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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF THE EFFECT OF CHLORHEXIDINE BASED MOUTHWASH AND HERBAL MOUTHWASH ON THE MICROHARDNESS OF TWO DIFFERENT COMPOSITE RESINS – AN IN VITRO STUDY.

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Abstract

Aim and Objectives: This in vitro study was designed to comparatively evaluate the effect of a chlorhexidine based mouthwash and a herbal mouthwash on the microhardness of nanofilled and nanohybrid composite resin.

Materials and Methods: 60 discs of nanofilled and nanohybrid composite resins were prepared, 30 for each type of composite. The specimens of each type of composite were divided randomly into three subgroups, each containing 10 specimens (n=10) as follows – Subgroup I Control (Distilled water), Subgroup II Herbal based mouthwash (Hiora) and Subgroup III Chlorhexidine based mouthwash (Hexidine). The specimens were immersed in 20 ml of the mouthrinses and incubated for 12 hrs at 37^{o} C. The specimens were then subjected for micro hardness measurement using Vicker's hardness tester and the results were analysed statistically using ANOVA and unpaired t test.

Results: Significant reduction in the microhardness was observed in both the groups after immersion in the mouth rinses compared to the control group and the reduction in mean VHN were as follows: Group I, GroupII and Group III.

Conclusion: Both the mouthrinses showed a reduction in the microhardness of nanohybrid and nanofilled resin composite with Hexidine (Group III) showing the highest reduction in microhardness value.

Introduction:-

Today, resin composites are largely used to build-up anterior and posterior restorations due to their high esthetic features and improved physical and mechanical properties.[1] Present day dental composites posses superior physical and mechanical properties that are attributed to the advancement in nano-science thus, implementing in modifying the filler particles of the dental composites.[2] Nanocomposites have many advantages, however various factors like, the dietary pattern of individuals and constant variation of pH and temperature in the oral environment may affect the surface properties of dental tissues and restorations. Ilie *et al*[3] and Hamouda *et al*[4] in their studies have stated that the surface of the restorative materials placed on the tooth may also be affected by the chemical action of various types of food, drinks and oral hygiene maintenance products.

Nowadays, mouth rinses are widely used to prevent and control caries and periodontal diseases, however frequent use of mouth rinses may have detrimental effects on oral tissues and on the restorations present in the oral cavity.[1]

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Commercially available mouth rinses contains various substances, like water, antimicrobial agents, salts, preservatives and, in some cases, alcohol. The pH of the mouth rinses is affected by the variation in the concentration of these substances. Alcohol in the mouth rinses may result in softening of the resin composite restorative materials and this effect is found to be directly related to the percentage of alcohol. The degradation of the restorative materials is also influenced by the type of restorative material used.[5-9]

Gurgan *et al*[10] stated that both alcohol containing and alcohol free mouthwashes may influence the hardness of the restorative materials. As hardness is related to material's strength and rigidity, it has implication on the longevity of restorations.

Hence the aim of this study was to comparatively evaluate the effect of a chlorhexidine based mouthwash and a herbal mouthwash on the microhardness of nanohybrid and nanofilled resin composite.

Materials and Methodology:-

In this in-vitro study two different resin composites i.e. nanohybrid (Filtek Z250 XT) and nanofilled (Filtek Z350 XT) with shade A2 were selected. These test materials were selected to be immersed in distilled water as the control group, a herbal mouthwash (Hiora) and chlorhexidine based mouthwash (Hexidine).

The details of the commercial mouth rinses and the tested resin composites are shown in Tables 1 and 2.

Table 1:- Details of mouthwashes used in the study

Sr no.	Mouthwash	pH	Manufacturer
1.	Hiora	4.26	The Himalaya Drug Company, Bengaluru, India Batch no: 18500922
2.	Hexidine	5.7	ICPA Health Products Ltd, Ankleshwar, India. Batch no: L50111

Table 2:- Details of composite resins used in the study

Sr no.	Composite resin	Shade	Manufacturer
1.	Filtek Z250 XT	A2	3M ESPE, Dental products, St. Paul, MN, USA. Lot # N617438
2.	Filtek Z350 XT	A2	3M ESPE, Dental products, St. Paul, MN, USA. Lot # N677867

Specimen preparation

60 cylindrical specimens (30 of nanofilled and 30 of nanohybrid) with 10 mm height and 2 mm width were prepared using a plastic mold (Figure 1). The mold was placed on a glass slide and filled with resin composite to a slight excess using composite filling instrument and was covered with a clear matrix strip and another glass slide was placed on top and gently pressed for 30 seconds to extrude excess material and to obtain a smooth surface. All resin composite specimens were light activated with quartz-tungsten-halogen unit for 40 seconds.

The specimens consisted of two groups i.e.

GROUP A – Nanohybrid composite resin (n=30)
GROUP B – Nanofilled composite resin (n=30)

These groups were subdivided into three subgroups containing ten samples each which were stored in the following,

Subgroup 1 – Distilled water (Control) (n=10)
Subgroup 2 – Herbal based mouthwash (Hiora) (n=10)
Subgroup 3 – Chlorhexidine based mouthwash (Hexidine) (n=10)

pH Evaluation

The pH of the mouthwashes was recorded using a digital pH meter. The values are entered in Table 1.

The first subgroup containing 10 specimens were immersed in distilled water. The second subgroup containing 10 specimens were immersed in herbal based mouthwash and the third were immersed in chlorhexidine based

mouthwash and kept in an incubator at 37^{o} C for 12 hours, as 12 hours of immersion was equivalent to one year of daily mouthwash use at two minutes/day. After this, the specimens were washed under abundant water.

Microhardness testing

The specimens were then subjected for micro hardness measurement using Vicker's hardness tester (microhardness tester, Reichert, Austria) (Figure 2) with 100 gram force and a dwell time of 20 seconds. Two indentations were made on the top surface at a minimum distance of 1 mm from each other. Readings of the two indentations were averaged to determine the hardness value for each specimen.

Statistical tests

One way ANOVA F test was carried out for comparing the groups and to determine whether significant differences existed among the tested groups. Further, unpaired t test was carried out to determine whether significant differences existed among the individual groups and also among each pair of groups.

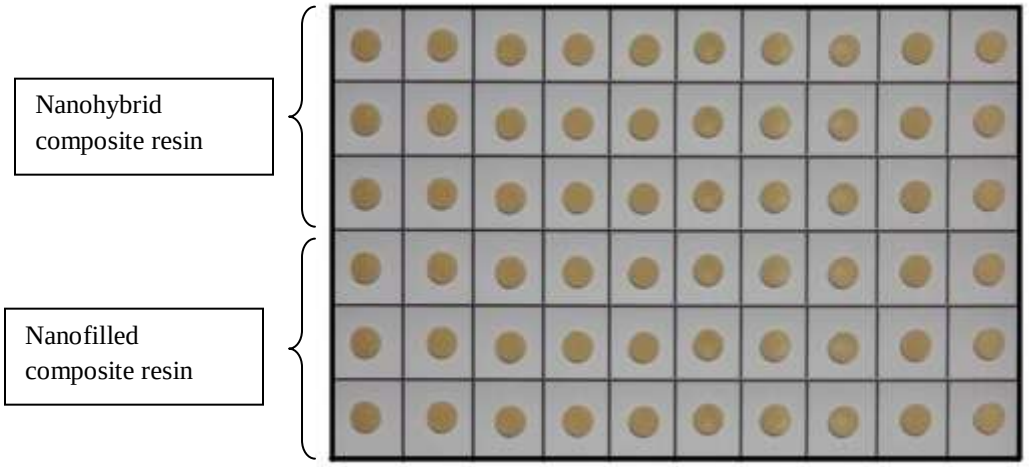


Figure 1:- 60 cylindrical composite specimens

Figure 2:-Vicker'smicrohardness tester

Results:-

Significant reduction in the microhardness was observed in both the groups after immersion in the mouth rinses compared to the control group.

To know whether the three subgroups differ significantly in the mean microhardness, ANOVA test is applied at 95% confidence level. The obtained value of test statistics for Group A (F=11.4755) and Group B (F=22.7622) were found significant with p value 0.000. Thus to further know which pair shows significant difference in the mean microhardness unpaired t test is applied. The results obtained are shown in the following tables (table3, 4 and 5).

Subgroup III showed significant reduction in the mean microhardness compared to Subgroup II. Moreover, there was no significant difference in the mean VHN values of Group A and Group B

Table 3:-Results of Nanohybrid composite resin (Group A)

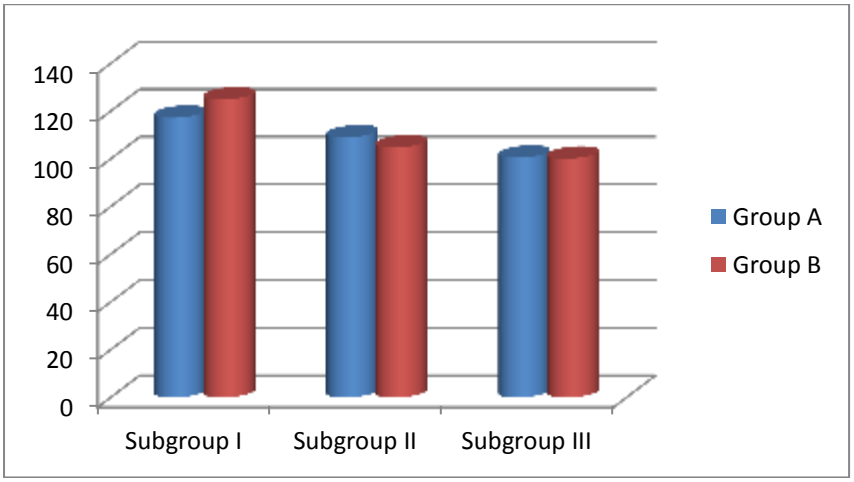
Pair	Mean microhardness	S.D.	SE	t value	p value	Remark
Subgroup I Subgroup II	117.281 109.05	8.3314 8.2285	9.2002	2.0005	0.062	Not significant
Subgroup I Subgroup III	117.281 100.523	8.3314 5.2993	7.7577	4.8303	0.000	Significant
Subgroup II Subgroup III	109.05 100.523	8.2285 5.2993	7.6896	2.4796	0.000	Significant

Table 4:-Results of Nanofilled composite resin (Group B)

Pair	Mean microhardness	S.D.	SE	t value	p value	Reamrk
Subgroup I Subgroup II	124.96 104.82	5.9854 6.3376	6.8489	6.5754	0.000	Significant
Subgroup I Subgroup III	124.96 100.132	5.9854 11.4197	10.1298	5.4806	0.000	Significant
Subgroup II Subgroup III	104.82 100.132	6.3376 11.4197	10.2612	1.0216	0.329	Not significant

Table 5:-Intergroup Comparison between the tested samples

Solution	Material	Mean microhardness	S.D.	SE	t value	Remark
Subgroup I	Group A Group B	117.281 124.96	8.3315 5.9855	8.0599	-2.1304	Not significant
Subgroup II	Group A Group B	109.05 104.82	8.2285 6.3376	6.866	1.3776	Not significant
Subgroup III	Group A Group B	100.523 100.132	5.2993 11.4197	9.8911	0.0884	Not significant



Graph 1:-Comparison of the two tested composite resins immersed in different solutions.

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Discussion:-

The present in vitro study was designed to comparatively evaluate the effect of mouth rinses on the microhardness of nanohybrid Filtek Z250 XT and nanofilled Filtek Z250 XT resin composite. Hexidine is a chlorhexidine based mouthwash and Hiora was a herbal mouthwash.

The widespread use of composite resins and their exposure to harsh oral conditions requires that they exhibit significant durability. One of the most important properties determining the durability of dental composites is hardness which can be defined as the resistance of a material to indentation or penetration.[11] Hardness of a material is related to its strength, proportional limit and its ability to abrade or be abraded by opposing dental structures/materials.[12] Therefore any chemical softening resulting from the use of mouthwash would have implications on the clinical durability of the restorative material.

In the present study, both the mouth rinses resulted in significant reduction in the micro hardness of the tested resin composite material compared to the control group. 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 Dieb *et al* in 2007[9] who stated that mouth rinses with low pH are detrimental to the hardness of resin composites. Basically this may be due to the low pH of mouth rinses, which may have acted in the polymeric matrix of the nanofilled resin composite used in the study, through the process of catalysis of the ester groups from dimethacrylate monomers present in the composition (Bis GMA, Bis EMA, UDMA and TEG DMA).[13] The hydrolysis of these ester groups may have formed alcohol and carboxylic acid molecules that may have accelerated the degradation of the resin composite.[14] Similarly, a study conducted by Rahawi *et al*[15] stated that all tested restorative materials showed decreased microhardness, but it was related to their low pH after each period of time.

Inter group comparison of the tested samples showed that chlorhexidine based mouthwash i.e. Hexidine (Subgroup III) resulted in more reduction in the micro hardness in both the composites compared to the herbal mouthwash i.e. Hiora (Subgroup II). The probable reason for this could be the presence of alcohol in the Hexidine. Miranda *et al*[16], Pengugonda *et al*[17] and Weiner *et al*[18] found that alcohol or hydrogen peroxide containing mouthwashes present a higher potential to alter the hardness of composite.

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[19] and irreversible leaching of the components.[20] This effect may be more pronounced in nanofilled resin composites according to the observation by Karabela *et al*[21] and Almeida GS *et al*[22] who showed higher sorption rate for nanofilled 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.

As observed in the study, alcohol content and low pH can have an 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 has low pH than Hexidine, it shows less reduction in micro hardness than Hexidine, may be because it has no alcohol in it. However, both the resin composites did not differ significantly in microhardness with respect to the mouthwashes used.

Saliva, salivary pellicle, foods and beverages may have negative effects on the physical and aesthetic properties of this group of restorative materials. Therefore, further studies are necessary to evaluate these parameters in-vivo.

Conclusion:-

Within the limitations of the study it can be concluded that:-

1. Both the resin composites exhibited decrease in microhardness upon immersion in chlorhexidine based and herbal based mouthwash.
2. Chlorhexidine based mouthwash showed greater reduction in microhardness as compared to herbal mouthwash.
3. The two composites did not show any significant difference in microhardness.

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