Evaluation and comparing the effect of ultrasonic scaling on four different tooth colored class V restorative materials on surface roughness: An Invitro Study.

Dr. Annil Dhingra  
Professor, Department of conservative dentistry and endodontics, Seema dental college and hospital, Rishikesh.

Dr. Bharatendu Kawatra  
Reader, Department of conservative dentistry and endodontics, Seema dental college and hospital, Rishikesh.

Dr. Sheetal Grover  
Senior Lecturer, Department of conservative dentistry and endodontics, Seema dental college and hospital, Rishikesh.

Dr. Sumit Sabharwal  
Senior Lecturer, Department of conservative dentistry and endodontics, Seema dental college and hospital, Rishikesh.

Dr. Vasundhra Gupta  
Post Graduate student, Department of conservative dentistry and endodontics, Seema dental college and hospital, Rishikesh.

Dr. Sankalp Verma  
Oral Physician, Sri sai hospital, Moradabad. - Corresponding Author

ABSTRACT

AIM: To evaluate and compare the effect of ultrasonic scaling on four different tooth colored class V restorative materials using surface roughness tester before and after ultrasonic scaling.

METHODOLOGY: One hundred and fifty human freshly extracted teeth 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 one hundred twenty 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 (Group II; n=30); GC Fuji II LC (Group III; n=30); Tetric N- Ceram Bulk Fill (Group IV; n=30); GC Fuji II (Group V; n=30).

All specimens were then stored in artificial saliva at 37°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 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. After completion of 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 Tetric N Ceram-Bulk Fill. Mean post-instrumentation surface roughness was highest with Riva Self Cure whereas it was least in case of Tetric N Ceram-Bulk Fill.

CONCLUSION: Riva Self Cure showed highest surface roughness compared to Tetric N Ceram-Bulk Fill which showed surface roughness and least susceptibility to ultrasonic scaling. However more in-vitro studies need to be conducted to correlate with the results of this study.

INTRODUCTION

The human tooth is a marvel of nature. However, it has one shortcoming; it has only a limited capacity of regeneration. This necessitates the replacement of tooth structure lost as a result of caries, trauma, or other reasons, with a suitable restorative material. Non carious cervical lesions are becoming an increasingly important factor when considering the long-term health of the dentition and can affect tooth sensitivity, plaque retention, caries incidence, structural integrity and pulp vitality, and they present unique challenges for successful restoration.

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. Traditionally the management of the cervical lesions was carried out by preparing class V cavities and restoring them with various materials like silver amalgam, gold, porcelain, silicates, etc. All these materials have some disadvantage and generally require removal of moderate amounts of remaining tooth structure which can be overcome by using materials having property such as strength, ease of use, longevity, past success esthetics, able to bond to tooth structure, good finishability and polishability. For restoring the class V restorations, various tooth colored restorative materials with diverse mechanical properties are available that can function properly.

The resistance of dental restorations to superficial degradation has an appreciable influence on their clinical performance. The analysis of wall to wall integrity of restored tooth requires that attention should be given to the elastic properties of restorative material. Resin composites and glass ionomer cements are widely used for restoring cervical lesions, as they are esthetic, mercury free and bond to the tooth structure. It has been demonstrated that microfilled resins tend to flex with the tooth rather than debond, as compared to the more rigid macrofilled resin restorations. The relationship between dental restorations and periodontal health has been thoroughly investigated for many years; focusing on the different aspects of periodontal–restorative interaction, such as surface roughness, the position of restoration with aspect of the gingival margin, the presence of an overhang and presence of marginal leakage. The surface roughness of restorative materials can influence staining, plaque accumulation, gingival irritation, recurrent caries, and aesthetic appearance.

Sonic and ultrasonic scaling have become the most widely used methods among dental surgeons, and oral hygienist, due to the decreased time requirement and ease of application in comparison...
with hand instrumentation. This in-vitro study was conducted to measure the surface roughness on tooth colored class V restorative materials before and after ultrasonic scaling using a surface roughness tester. The aim of this study was to evaluate and compare the effect of ultrasonic scaling on four different tooth colored class V restorative materials using surface roughness tester before and after ultrasonic scaling.

Material and Methods:
The study was carried out on one hundred fifty freshly extracted non carious teeth extracted either for orthodontic purpose or were periodontally involved.

Inclusion criteria: Maxillary Premolars teeth extracted for orthodontic or periodontal purpose.

Exclusion criteria: Any carious teeth or previously restored teeth.

METHOD:
One hundred and fifty 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. Restorations in Group II and III were covered with cocoa butter. All specimens were then rinsed in running tap water for 30 seconds and then air dried, and post-ultrasonic instrumentation roughness was evaluated in terms of Ra value (µm) using a 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° to the restoration surface. The direction of scaling was approximately perpendicular to the 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.

RESULTS:
On comparing the mean surface roughness values initial surface roughness values (Ra) from highest to lowest were in the order of Riva self cure, GC Fuji II LC, Tetric N Ceram- Bulk Fill (Table 1, Graph 1) whereas post-instrumentation surface roughness were in the order of Riva self cure, GC Fuji II LC, Tetric N Ceram- Bulk Fill (Table 2, Graph 2). There was statistically significant difference between roughness values before and after ultrasonic instrumentation.
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Glass Ionomer (GI) restorative materials have been widely used in
dentistry, mainly in Class V and primary tooth restorations. Chemical adhesion to tooth structure, long-term fluoride release, ability to uptake fluoride, and low coefficients of thermal expansion are characteristics that make GI clinically attractive. The properties of GI have improved in recent years as the result of an increased percentage of filler particle loading, the incorporation of resin monomers into the cement, or both. Resin-modified GI cements (RMGICs), one of the major categories of commercial GIs, were developed to partly overcome the problems associated with conventional GIs, such as poor handling characteristics, sensitivity to moisture during initial setting, and poor physicomechanical strength.

The surface roughness of restorative materials can promote biofilm formation, and a positive correlation was observed between surface roughness and vital Streptococcus mutans adhesion. Smooth resin composite surfaces exhibit less bacterial adhesion and accumulation than rougher ones do, and the smoothness of composite surfaces plays an important role in retardation biofilm adhesion and growth. Thus, increased surface roughness facilitates the adhesion of bacterial populations, which promotes periodontal diseases, secondary caries, surface staining, and discomfort due to the retention of bacterial plaque. Therefore, it is of great importance to be able to clean properly and treat tooth and restoration surfaces without traumatizing or damaging them. Ultrasonic scaling (USS) devices have recently become universally used in addition to conventional periodontal handheld instruments, and they effectively disrupt biofilms with minimal trauma to tooth structures Sonic and ultrasonic scalers have become the most widely used cleaning instruments among dental practitioners, because they make scaling more efficient and are easier to use than conventional handheld instruments. The effects of sonic and ultrasonic devices and laser treatments on hard and soft dental tissues have been investigated and well-documented in various studies. Laser treatments, however, have shown similar or less effectiveness than piezo-electric-driven scalers in removing calculus and treating periodontal tissues. Nevertheless, limited information is available about the effects of sonic and USS on dental restorative materials and a number of studies has shown that sonic and USS increased the surface roughness of tooth-colored restorations. It was also concluded that polishing scaled surfaces might overcome the change in surface roughness. Besides the type of adhesive system, margin locations also play an important role in the adaptation and integrity of composite restorations. Considering that the proximal or gingival margins of restorations are located near the periodontal tissues, we can suppose that sonic and ultrasonic devices may damage the marginal integrity of cervical restorations, thus leading to the development of tooth sensitivity and adversely affecting the longevity and esthetic appearance of the restorations.

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.

Samples were prepared on extracted teeth extracted for orthodontic or periodontal purpose; a standardized class V cavity measuring 2 mm length, and 1.5 mm depth on facial surface with carbide bur. 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 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 was carefully removed. Restorations in Group II, III and IV were covered with cocoa butter. All specimens were then stored in artificial saliva at 37°C in 100% relative humidity for 60 days. 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 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.

The readings were recorded and results were statistically evaluated. The results were then subjected to Student t test analysis.

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

Graph 2

DISCUSSION:
A wide range of materials is used in daily practices in dentistry to restore tooth structure. Dentists and patients choose a restorative material that has a priority under considerations of various factors.

The longevity of restorations is usually the most prior factor among them. It was estimated that the replacement of failed restorations constitutes about 60 percent of all operative works of dentists. Life expectancy of dental restorative materials have been reported in many clinical researches, but there have been discrepancies in the estimated values among the reports due to the differences in the study design, criteria for case selection, determination of success and failure, estimation of survival time, etc.

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.
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.

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 Tetric N- Ceram Bulk Fill 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.

REFERENCES: