

A COMPARATIVE STUDY OF FREQUENCY OF RETENTION OF FLOWABLE NANOCLUSTER COMPOSITE AND RESIN MODIFIED GLASS IONOMERS IN NON CARIOUS CERVICAL LESIONS IN MAXILLARY MOLARS

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ABSTRACT

Objective: To investigate and compare the retention rates of Flowable-Nanocluster-Composite and Resin-modified-Glass-Ionomers in non-carious cervical lesions in maxillary molars.

Study Design: Prospective cross-sectional comparative study.

Place and Duration of Study: Department of Operative Dentistry, Armed Forces Institute of Dentistry, Rawalpindi, from Jan 2017 to Dec 2018.

Methodology: Male patients ranging from 30-40 years with moderate non-carious cervical lesions of maxillary premolars and molars of either quadrant presenting to out-patient department were selected through convenience sampling. These lesions were restored with Flowable-Nanocluster-Composite and Resin-Modified-Glass-Ionomer. Retention of these two materials over the period of 6 months, 1 year and 2 years was noted. Chi square statistics were used to compare groups.

Results: The retention of Flowable-Nanocluster-Composite was 92% in 6 months, 85% in one year and 81% in two years. Whereas, for resin-modified-glass-ionomer restorations, the frequency of retention of the filling material was 97% at 6 months, 93% at one year and 89% at two years period. Out of the total 74 resin-modified-glass-ionomers restorations, 8 (11%) had dislodged by the end of the second year as compared to 14 (19%) dislodged restorations for Flowable-Nanocluster-Composite.

Conclusion: In conclusion, the study reveals that resin modified glass-ionomer has a superior retention rate over the period of two years as compared to Flowable-Nanocluster Composite. A dentist should have an insight into compositions of restorative materials for the longevity of their retention in various lesions.

Keywords: Flowable-nanocluster composite, Non-carious cervical lesions, Resin modified glass ionomer cements.

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INTRODUCTION

Non cervical carious lesions (NCCL) evolve as a result of physiologic or pathological damage and induce degradation of dental tissues¹. Etiology is mostly multifactorial contributed by mechanical and erosive processes. Tensile stresses from occlusal overloading or eccentric movements are unlikely causal factors. Its etiology remains poorly understood. The primary factor in NCCL was initially proposed as occlusion and masticatory forces and these defects were named as abfraction lesions. Regardless of many experiments to prove that biting forces are the main cause of these defects, it is wrong to identify a single

causative etiology of any form of NCCL as patient factors including mechanical (toothbrush/toothpaste) as well as erosive (acidic food and carbonated drinks) are also accountable for the various stages of tooth loss^{1,2}. NCCL are common clinical conditions. Prevalence varies from 5% to 85%³. The lesions are notably more frequent at elderly ages (<50%). The commonly encountered teeth are premolars^{2,3}.

The detection of NCCL plays an important role in the right treatment of these lesions. It requires taking a thorough patient history along with a meticulous physical examination. It is important to evaluate all potential causal factors. An in depth medical and dental history which should comprise of an assessment for systemic ailment for example gastro esophageal reflux,

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bulimia nervosa/anorexia nervosa, and dietary factors. One should also check for para functional habits, occlusion and oral hygiene routine. The combination of chemical, biological, and behavioral factors is critical. The identification of patient factors may help in diagnosis and help the dentist in the development of a suitable management outline for the particular patients¹.

The type and severity of the etiological factors involved causes the variation in the clinical appearance of NCCL. Various indices of such wear have been suggested for determining the development of abfraction or any type of NCCL. According to the index proposed by Smith and Knight, a scale from 0 to IV has been used, in which 0=no alteration in profile, I=minute loss of profile, II=1 mm depth of deformity, III=1 to 2 mm depth, and IV=2 mm of depth or display of secondary dentin or sometimes pulp¹.

The presenting complaints of patients seeking for a solution of NCCLs are dentine hypersensitivity, poor aesthetics, food stagnation and likelihood of pulpal exposure⁴. Treatment of NCCLs is challenging for dentists. Retention loss and marginal staining are the chief drawback of such fillings. Loss of retention of NCCLs can differ between 0-50%^{2,5}. Loss of retention mostly take place because of the hassel of adhesion of the restorative material to the tooth structure. A high value of sclerosis of dentine and a excessive amount of minerals in dentine can diminish the sufficient formation of a hybrid layer³. The sclerotic dentine has been physiologically and pathologically modified because of body's own immune system to the damaging affects of oral micro flora which makes it a difficult bonding substrate in which partial or total destruction of the dentinal tubules is commonly observed. Recent studies showed that when sclerotic dentine is etched with an acid, the sclerotic casts destructing the dentinal tubules and hyper mineralized dentine were still persistent resulting in negligible tag formation. The bonding capacity of the present time adhesives to the non-carious cervical lesions with sclerosed dentine was accounted to 20-45% lesser than those attached to self-made similarly

shaped cavities created in healthy tooth structure. This disparity is due to the thin hybrid layers in the former, and the complex structure of the resin-bonded interface^{6,7}.

An essential part for the success of restoration of NCCL should be the restorative material selection with all the favorable characteristics to resist the stresses. Stress bearing and mechanical properties of dental materials are thought to be the affecting factors for the long term accomplishment of NCCL restorations. Materials with more flexibility would be able to divert more comparable to tooth structure under stress diminishing failure of marginal soundness or the possibility of dislodgment of the filling material⁵. Number of tooth color materials is being used in restoration of NCCL. Self-cured glass ionomer cements (GIC) have been used in NCCLs for years. However, the conventional GICs are relatively unaesthetic with poor properties. To overcome the disadvantages of GIC, resin-modified GIC has been developed with light cure mechanism and upgraded properties for better results.

Due to the improved esthetics and adhesion, composites are also alternative material for restoration of NCCL. Shortcomings of composite restorations in cervical areas have been associated with stress generation on the tooth restoration interface due to polymerization shrinkage, and tensile stress caused by oblique occlusal loading causing debonding^{6,8}. Flowable composites with low viscosities provided excellent handling characteristics with syringe delivery system. Introduction of nanotechnology to flowable composite improved mechanical properties, wear resistance, strength, polish ability, excellent polish retention, translucency, elasticity, adaptation, and polymerization shrinkage by almost 20%^{7,9}. Fillers in the form has recently been introduced which is based on lightly sintering nanomeric oxides to form clusters of a controlled particle size distribution imparting good physical properties to composite restorations⁹.

The purpose of the study was to evaluate the frequency of retention of flowable nano

cluster composite and resin modified Glass ionomer in non-carious cervical lesion in maxillary molars that would help in decision making for selection of best choice for restorations when dealing with Class V Non carious cervical lesions.

METHODOLOGY

This study was conducted in Armed Forces Institute of Dentistry, Rawalpindi, from January 2017 to December 2018. The research was approved by the ethics committee of Armed Forces Institute of Dentistry under the IRB number 905/Trg-ABP1K2. 60 male patients with age ranging from 30 to 40 years were selected by convenience sampling from OPD of operative dentistry department in the first month of the research. Patients having moderate sized non carious cervical lesions (NCCL) in maxillary molars and premolars due to abrasion or erosion with dentinal hypersensitivity lasting for few seconds were included in the research. The patients with signs of irreversible pulpitis, pulpal necrosis and radiographic signs of peri-apical radiolucency were excluded from the study. Mentally and physically retarded patients were not included in the study. An informed consent was taken from the patients. The selected patients were then divided into two groups. The maxillary molars in patients in group labeled as "Group M" were restored using flowable nano cluster composite Filtek Z350 XT 3M ESPE Dental product manufactured in USA and maxillary molars patients in the second group labeled as "Group R" were restored with light cured resin modified Glass Ionomer (RMGI) with the trade name of Vitremer 3M ESPE manufactured in USA. The cavities were not prepared with any burs nor were any retentive grooves given. The NCCL lesions were cleaned with pumice and then etched with 37% phosphoric acid gel (medident Australia). The lesions were dried

with triple syringe and then Scotchbond universal adhesive 3M ESPE manufactured in USA was rubbed in for 20 seconds and the air dried for 5 seconds and light cured for 10 seconds. The flowable Filtek Z350XT was applied and cured for 20 seconds. The restoration was then finished with multiple fluted carbide burs (SS White company) and polished with Soflex Discs (3M ESPE). For the group R Vitremer (3M ESPE manufactured in USA) powder liquid was mixed with equal parts of powder and liquid in 30 seconds and then placed in the disposable vitremer cones with plungers for placement at the site of the NCCL lesions. The restorations are then cured for 40 seconds. The restorations are then polished with sofex discs. The data was recorded on the specially formulated form having the biodata of the patient along with the columns of evaluation of restoration at scheduled four visits of follow up. In the first visit the restoration were given to the patients. The second, third and fourth visit were planned after 6th month, 1 year and two years to evaluate the retention or dislodgement of the restoration. The patients in the first visit were also counseled of removal of the causative factors such as changing habit of aggressive tooth brushing and reducing the frequency of erosive food and drinks. The frequency of retention of restoration of the two groups after 2 years was compared and statistically analyzed using SPSS-21. The *p*-value for significance was evaluated by chi-square test.

RESULTS

Hundred percent of the participants were available for recall at 6 months, one year and two years. The data for retention of the tested materials for each period is summarized in table-I. The retention of flowable nano cluster composite (group M) was in 68 (92%) in 6 months, 63 (85%) in one year and 60 (81%) teeth in two years.

Table-I: Rate of retention of restorations.

Group	Follow up (6 Months)		Follow up (1 Year)		Follow up (2 Years)	
	Retained n (%)	Dislodged n (%)	Retained n (%)	Dislodged n (%)	Retained n (%)	Dislodged n (%)
Group M (n=74)	68 (92%)	06 (08%)	63 (85%)	11 (15%)	60 (81%)	14 (19%)
Group R (n=74)	72 (97%)	02 (03%)	69 (93%)	05 (7%)	66 (89%)	08 (11%)

Whereas, for RMGI restorations (group R), the frequency of retention of the filling material was in 72 (97%) at 6 months, 69 (93%) at one year and 66 (89%) teeth at two years tenure. Out of the total 74 RMGI restorations, 8 (11%) had dislodged by the end of the second year as compared to 14 (19%) dislodged restorations for flowable nano cluster composite with a statistical significance of ≤ 0.001 .

Table-II: Comparison of frequency of retention of restoration at 2 years.

S. No.	Retained n (%)	Dislodged n (%)	p-value
Group M (n=74)	60 (81%)	14 (19%)	≤ 0.001
Group R (n=74)	66 (89%)	08 (11%)	

DISCUSSION

Non carious cervical lesions are commonly received in the clinics during general dental practice which evidently increase in prevalence and severity with the increase in age and often present a restorative challenge for the practitioners^{10,11}. Temperature changes and occlusal load in the oral cavity, physical properties of the restorative material, water sorption, hydrolysis, and various stress patterns at the cervical margin of the tooth may cause failure of marginal adaptation of the restoration¹². Cervical areas are different from the crown and the root regions of the tooth anatomically as well as at a cellular level¹². NCCLs may have their margins in dentine, cementum or enamel and often at subgingival position in a moist surroundings, which in turn causes a part of the cavity to be out of reach or impossible to isolate¹³.

The conventional Glass Ionomer Cements are relatively unsightly and are inferior in mechanical properties than the composite resins. Resin-modified GIC with advanced resin components have been introduced to overcome various shortcomings of the conventional GIC, which have led to a greater resistance to early contamination by salivary contact, improved mechanical characteristics and identical fluoride release as compared to the prior one¹⁴. When compared to conventional paste-like composites, flowable composites

have low modulus of elasticity, which in turn gives the latter the ability to relief stresses at the adhesive interfaces and a stress-breaking effect in relieving thermal and occlusal stresses as well as polymerization shrinkage¹⁵. Filtek Z350 XT flowable has a filler load of 65% by weight and particle size of 0.6: 1.4 μm for better strength and physical properties¹⁶. The available data in the literature regarding the use of flowable composite in load bearing cavities is limited and does not present conclusive evidence and shows different experimental results because of impaired wear resistance of these restorations due to The reduced filler loading in early generations^{17,18}.

This study showed that the retention of Resin Modified Glass Ionomer restoration is higher than flowable nano cluster composites in non carious cervical lesions. Similar studies from other countries are being done. A study conducted in 2018 by Hussainy *et al* showed a similar result showing 100% and 87.9% retention of RMGI and 94.1 and 85.3% retention rate of flowable nano cluster composites in non caries cervical lesions over the time period of 6 months and one year respectively¹⁹. Similarly, A study from Nigeria conducted over a time period of one year showed great performance of RMGI with the retention rate of 91% in NCCL with 13 dislodged restorations out of 144.4. Our study showed a statistical significance of better retention of RMGI when compared with flowable nano cluster composite which is comparable to other studies done.

CONCLUSION

Within limitations of this study, it has been concluded that both materials are clinically acceptable for the restoration of NCCLs. However, RMGI demonstrated a superior retention rate over the period of two years. A restorative dentist should have a better understanding of the material being used in various lesions for better results in the longer run. More studies conducted over a longer period and with a higher number of samples are required to conclusively compare these restorative materials.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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