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Surface Roughness Analysis Before and After Ultrasonic Scaling Of Two Different Tooth Coloured Class V Restorative Materials: An *In Vitro Study*

Dr. Anil Dhingra*, Dr. Prem Prakash**, Dr. Vasundhra Gupta***, Dr. Bhartendu Kawatra****

**Professor, **Vice Principal, Professor &Head Department of Biochemistry, ***Post Graduate Student, ****Reader*

Department of Conservative Dentistry And Endodontics, Seema Dental College & Hospital, Rishikesh, UK.

Abstract

Aim: *To evaluate and compare the effect of ultrasonic scaling on two different tooth coloured class V restorative materials using surface roughness tester before and after ultrasonic scaling.*

Methodology: Ninety *human freshly extracted teeth extracted for orthodontic or periodontal purpose were taken. Thirty were randomly selected and included in control group (Group I).Control group were marked with area of 2x4 mm to simulate outline of class V cavity; no cavity preparation was done on them. On remaining sixty teeth standardized class V cavities of 4 mm width, 2 mm length, and 1.5 mm depth were prepared on facial surface with carbide bur. These one hundred twenty cavities randomly and equally divided into 4 groups according to type and were restored with Riva self cure and GC Fuji II LC. All specimens were then stored in artificial saliva at 37oC in 100% relative humidity for one week. Initial surface roughness was evaluated in terms of Ra value (µm) using Surface Roughness Tester. Later, ultrasonic scaling was performed on all specimens with ultrasonic scaler and post-ultrasonic instrumentation roughness was evaluated as mentioned previously. After completion of the procedure, all the data was collected and subjected to statistical analysis and results was evaluated.*

Results: *On statistical evaluation mean pre-instrumentation surface roughness was highest with Riva Self Cure whereas it was least in case of GC Fuji II LC. Mean post-instrumentation surface roughness was highest with Riva Self Cure whereas it was least in case of GC Fuji II LC.*

Conclusion: *Riva Self Cure showed highest surface roughness compared to GC Fuji II LC which showed surface roughness and least susceptibility to ultrasonic scaling.*

Keywords*: Class V restorations, surface roughness, ultrasonic scaling.*

I. Introduction

Non carious cervical lesions are becoming an increasingly important factor when considering the long-term health of the dentition and it is not possible to determine a unique etiological factor, but there is a concern that it is multifactorial condition.[1, 2, 3, 4, 5] These lesions can affect tooth sensitivity, plaque retention, caries incidence, structural integrity and pulp vitality, and they present unique challenges for successful restoration.[1, 6, 7, 8, 9]

Longevity and leakage of class V restorations is a matter of concern in day to day practice for dentists. With the advent of new adhesive materials and ease of their application, the demand for non-metal dental restorations has grown considerably in class V cavities.[2.,10,11,12]

The aim of this study was to evaluate and compare the effect of ultrasonic scaling on two different tooth coloured class V restorative materials using surface roughness tester before and after ultrasonic scaling.

II. Materials And Method

Method:

Ninety freshly extracted teeth for orthodontic or periodontal treatment purpose were taken. Thirty teeth were randomly selected and included in control group (**Group I)**. Teeth of Control group were marked with area of 2x4 mm to simulate outline of class V cavity; no cavity preparation was done on them.

On remaining sixty teeth, the standardized class V cavities of 4 mm width, 2 mm length, and 1.5 mm depth were prepared on facial surface with carbide bur.

The sixty cavities so prepared were randomly and equally divided into 2 groups according to the type they were restored with-

Group II: Riva self cure (n=30)

Group III: GC Fuji II LC (n=30)

Restorative materials in each group were manipulated according to manufacturer's instructions and placed into the prepared cavity. A transparent matrix band was placed over it, and pressure was applied to extrude excess material. The restorations in Group II were allowed to set against Mylar strip. Restorations in Group III were cured against a Mylar strip with light curing unit for 40 seconds.

After initial set of each material, excess material was carefully removed.Restorations in Group II was covered with cocoa butter. All specimens were then stored in artificial saliva at 37^{o}C in 100% relative humidity for one week.

Specimens in each group were rinsed in running tap water for 30 seconds and further cleaned in an ultrasonic cleaner for 6 minutes. Then they were air dried, and initial surface roughness was evaluated in terms of Ra value (µm) using Surface Roughness Tester.

Later, ultrasonic scaling was performed on all specimens with ultrasonic Scaler having under copious water flow for 60 seconds. The scaling tip was angled approximately 15^{o} to the restoration surface. The direction of scaling was approximately perpendicular tooth long axis of the tooth in the horizontal plane, moving the scaler insert slowly from gingival to coronal third of the restoration.

The specimens were then rinsed in running tap water for 30 seconds and cleaned in an ultrasonic bath for 6 minutes. All specimens were then air dried, and post-ultrasonic instrumentation roughness was evaluated as mentioned previously.

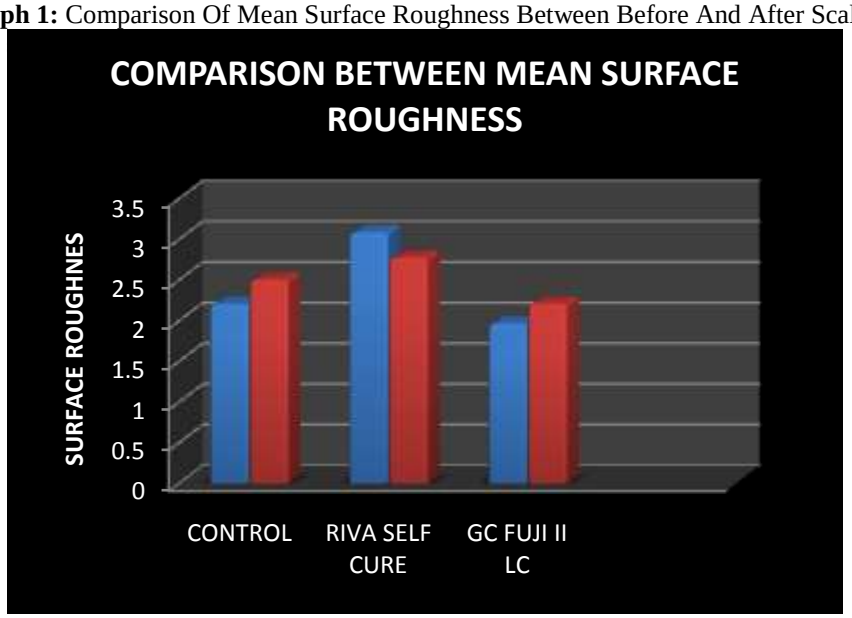
III. Observation And Results

The data so obtained before and after scaling were recorded and subjected to statistical analysis.

Table 1: Paired T Test Value

GROUP	MEAN DIFFERENCE	t value	df	SED	P	95% CI
G1CONTROL	-0.344	2.14	29	0.161	0.040	-0.67 to -0.01
G2(RIVA Self Cure)	0.307	1.44	29	0.213	0.159	-0.128 to 0.743
G3(GC Fuji II LC)	-0.217	0.794	29	0.274	0.433	-0.77 to 0.343

Graph 1: Comparison Of Mean Surface Roughness Between Before And After Scaling



On comparing the mean surface roughness values initial surface roughness values (Ra) was highest for Riva self cure, followed by Control Group and lowest for GC Fuji II LC (Graph 1) whereas post-instrumentation surface roughness were in the order of Riva self cure, Control Group, GC Fuji II LC (Graph 1). There was statistically significant difference between roughness values before and after ultrasonic instrumentation.

The difference (δ) between the mean pre-instrumentation and post-instrumentation roughness, which gives actual effect of ultrasonic scaling on the surface roughness of control and test group, was highest in case of Control followed by and Riva self cure and least in GC Fuji II LC (Table 1). Though initial surface roughness values of all the groups were significantly different, there was no correlation found between initial surface roughness and change in mean surface roughness (δ).

IV. Discussion

This *in vitro* study evaluated and compared the effect of ultrasonic scaling on four different tooth colored class V restorative materials using surface roughness tester before and after ultrasonic scaling. It was assumed that Ultrasonic scaling would alter restoration surfaces to varying degrees, depending on which materials were used, and that repolishing the scaled surfaces would reduce their surface roughness to clinically acceptable values.

Restorative materials used in this study were Riva self cure, GC Fuji II LC (RMGIC), Tetric N Ceram-Bulk Fill and GC Fuji II.

The mean surface roughness observed in different groups: Group II (Riva Self Cure), Group III (GC Fuji II LC), Group IV (Tetric N Ceram –Bulk Fill) and Group V (GC Fuji II) were 3.08, 1.98, 1.11, 2.50 before scaling and 2.77, 2.20, 1.73, 2.61 after scaling respectively.

The differences in the obtained results can be attributed to differences in the morphology of the cavity, variability, and operator skill; type of occlusion; binding capacity of the restorative system; and the polymerization of the restorative materials.[13, 14, 15] As patient ages, dentin becomes more sclerotic, the frequency of NCCLs is higher, and the retention of restorations is decreasing, as shown by Bayne and others. Those authors found that the percentage of the loss of restorations in patients aged 21–40, 41– 60, and 61–80 was 31%, 62%, and 75%, respectively.'[14, 16, 17, 18]

V. Conclusion

Within the limitations of the study it can be concluded that ultrasonic instrumentation has caused significant changes in the surface roughness of both control and test specimen. Riva self cure had highest, whereas GC Fuji II LC had lowest pre- and post-instrumentation roughness values. Riva self cure was found most susceptible to ultrasonic instrumentation, but the post-instrumentation roughness values were still close to that of control group. Nanohybrid composites are found to withstand the Ultrasonic scaling instrumentation better than other tested materials, but still we would like to pass a message that carry out the routine ultrasonic scaling with caution, and subsequently polish the roughened restorations after scaling.

However more in-vitro studies need to be conducted to correlate with the results of this study.

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