EFFECT OF FOUR COMMERCIAL MOUTHRINSES ON THE MICROHARDNESS OF NANOHYBRID COMPOSITE RESTORATIVE MATERIAL- AN IN VITRO STUDY.

Original Article

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ABSTRACT

Aim: To evaluate the effect of four commercial mouthrinses on the microhardness of nanohybrid composite restorative material. **Materials and Method:** Forty specimens of nano-hybrid composite material (Tetric-N- Ceram Ivoclar Vivadent) with 3mm diameter and 3mm height were prepared using Teflon moulds. The baseline microhardness of the specimens were recorded using Vickers Microhardness Tester. The specimen were randomly divided into four groups according to mouth rinses used, each containing ten specimens as follows: **GROUP A:** LISTERINE (Alcohol based) **GROUP B:** PERIOGARD (Alcohol based) **GROUP C:** FRESHCLOR (Alcohol Free) **GROUP D:** HIORA (Alcohol Free). The pH of all mouth rinses were recorded. Then the specimens were immersed in 20 ml of respective mouthrinses and kept in incubator at 37^{o}C for 24 hr. The post immersion microhardness values of the specimens were recorded using Vickers Microhardness Tester and results were subjected to statistical analysis which was done by one-way ANOVA and Post Hoc analysis **Result:** The decrease of microhardness was seen highest in GROUP A followed by Group B and least in GROUP C and GROUP D. **Conclusion:** All the mouth rinses showed reduction in surface hardness of the esthetic restorative material. Highest reduction of surface hardness was seen with use of Listerine®mouth rinse followed by Periogard®. There was no statistically significant difference between Freshclor® and Hiora® mouth rinses.

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INTRODUCTION:

In the recent years, there is a great research and development in the field of esthetic dentistry as esthetics is the main concern for an individual. There is a marked increase in the use of composite resin as it is a tooth colored restorative material[1].

Various internal and external factors influence the longevity, durability, and degradation of dental composite resins[2,3]. Failure of resin restoration may occur due to change in the mechanical and chemical properties of the composite resin material. Both of them are inter-dependent on each other. Mechanical properties may be altered as the resin is exposed to unwanted compressive and tensile forces while chemical properties of resin is altered by the internal environment of oral cavity, food or other materials used; which further affects the mechanical properties.[4,5]

The wear resistance of a resin composite is affected when there is reduction in surface hardness. Due to decrease in wear resistance there may be increase in surface roughness which is favourable for plaque accumulation, staining of resin composite and finally early loss of restoration, requiring re-restoration.[6,7]

To overcome plaque accumulation and periodontal problems there is increase in prescription of mouth rinse by the dentist also there is increased purchase of over-the-counter mouthrinses by the patients.

Mouthrinses contain water, antimicrobial agents, salts, preservatives and in some cases alcohol. The variation in the concentration of these substances affects the pH of the mouthrinses. Although mouthwashes are effective in reducing periodontal disease and dental caries, there are some risks associated with them when used daily. The risks include dry mouth, pigmentation of tongue and change in the physical properties of composite resin restorations[8].

Alcohol containing mouthrinses such as LISTERINE and PERIOGARD are most frequently used mouthrinses; The alcohol in the mouthwashes influences the degradationof composite resins[8,9] and this effect is found to be directlyrelated to the concentration of alcohol[9]. Furthermore, lowpH affects sorption; solubility and surface degradation of there storative material. Therefore, alcohol-free mouth washes have been introduced into the market[9]. However, studies have reported the fact that both alcohol and alcohol-freemouth rinses can reduce the hardness of the restorative materials[9].

Recently, manufacturers have introduced a new nano hybrid restorative composite material (IVOCLAR TETRIC-N-CERAM ®), which they

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claim to be resistant to wear in the oral environment. In addition, an alcohol-free mouthrinse (FRESHCLOR®) and a new alcohol free herbal mouth rinse (Hiora®) are available in the market. As these products are recently introduced, there are no studies assessing the effect of these mouth rinses on the composite resin restorative material. Hence, the aim of the present study was to assess and compare the effect of these newly available mouth rinses (Hiora® and Freshclor®) onthe newly introduced restorative composite (IVOCLAR TETRIC-N-CERAM®). This was studied by assessing the change in the surface micro hardness of the restorative composite after exposure to the mouth rinses.

MATERIALS AND METHOD

Forty specimens of nano hybrid resin based composite material (IVOCLAR TETRIC-N-CERAM) with 3 mm in diameter and 3 mm in height were prepared using a teflon mould which was custom modified to get the desired size.

Moulds were placed on glass slide and then filled with composite resin using Teflon coated composite instruments. Excess material was removed using glass slide, following which clear matrix strip was placed and cured with LED light for 40secs from top and bottom. The samples were then removed from the mould.

The baseline microhardness of each specimen was recorded using Vickers Micro Hardness Tester with load of 40g and dwell time of 15secs.The specimens were divided into 4 groups of 10 specimen each n=10 according to mouth rinses used as follows:

GROUP A: LISTERINE MOUTH RINSE

GROUP B: PERIOGARD MOUTH RINSE

GROUP C: FRESHCLOR MOUTH RINSE

GROUP D: HIORA MOUTH RINSE

GROUP	MOUTH RINSE	pH	COMPOSITION	MANUFACTURER
A	Listerine®	3.7	Thymol - 0.06% w/v Eucalyptol - 0.09% w/v Menthol - 0.04% w/v Ethanol - 21.6% w/v	Johnson & Johnson Ltd., Kolhapur, India
B	Colgate Periogard®	4.5	Chlorhexidine gluconate- 0.12% w/v, Ethyl alcohol- 11.6%w/v	Colgate-Palmolive India Pvt. Ltd., Mumbai, India
C	Freshclor®	6.2	Stabilized chlorine dioxide - 1% Sodium phosphate, tribasic, citric acid, sucralose	Group Pharmaceuticals Ltd
D	Hiora®	4.2	Ela (Salvadora persica) - 5 mg Babul (Acacia arabica) - 10mg Kapoor (Camphor) - 10mg Sandhapura (Coleus aromaticus) - 1.2mg Ela (Elettaria cardamomum) - 0.2mg Peppermint (Mentha spp.) - 1.6mg Ajwain (Trachyspermum ammi) - 0.4mg	The Himalaya Drug Company, Bangalore, India

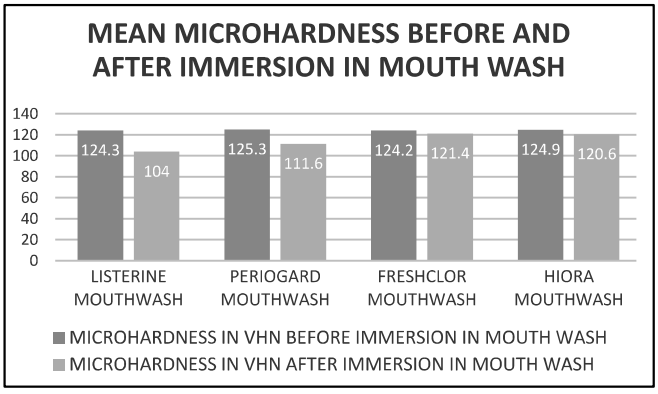
The specimens were then immersed in 20 ml of respective mouth rinses in a glass beaker and kept in an incubator at 37°C for 24 hrs. Each specimen were removed from mouth rinses and dried. The specimens were then checked for post immersion microhardness using the same micro hardness tester previously mentioned for base line values. The change in the microhardness values of the specimens were recorded. The obtained result was subjected to statistical analysis using one way ANOVA and Post Hoc Analysisin which $P < 0.05$ and was considered statistically significant.

RESULTS

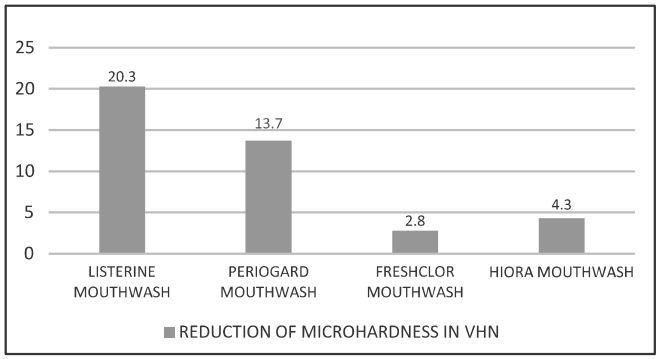
GROUPS	BEFORE IMMERSION		AFTER IMMERSION		MEAN DIFFERENCE
	MEAN	SD	MEAN	SD	
A	124	2.79	104	2.62	20.3
B	125.3	2.67	111.6	2.5	13.7
C	124.2	2.8	121.4	2.41	2.8
D	124.9	3.9	120.6	3.62	4.3

Table 1: Comparison of change in microhardness (VHN) before and after immersion in each group.

MEAN MICROHARDNESS (IN VHN)



Graph 1: Microhardness at Before and After Immersion



REDUCTION OF MICROHARDNESS (IN VHN)

Graph 2: Reduction of Microhardness

INTERPRETATION:

There was reduction in the microhardness of all specimens after immersion in the mouth rinses. Specimens in Group A showed significant reduction in the microhardness compared to the other three groups. There was no statistically significant difference in the microhardness of specimens of Group C and Group D.Mean difference of microhardness before and after immersion in mouth rinses was highest in GROUP A (20.3) followed by GROUP B (13.7). It was lowest in GROUP C (2.8) and then GROUP D (4.3).

DISCUSSION

The ideal requirement of a restorative material is that it should function in the same manner as dental hard tissue in the dynamic oral environment. To have long-term durability in the oral cavity, the restorative material should have sufficient hardness[9]. Hardness is the resistance of a material to indentation or penetration[9]. When there is reduction in the hardness of resin material, there may be premature failure of resin restoration.

Mouth rinses have been reported to affect the solubility of some restorative materials. Asmussen[7,10] reported that alcohol in the mouth rinses softens the resin composite restorations. Alcohol in mouth rinses is used as a solvent, taste enhancer, and antiseptic agent[11]. Ethanol, which is a component in various mouthwashes, may increase the hydrolytic degradation of composite-based materials[12]. Thus, there is an increasing demand for alcohol-free mouth rinses.

Freshclor® (alcohol free) and Hiora® (alcohol free herbal mouth rinse) are the newly introduced mouth rinses in the market and their effect on the surface hardness of restorative composite material (IvoclarTetric-N-Ceram®) is not known.Composite restorative material IvoclarTetric-N-Ceram® is claimed by the manufacturers to be resistant to wear in the oral environment. It contains Urethane Dimethacrylate, Bis GMA 15 wt%, Ethoxylted Bis-EMA 3.8%wt, Barium glass, ytteribium trifluoride mixed oxide, silicon dioxide 63.5 wt%, prepolymers 17 wt%, additives, stabilizers, catalysts and pigments 0.7 wt %.

The surface hardness test is important because it may affect the surface properties of esthetic materials[13,14]. In the present study use of all the mouth rinses, irrespective of the presence or absence of reduced the micro hardness of the tested nanohybrid resin composite material compared to base line values. This may be because of the acidic pH of the mouth rinses which would have caused acid erosion of the resin composite by acid etching and leaching the principle matrix forming cations. This is in accordance with the observations by Diab et al[15] reported that mouth rinses with low pH are detrimental to the hardness of resin composites.

Basically the low pH of mouth rinses may have acted on the polymeric matrix of the nanohybrid resin composite used in the study, through catalysis of ester groups from dimethacrylate monomers present in the composition (Bis GMA, Bis EMA, UDMA and TEG DMA). The hydrolysis of these ester groups may have formed alcohol and carboxylic acid molecules that may have accelerated the degradation of the resin composite[16]. Inter group comparison showed Listerine (Group A) and Periogard (Group B), containing alcohol 21.6% w/v and 11.6 % w/v respectively, resulted in more reduction in the micro hardness as compared to Freshclor (Group C) and Hiora (Group D) which are alcohol free. This may be because of the presence of alcohol in Listerine (Group A) and Periogard (Group B) but reduction in microhardness in Periogard (Group B) is less as compared to Listerine (Group A). This must be due to lower percentage of alcohol in Periogard (Group B) compared to Listerine (Group A). This observation is in accordance with the observation of Penugondaet al[11] who reported that the higher percentage of alcohol in the mouth rinses causes more reduction in the hardness of restorative

materials. The softening effect of alcohol in the mouth rinses on the resin composite may be due to susceptibility of Bis GMA and UDMA based polymers present in them[14] and irreversible leaching of the components[17]. This effect may be more pronounced in nanohybrid resin composites according to the observation by Karabelaet al[18] and Almeida GS et al[13] who showed higher sorption rate for nanohybrid resin composites in ethanol/water than in water or saliva.

The reasons for this may be –Greater surface area to volume ratio derived from the non-agglomerated 20 nm silica filler. Poor impregnation of 5 to 20 nm sized primary particles by the polymeric matrix[18,13].

As observed in the study, alcohol content and low pH can have detrimental effect on the micro hardness, but these two factors may not be interdependent on each other in reducing the micro hardness of the resin composite tested. Though Hiora (Group D) has low pH than Periogard (Group B), it shows less reduction in micro hardness than Periogard (Group B) which may be due to absence of alcohol. Hence the long-term, regular use of alcohol based mouth rinses like Listerine (Group A) and Periogard (Group B) with higher alcohol content (21.6% w/v and 11.6% w/v respectively) and low pH may be detrimental to the nanohybrid resin composite used in the present study.

The result of this study are similar to some other studies done by George et al[19] and Jyothi et al[20] concluded that use of alcohol based mouthrinses reduces the microhardness of esthetic restorative material like composite.

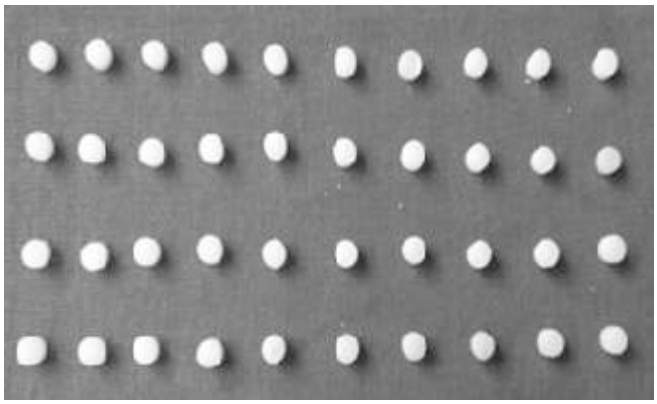
However, the results of this in vitro study may not be directly related to the clinical situation where saliva may dilute or buffer the mouth rinses.

CONCLUSION

- Listerine® mouth rinse containing the highest amount of alcohol showed maximum reduction in microhardness followed by Periogard® of resin composite IvoclarTetric-n-Ceram.
- Reduction in the surface microhardness in the tested composite was lower in alcohol free mouth rinses than in alcohol containing mouth rinse.
- All the mouth rinses used in the study irrespective of the presence or absence of alcohol reduced the microhardness of the tested composite resin material.

Ivoclar Tetric N Ceram

Mouthrinses Used In Study: Group A: Listerine, Group B: Perogard, Group C: Freshclor, Group D: Hiora.



Prepared Samples

Samples Placed In Mouthrinses

INCUBATOR

Samples Placed In Incubator At 37oc For 24 Hrs

Vickers Microhardness Tester

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