AN IN-VITRO STUDY OF SURFACE FINISHING OF GLASSIONOMER CEMENT

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ABSTRACT

The aim of this study was to evaluate the finishing efficacy of different finishing instruments on GC Fuji GIC-IXGP. The finishing instrument used were Mylar strip, super snap finishing disc, fine grit diamond finishing bur and cabide bur.

The results showed that the surface which was set against mylar strip and left undisturbed without resorting to any finishing, has the smoothest appearance and that any finishing procedure results in disruption of the surface smoothness of the glass ionomer restoration.

KEYWORDS

Efficacy, ANOVA, Esthetics.

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INTRODUCTION

Esthetics is the science of beauty and it plays a very important role on the emotional and psychological perspective of an individual's day to day activities. To meet the esthetic demand of patient, researchers and manufacturers are in a continuous endeavour in search for better restorative material.

The advent of adhesive dentistry has caused a dramatic change in the restorative procedures. The search for ideal restorative material for conservative dentistry has led to the improvement in materials and techniques in recent years. The invention of glass ionomer cement by Wilson and Kent in 1972.[1] has gone through several stages of improvement in materials. The Fuji IX GP is the reinforced typed of GIC, which has improved qualities such as having stronger physical and mechanical strength, is insoluble in saliva, has improved fluoride release, good radiopacity, satisfactory wear resistance and resistance to water attack.

The visual appearance of any restorative material depends upon the proper finishing and polishing, which makes the surface smooth. The irregularities present on the surface may result in unaesthetic appearance due to plaque accumulation and stains. Thus poor finishing procedures of the restoration establish rough or uneven surfaces, which invite microbial flora to flourish.

Therefore, a restored tooth should have an evenly smooth surface which should reflect light uniformly. Such a process of making the surface smooth so as to enable the surface to reflect light evenly is known as finishing and polishing.

A well-finished and polished surface promotes oral health, especially at the gingival margins by preventing the accumulation of food debris and pathogenic bacteria. Smooth surfaces are also easy to clean during the daily oral hygiene regime.

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The present study was undertaken to evaluate the surface topography of this new GIC with different finishing devices.

MATERIALS AND METHODS

Twenty-four non-carious, unrestored human maxillary first premolars, freshly extracted for orthodontic purpose were used for this study. Following extraction the collection, storage and handing to teeth was done as per the recommendation of Occupational Safety and Health Administration (OSHA) and the Centre for Disease Control and Prevention.

Class V cavities were prepared on the buccal surface of extracted premolar using round diamond bur for initial penetration followed by straights fissure bur to extend the cavity margins. Profilometer was used to measure the depth of cavity, i.e. 1.5mm in dentin so as to minimize variation.

After thorough washing the entire surface of cavity was conditioned using polyacrylic acid in 10% to 20% concentration. All the class V cavities were restored with glass ionomer cement as per the manufacturer's instructions. These samples were divided into 4 groups with 6 samples each and were subjected to finishing sequence accordingly.
Graphs No. 1–5 show the material needed for the experiment.

Distribution of Samples

All the samples in which the cavity was prepared and filled with the GC Fuji IX GP were divided into 4 groups. Each group consisted of six samples and were subjected to finishing sequences accordingly.

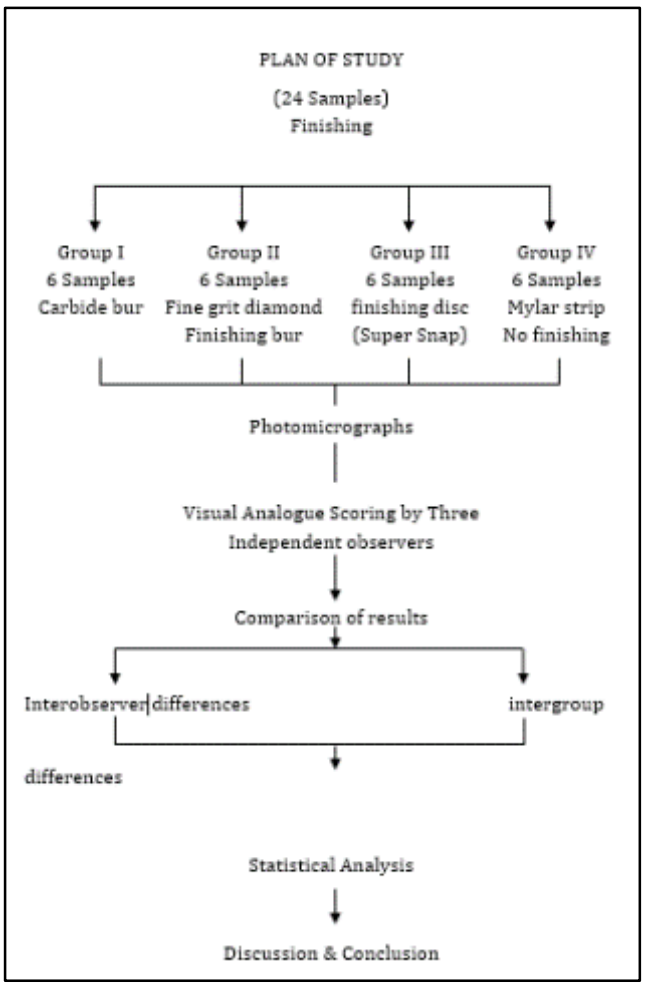
Group–I: The samples were finished with carbide finishing bur.

Group–II: Diamond finishing bur of fine girl was used to finish the samples in his group.

Group–III: Finishing of the sample in this group was done with finishing disc (Super Snap).

Group–IV: The samples of this group were left as such after restoring under Mylar strip.

After the finishing of the restoration was over the samples were studied by scanning electron microscopy. Representative photomicrographs of finished surfaces of the samples were taken and evaluated; and were subjected to statistical analysis.



RESULT

After finishing and polishing, samples were scanned as a whole with the help of SEM and photomicrograph of areas of interest taken at XI20 and X500 magnification. On the basis of the photomicrographs shown to the three independent observers. The Visual Analogue Scale (VAS) criteria were selected for assessing the surface smoothness of the glass ionomer restoration. Score 0 was given to roughest surface and score 5 was given to smoothest surface.

SEM photomicrographs of the samples restored using different finishing devices are shown in the Photographs 6, 7, 8, 9, 10, 11, 12 and 13.

Photograph 12, 13 showing the SEM photomicrograph of the sample restored under Mylar strip gives the best finish surface while Photograph 6, 7 showing the SEM photomicrograph of the sample finished with carbide bur gives the roughest surface.

The mean surface finish score for different finishing devices is shown in the Table 1.

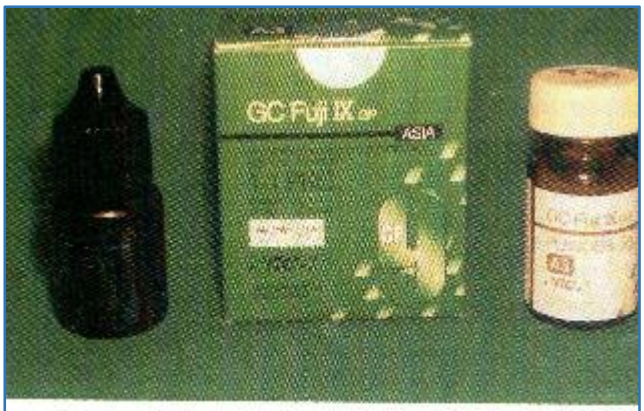
The Table – 1 shows the mean surface score was found to be maximum for the Group IV followed by the group III, group II and group I.

The Table – 2 shows the analysis of variance (ANOVA) of mean finish score among different groups under study. The findings reveal a statistically significant difference among the group.

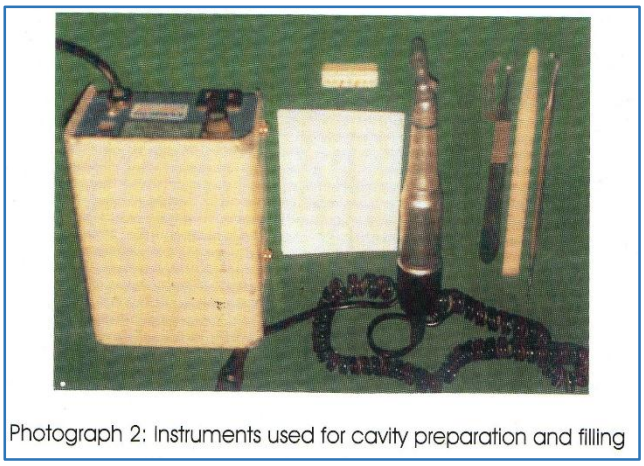
The Table – 3 shows the intergroup comparison of mean finish score. It reveals a statistically significant difference between group I and II, I and III, I and IV, II and III, II and IV and group III and IV.

On the basis of the results obtained the order of different finishing devices in respect of their relative finishing capacity is a follows:

Group IV > Group III> Group II> Group I

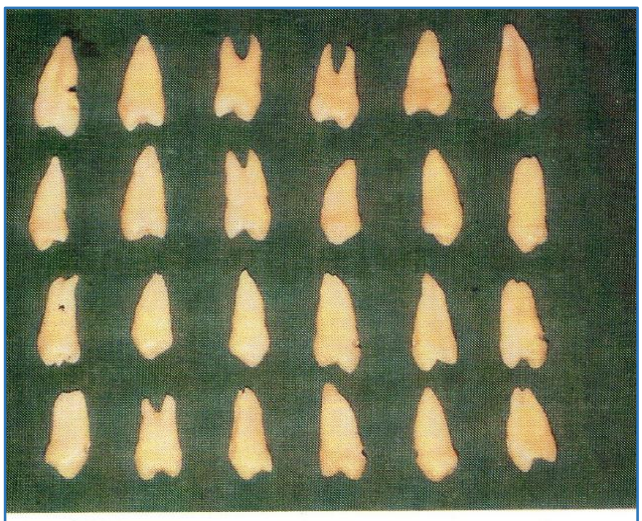


Photograph 1: Basic material used for restoration GC Fuji Glass Ionomer cement IX GP

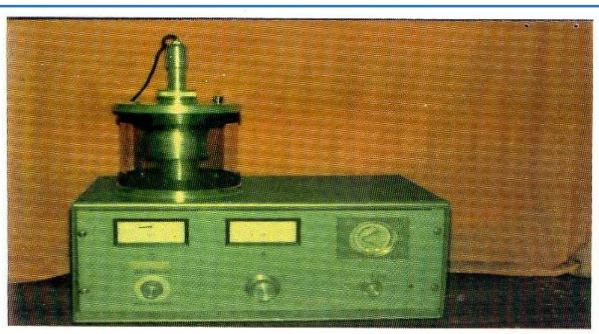


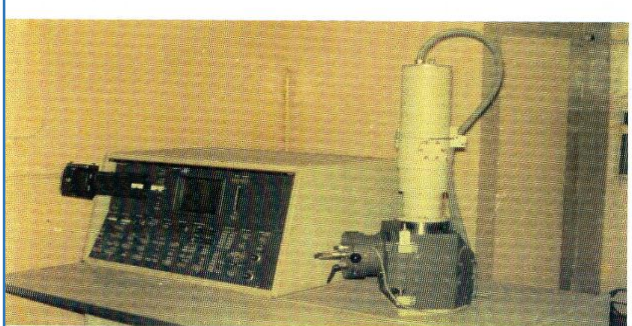
Photograph 2: Instruments used for cavity preparation and filling

Photograph 3: Material used for finishing

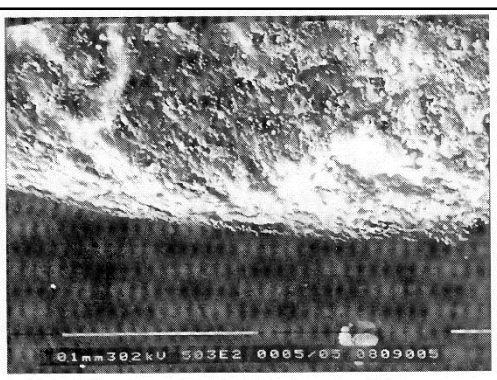


Photograph 4: Extracted human teeth used for the experiment.

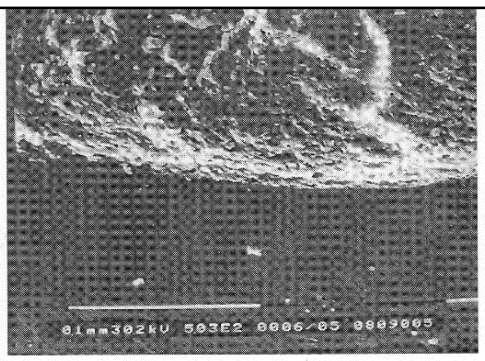




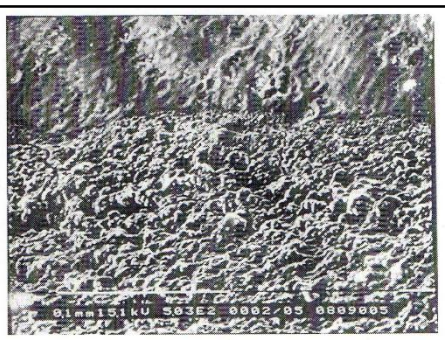
Photograph 5: Scanning Electron Microscope



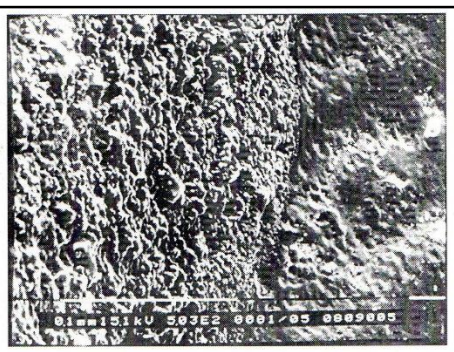
Photograph 6: SEM Photomicrograph of sample finished with the carbide bur
(X120-X500 magnification)



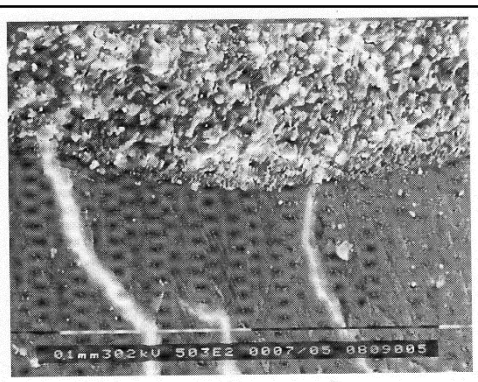
Photograph 7: SEM Photomicrograph of sample finished with the carbide bur
(X120-X500 magnification)



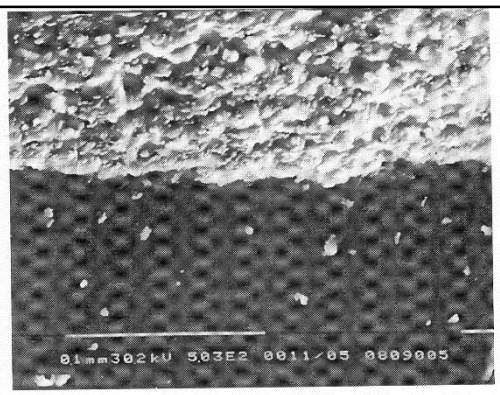
Photograph 8: SEM Photomicrograph of sample finished with the diamond bur of fine grit
(X120-X500 magnification)



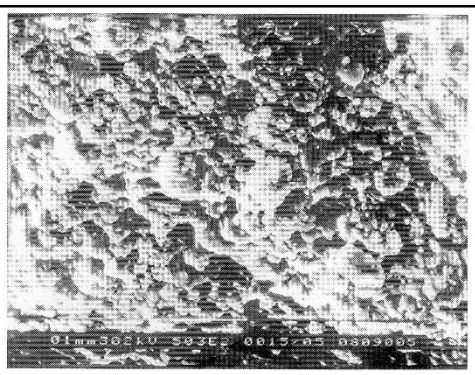
Photograph 9: SEM Photomicrograph of sample finished with the diamond bur of fine grit
(X120-X500 magnification)



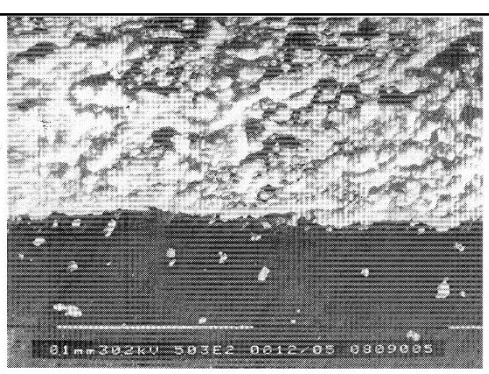
Photograph 10: SEM Photomicrograph of sample finished with finishing disc (Super Snap)
(X120-X500 magnification)



Photograph 11: SEM Photomicrograph of sample finished with finishing disc (Super Snap)
(X120-X500 magnification)



Photograph 12: SEM Photomicrograph of sample restored under mylar strip, no finishing was done
(X120-X500 magnification)



Photograph 13: SEM Photomicrograph of sample restored under mylar strip, no finishing was done
(X120-X500 magnification)

DISCUSSION

Finishing is an important part in the restoration procedure as it enhances both esthetic and longevity of the restored teeth. It refers to the gross contouring of the restoration to obtain the desired anatomy. The present study reports on the surface finishing of the glass ionomer cement restoration.

In spite of a wide variety of finishing and polishing devices namely carbide finishing bur, diamond finishing bur, stones, impregnated rubber, silicon disc, wheels, etc., a satisfactory result has not yet been produced on the final finish surface of the restorations. Each of these devices leave the surface of the restoration with varying degree of surface roughness. Many studies have been undertaken to evaluate the finishing and polishing of restorations, however, with conflicting results.

A set of four different types of finishing devices were used in the study for the finishing of the glass ionomer cement restoration. The effects of the different types of the finishing devices on the restoration surface were significantly different. A degree of surface smoothness was assessed using Visual Analogue Score (VAS) from the effects produced by the four different finishing devices on the glass ionomer cement restoration and the mean surface finish score was calculated for all the finishing devices.

The finished surface of the restoration produced by the carbide bur gave the roughest surface while the Mylar strip gave the smoothest finish surface. The carbide bur is a coarse abrasive, which cuts and forms rough pattern on the restoration surface. That is why the finish surface produced by the carbide bur produced the worst surface.

Our finding is in accordance with the results of the study undertaken by Bouvier D et al. (1971).[2] who compared the efficacy of three different finishing and polishing methods on composite, glass ionomer and compomer. The surface roughness of the samples were measured using the profilometer and the results showed that the carbide bur finishing produced the roughest finish surface.

The study indicated that the inserts finished by the carbide bur had more surface damage and edge fractures than those polishing with other instruments. This may have been caused by the cutting mode of the carbide bur, which is fluted. The diamond abrasive burs removed the glass ceramic more uniformly than the fluted burs.

The fine grit diamond finishing burs remove the glass ceramic more uniformly than the carbide bur. As a result, the fine grit diamond finishing bur produced better smooth finish surface than the carbide bur. Johnson LW et al. (1971).[3] have also concluded in their study that 12 fluted bur produced best surface while are diamond bur produced the worst surfaces. The diamond bur is considered the hardest which can abrade all materials. It is the most effective abrasive in use in dentistry. It forms find multiple scratches on the surface. As far as finish surface smoothness is concerned, the diamond bur is not recommended as the final finishing instrument.

Finishing disc produced slightly less smooth finish surface, which is in agreement with Pedrini et al. (2003).[3] and Johnson LN et al. (1971).[4] Our study is not in strict accordance with that of the study undertaken by Geiger SA. Ravchankayev M and Liberman R (1999).[5] In their study it was shown that Soflex discs manifest superior polishing effect on the resin modified glass ionomer as compared to the enhance system.

Statistical comparisons of the smoothness of finish surfaces of the glass ionomer restoration done by setting against Mylar strip versus the one finished by the finishing disc super snap show a significant difference between them. The finish surface obtained using the Mylar strip was found to be far better than that obtained by using the super snap.

Johnson LN et al. (1971).[3] also concluded in his study that the best finish surface was obtained by using a polyester matrix band. Any finishing procedure performed after the removal of the matrix resulted in gross disruption of the surface.

The result of the present study was that the best finish surface of glass ionomer cement restoration was produced by the Mylar strip has been similarly found in various studies undertaken by Paulilo, Caradaizzi, Loradino and Sara et al. (19997).[6] Pedrisi D. Cardido MS. Rodriguez AL et al. (1994).[6] Johnson LN et al. (1971)[4] and St. Germain HA Jr. Meier JC (1996).[7]

CONCLUSION

It is best to allow glass ionomer cement be set against the Mylar strip, left undisturbed without resorting to any finishing. The smoothest finish surface of glass ionomer restoration can

be produced in this way. Any finishing procedure results in disruption of the surface smoothness of the glass ionomer restoration. Among the finishing procedures, the finishing disc super snap produce the best result while the carbide bur produce the worst result.

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Sl. No.	Material	Mean Surface Finish Score	SD
1.	Group – I (Carbide Bur) (n=18)	1.72	0.46
2.	Group – II (Find grit diamond finishing bur) (n=18)	2.72	0.57
3.	Group – III [Finishing disc (Super Snap)] (n=18)	3.22	0.43
4.	Group – IV (Mylar Strip – No finishing)	3.72	0.46

Table 1: Mean Surface Finish Score for different finishing materials

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39.375	3	13.125	55.976	.000
Within Groups	15.944	68	.234		
Total	**55.319**	**71**			

Table 2: Analysis of Variance for Mean Finish Score

Comparison	't'	'p'
Group I vs II	5.760	<0.001
Group I vs III	10.120	<0.001
Group I vs IV	13.018	<0.001
Group II vs III	2.962	<0.001
Group II vs IV	5.760	<0.001
Group III vs IV	3.373	<0.002

Table 3: Intergroup Comparison of Mean Finish Score