcohol free Miswak rinse showed statistically significant reduction in microhardness, when compared with Group II(colgate plax alcohol free) and Group III (Artificial saliva-control).

INTRODUCTION

Tooth wear is a common entity with increased incidence in the recent years. Which involves old age, lifestyle trends, urbanization, dietary habits etc. This might be due to several reasons like abrasion (physical wear by objects or substances other than teeth), attrition (Direct tooth-to-tooth rubbing), or erosion (non-bacterial acid dissolution). Tooth wear might be the reason which results in sever damage to the tooth occlusal surface as well as to the restorative material. Currently, erosion is believed to be the most common cause of tooth surface loss. Tooth erosion is a well-recognized problem that has increased in incidence among younger patients over the last few decades (Jaeggi *et al*., 2006)[1]

In addition to certain food components and beverages, mouth rinses have been reported to affect the solubility of some restorative materials[2]. Awareness about using mouth rinses are increasing nowadays. They are widely used to prevent and control caries and periodontal diseases, with some individuals using mouth rinses at a frequency of six times per day.[3] Reports have been suggesting that they have been used on daily basis along with their dentrifices without any doctors prescription.

Asmussen *et al*, reported that alcohol in the mouthrinses softens the composite resin restorations[4]. In another study, Penugonda *et al* who reported that the higher percentage of alcohol in the mouth rinses causes more reduction in the hardness of restorative materials[5].

So there is a logical question which persists for years together Whether, it is always advisable to use non-alcoholic mouthrinses over alcoholic mouth rinse. There is no evidence or study regarding the use of non-alcoholic mouth on commonly used restorative material.

This study was conducted to assess the effect of commonly used non-alcoholic mouthrinses, on surface microhardness of Glass ionomer cement, Resin modified glass ionomer cements, microhybrid resin-based composite.

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MATERIALS AND METHODS

For this study three commercially available restorative materials were chosen. These include Conventional glass ionomer cement (Fuji IX), a resin modified glass ionomer cement (Fuji II LC) supplied as a powder and liquid which were mixed and cured in accordance with the manufacturer's instructions), and a resin composite (Filtek Z250), supplied as a one-component paste in 4 g syringes).

Specimen preparation

For each group 30 specimens were prepared hence totally 90 specimens were prepared. A polytetrafluoroethylene mold measuring 3 mm diameter and 2 mm thickness were prepared. Conventional glass ionomer cement (Fuji IX) and Resin modified glass ionomer cement (FujiII LC), supplied in a powder/liquid form, was used as the hand-mixing material in the powder liquid ratio of 1:1 and 1:2 respectively. The mold was filled with the mixed cements and uncured paste. It was covered with a polyethylene sheet and glass slide. Light pressure was applied. This method provided specimens with smooth top surfaces. The resin modified glass ionomer material were cured for 20 seconds on each side according to the manufacturer's instruction using a LED curing lamp (LEDITION, intensity mW/cm2,). Filtek Z250 was supplied as a single-component paste. The uncured paste was molded in a similar manner and curedusing 20-s exposures on each side. While still in their molds, the specimens were matured in an incubator at 37 °C for 24 hrs after mixing to simulate the time during which the restorations would be exposed to a normal oral environment.

Specimen immersion

Group I: Specimens were immersed in non - alcoholic Miswak mouth rinse (Dabur). Expiry date noted prior to the usage. The rinse used in this study was purchased 7 days from the date of manufacture.

Sub group IA*:* 10 specimens of Conventional Glass ionomer cement (Fuji IX) were immersed in 10ml of Non-alcoholic Miswak rinse for 10 minutes for 10 days. After 10 mins of immersion specimens were washed in distilled water and stored in the incubator at 37°C.

Sub Group IB: 10 specimens of Resin Glass ionomer cement (Fuji II LC) were immersed in 10ml of miswak rinse for 10 minutes for 10 days. After 10 mins of immersion specimens were washed in distilled water and stored in the incubator at 37°C.

Sub Group IC: 10 specimens of Resin composite (Filtek Z 250) were immersed in 10ml of non-alcoholic miswak rinse for 10 minutes for 10 days. After 10 mins of immersion specimens were washed in distilled water and stored in the incubator at 37°C.

Group II: Specimens were immersed in non - alcoholic colgate plax mouth rinse (colgate, India)

Sub group IIA: 10 specimens of Conventional Glass ionomer cement (Fuji IX) were immersed in 10ml of non - alcoholic colgate plax mouth rinse for 10 minutes for 10 days. After 10 mins of immersion specimens were washed in distilled water and stored in the incubator at 37°C.

Sub Group IIB*:* 10 specimens of Resin Glass ionomer cement (Fuji II LC) were immersed in 10ml of non - alcoholic colgate plax mouth rinse for 10 minutes for 10 days. After 10 mins of immersion specimens were washed in distilled water and stored in the incubator at 37°C.

Sub Group IIC:10 specimens of Resin composite (Filtek Z 250) were immersed in 10ml of non - alcoholic colgate plax mouth rinse for 10 minutes for 10 days. After 10 mins of immersion specimens were washed in distilled water and stored in the incubator at 37°C.

Group III: Specimens were immersed in wet mouth-Artificial saliva (ICPA, India). The wet mouth solution was changed everyday.

Sub group III A: 10 specimens of Conventional Glass ionomer cement (Fuji IX) was immersed in wet mouth and stored in the incubator at 37°C.

Sub Group III B: 10 specimens of Resin Glass ionomer cement (Fuji II LC) were immersed Wet mouth and stored in the incubator at 37°C.

Sub Group III C: 10 specimens of Resin composite (Filtek Z 250) were immersed in wet mouth and stored in the incubator at 37°C.

Hardness testing

Hardness is considered as the test parameter as it is an important property for the restorative materials to have long-term durability in the oral cavity [6]. So decrease in the hardness of a material may result in premature failure of a restoration requiring its replacement. The hardness of each specimen was determined using a nano intender micro hardness tester with 1000N force for 15 seconds.

Statistical analysis

Descriptive statistics were shown as Mean±SD. To evaluate the differences between different materials and solutions, Univariete ANOVA was used (Table 1). For comparison with the control group Student T test was performed for comparison of the other groups Tukey test was used at a significance level of $P \leq .05$.

RESULTS

On performing an intergroup comparison between Group I, Group II and Group III. Group I (miswak rinse) and Group II (colgate plax rinse) showed statistically significant reduction in hardness when compared Group III (Artificial saliva-control). When Comparing materials of the Group I, subgroup IA showed statistically significant reduction in hardness when compared to subgroup IIA and subgroup III A. Subgroup I B showed statistically significant reduction in hardness when compared to subgroup II B and subgroup III B. Subgroup IC showed statistically significant reduction in hardness when compared to subgroup IIC and subgroup III C.

Product Name	pH	Components	Producers
Colgate plax	7	Water, glycerin, propylene glycol, sorbital, poloxamer 407, flabour, sodium saccharin, cetylpyridinium chloride, potassiumsorbate, menthol, camellia sinensis leaf extract	Colgate palmolive co Made in India
Miswak rinse	4.5	Aqua,PEG-40hydrogenated castoroil, glycerin, sorbitol, foeniculum vulgare, salvadora Persica stem extract, Menthol, citric acid, sodim saccharin, sodium benzoate, pottassium sorbate and eugenol	United Arab Emirates (U.A.E) Under license from Dabur,U.K limited

Group	Material	Mean	Std. Deviation	Anova test – p value	Sig.
Dabur Miswak Group I	GIC	90.8000	1.814	2.548	.036 *
	RMGIC	91.0000	2.108		
	Composite	92.3000	1.265		
Colgate plax Group II	GIC	93.0000	1.944	2.938	.045
	RMGIC	93.2000	1.874		
	Composite	94.5000	1.354		
Artificial saliva Group III	GIC	93.0000	1.944	2.938	.045
	RMGIC	93.2000	1.874		
	Composite	94.5000	1.354		

Figure 1 Specimen Preparation

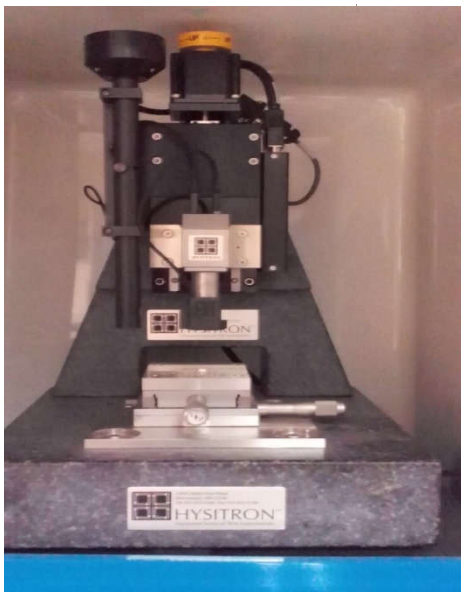


Figure 2 Hardness was tested using Nano intender with 1000N force for 15 seconds.

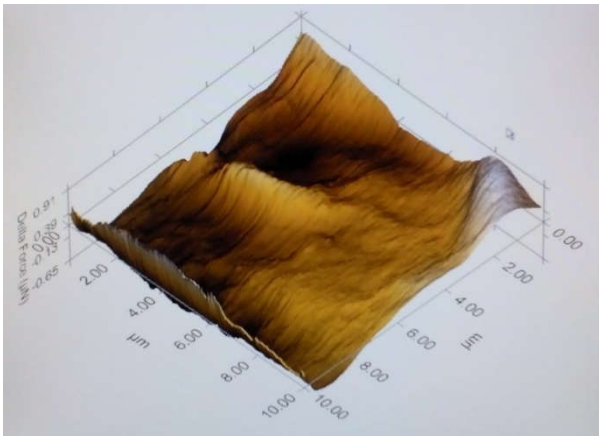
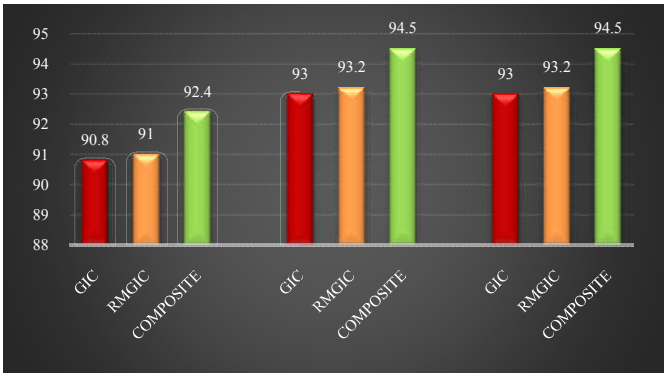


Figure 3 Surface Topography analysis



Graph 1 Graphical representation of microhardness after immersion in different non-alcoholic mouthrinses

DISCUSSION

Restorative materials used in the mouth shows changes when exposed to various environment condition. The longevity and durability of the restorative materials in the oral environment are important factors for the proper selection of a restorative material. The use of antimicrobial mouth rinses is an approach to limiting the accumulation of dental plaque, with a primary objective of controlling the development and progression of periodontal diseases and dental caries[7].

Mouth washes are frequently used, even without professional prescription. The formulation of these mouthwashes consists of water, anti microbial agents, salts and in some cases alcohol[8]. and the different concentrations of these substances can affect the pH of mouthwashes[9, 10]. Alcohol in mouthrinses is used as solvent, taste enhancer and as an antiseptic agent[11]. Concern has been expressed regarding the use of alcohol containing mouthrinses as it may soften the tooth coloured restorative materials.

Non alcoholic mouth rinses were selected because of its proven results for safe use[12]. (Shreemoy *et al*). However, both alcohol and non-alcoholic mouth rinses affects the hardness of the restorative materials.[9] One of the most important physical properties of a restorative filling material is surface hardness, which correlates well to compressive strength and abrasion resistance of the material. Hardness is defined as the resistance of a material to indentation or penetration [13].

In the present study, the non - alcoholic mouth rinses were selected to avoid the proven adverse effects of alcohol containing mouthrinse on the restorative materials. During the usage of mouth rinse, it comes in brief contact with the tooth surfaces before being washed away with saliva. Thus, the immersion regimen selected was to immerse samples after grouping them in the specific mouth rinses for ten minutes for ten days. For the remaining part of the day the samples were kept in artificial saliva and stored it in the incubator for 37ºC to mimic the neutralizing effect of saliva.

There was statistically significant correlation between the reduction in hardness and usage of non-alcoholic mouth rinses. The highest alteration occurs in the glass ionomer of miswak rinse group. because, Miswak rinse contains a small amount of citric acid. According to (Yusuf *et al*)[14] Citric acid chelates calcium ions present in the glass ionomer and resin modified glass ionomer cement at an acidic pH. This makes it erosive there is a reduction in hardness.

Resin-modified glass ionomer cement of miswak rinse showed reduction in surface hardness. It may be caused by a selective attack on the polysalt matrix among the residual particles. [15]. The polysalt matrix of the set cement results from the formation of contact cation-anion ion pairs or complexes between the carboxylic groups of the polyalkenoic acid and metallic ions, especially trivalent aluminium, leached from the glass particles.

Another explanation can be due selective acid attack on the polysalt matrix between the residual particles which may release additional fluoride after immersionin acidic environments. This can result from the dissolution of matrix-forming constituents with in the restorative material (Wilde *et al*.)[15]. However, some research indicates that it may also resist acid better than conventional glass ionomer cement, as was found in studies by Shabanian and Richards, McKenzie *et al* and Aliping-McKenzie *et al*.[16,17,18]

The deterioration of the physical and mechanical properties of filtek Z250 resin composite could be due to a hydrolytic breakdown of the bond between silane and the filler particles, filler-matrix debonding, or even hydrolytic degradation of the fillers. Alternately, it could be due to chemical degradation occurring via hydrolysis. Water which has entered the polymer through sorption can also cause hydrolytic degradation of theres in matrix, the filler matrix interface, or the fillers. The effect of hydrolysis includes loss of molecular weight, filler debonding, and decreased physical and mechanical properties. This is in agreement with the finding of Ramoglu *et al*[19].Progressive degradation altered the microstructure of the composite bulk through the formation of pores (Wongkhantee *et al*),[20] also found that organicacids induced softening of BIS-GMA based polymers. The softening of resin matrix could promote the displacement of filler particles, thereby contributing to the decrease in the hardness of composite resin. In this present study, Filtek Z250 resisted acid solution better than Fuji IX and Fuji II LC. This finding coincides with the results of Salama, Badra *et al*, and Tahir *et al*, and Chanothai *et al* [21,22,23].

On analyzing the overall results, the materials immersed in miswak rinse group showed a reduction in micro hardness. The citric acid component in its formulation along with pH of 4.5 which is lesser than that of critical pH of enamel 5.0 - 5.7. Any substance below this level has been known to trigger dental erosion of tooth as well as the restorative material.

On the other hand non-alcoholic colgate plax mouth rinse, shows no reduction in the surface hardness. This may be due to its neutral pH. It does not contain any acidic components in its formulation.

CONCLUSION

- Miswak rinse has an effect on the reduction of surface hardness of restorative materials because of its acidic pH of 4.5.
- Colgate plax doesn't reduce the surface hardness of restorative material because of its neutral pH 7.
- Conventional glass ionomer and resin modified glass ionomer were susceptible to acidic pH of mouthrinses than Composite.
- Composite might be a suitable restorative choice for patients using mouth rinses as a routine cleansing aid.

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