

An in vitro evaluation of pH variations on physical properties of tooth coloured restorative materials.

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I. Introduction

Dental erosion is defined as tooth wear due to dissolution of the dental hard tissues by acids without the involvement of bacteria. However it has become possible to rehabilitate eroded teeth in a less invasive manner using composite resins & glass ionomer cements.

Clinically, these restorations are exposed intermittently or continuously to chemical agents found in saliva, food, & beverages, which can significantly affect the hardness & roughness of material. Worn & roughened surfaces may be plaque retentive, allowing bacterial flora to flourish, leading to increased caries risk & periodontal inflammation.

II. AIM

Study aims to evaluate the effect of pH cycling on the hardness & surface roughness of Glass ionomer cement, Resin modified glass ionomer cement and composite resin.

III. Materials And Methods

30 customized square mould prepared & randomly divided into three groups according restorative material.

Group I – Specimen of LC GIC

Group II – Specimen of VITREMER

Group III – Specimen of FILTEK Z 250

30 specimens of LC GIC, Vitremer, filtek Z 250 (10 of each material) were prepared in a customized square mould and were stored in distilled water at room temperature.

pH cycling model consist:

1. Demineralization solution.
2. Remineralization solution.

The specimens will be first immerse in 10 ml of demineralisation sol. For 6hr at 37c, rinse with distill deionized water & then stored in 10 ml remineralization sol. For 18 hr at 37c

The experimental conditions was repeated for 10 uninterrupted cycles .

1. Demineralization solution :- Contain 2.0 mM Calcium & 2.0 mM Phosphate In 74.0mM Acetate At pH – 4.3.

2. Remineralization solution :- Contain 1.5 mM Calcium & 0.9 mM Phosphate In 1 mM Tris At pH –7

Figures:--

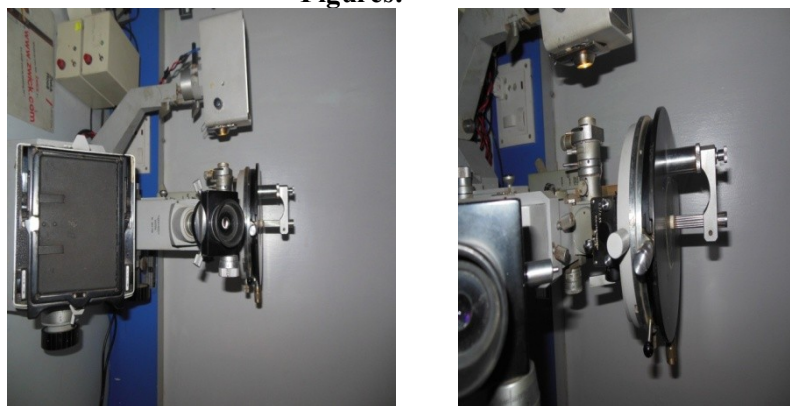


Fig 1:- Digital Micro Hardness Tester

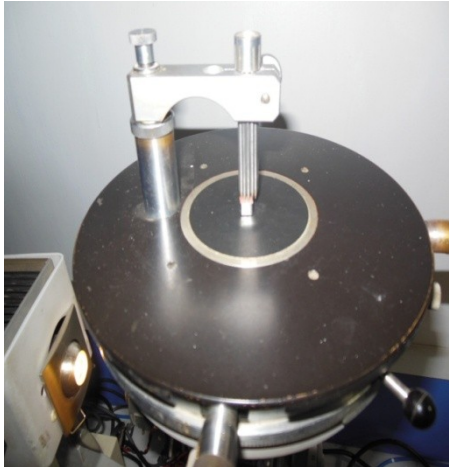


Fig 2:- Checking The Hardness Of Sample



Fig 3:- Profilometer

Surface Roughness Measurements : - Before afterthe pH – cycling regime all specimens was analyzed using surface Roughness Tester

Hardness Measurements : -Before & after the pH – cycling regime all specimens was analyzed using a Digital microhardness Tester in vickers hardness value



Fig 4:- Graph displaying the values.

Statistical analysis was done using by using paired t test for each group, at 5% level of significance

GROUP I	Mean difference	Standard deviation	statistic value	P value	Result
Surface roughness	0.03490	0.04463	2.473	0.0354	Significant
Hardness	-22.5240	7.5629	-9.418	0.0001	Significant

GROUP II	Mean difference	Standard Deviation	Statistic value	P value	Result
Surface roughness	0.05350	0.06527	2.592	0.0291	Significant
Hardness	-22.5240	7.5629	7.5629	7.5629	Not significant

GROUP III	Mean difference	Standard Deviation	Statistic value	P value	Result
Surface roughness	0.06540	0.05919	3.494	0.0068	Significant
Hardness	-50.2580	14.8956	-10.670	0.0001	Significant

IV. Results

LC GIC (GROUP I) showed a statistically significant increase in surface roughness & decrease in hardness after pH cycling.

VITREMER (GROUP II) showed a statistically significant increase in surface roughness .

But there was no significant difference in the hardness after pH cycling of vitremer .

FILTEK Z 250 (GROUP III) showed a statistically significant increase in surface roughness & decrease hardness after pH cycling.

V. Discussion

Mouth is considered the ideal environment for predicting the behavior of restorative material. However, due to the complexity & diversity of intraoral conditions, in vitro models are very important for providing an insight into the fundamental mechanisms of biodegradation.

The pH cycling regimen used in this study was to simulate the alterations in the pH of the oral cavity.

In this study LC GIC & FILTEK Z 250 showed a statistically significant increase in surface roughness & decrease hardness after pH cycling

However VITREMER showed a statistically significant increase in surface roughness, But there was no significant difference in the hardness after pH cycling.

Hardness is defined as the resistance of a material to permanent indentation

Low hardness value lead to worn & roughened surface may be plaque retentive

A reduction in the surface hardness of composite resins soaked in organic acid has been attributed to the softening of bisphenol-A- glycidyl methacrylate (BIS-GMA)-based polymers, which could be caused by leaching of the diluent agents such as triethylene glycol dimethacrylate(TEG-DMA).

The softening of the resin matrix could promote displacement of filler particles, contributing to the formation of a rough surface in this study

Roughness parameters are dependent on several factors , such as filler particles , hardness, degree of polymer conversion to resin matrix, and filler-matrix interaction

VI. Conclusion

According to our results we are conclude the following :

- ☐ LC GIC & FILTEK Z 250 showed a statistically significant increase in surface roughness & decrease in hardness after pH cycling.
- ☐ VITREMER (GROUP II) showed a statistically significant increase in surface roughness .
- ☐ But there was no significant difference in the hardness after pH cycling of VITREMER.

References

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