WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 13, Issue 11, 1938-1944. Research Article ISSN 2277–7105

CLINICAL EVALUATION OF NANO HYBRID RESIN - BASED COMPOSITE AND TYPE II GLASS IONOMER CEMENT IN POSTERIOR RESTORATION – A 6 MONTH FOLLOW UP STUDY

***Dr. Sampurna Dutta Gupta**

India.

Article Received on
19 April 2024,

Revised on 09 May 2024,
Accepted on 29 May 2024

DOI: 10.20959/wjpr202411-32683

***Corresponding Author**
Dr. Sampurna Dutta Gupta
India.

ABSTRACT

AIM: The purpose of this study was to compare the 6 month clinical performances of nanohybrid composites in Class I and Class II and Class V restorations. and type II glass ionomer cement in Class I and Class V restorations.

OBJECTIVES

- To restore Class I, Class II and Class V restorations using nanohybrid composite resin.
- To restore Class I and Class V restorations using Type II GIC.
- To clinically compare 6 month performance of the materials under modified USPHS criteria.

INTRODUCTION

The desire for minimally invasive and esthetic restorations have made posterior composites an indispensable part of the restorative process.[1,2] A variety of dental composites that could be used in both anterior and posterior areas is available for clinical use, presenting a wide range of organic and inorganic components that may affect both their handling characteristics and clinical service. The introduction of well-dispersed inorganic particles into a resin matrix has been shown to be extremely effective for improving the performance of polymer composites.[1] The fillers used in dental resins directly affect their radiopacity, properties, wear resistance and elastic modulus.[2] In addition to traditional microhybrid and microfilled materials, nanofilled and nanohybrid composites were more recently introduced in an endeavor to provide a material presenting high initial polishing combined with superior polish and gloss retention.

Glass ionomer cement was developed by Wilson and Kent in the early 1970's. Originally, the cement was intended for aesthetic restoration of anterior teeth and it was recommended for use in restroring teeth with class III and class V cavity preparation. Because of its adhesive bond to tooth structure and its caries prevention potential, the types of glass ionomers have expanded to include their use as luting agent, orthodontic bracket adhesives, pit and fissure sealants, liners and bases, core buildups, and intermediate restorations.

A critical factor for the restorative success is the selection of the restorative materials.[6] Currently, the materials of choice include conventional glass ionomer cements (GICs), composite resins, and their combinations.

Inclusion Criteria

- For Glass ionomer cement restoration cervical carious and non carious lesions and pit and fissure caries of the occlusal and the buccal/labial surface was taken in to consideration.
- For nanohybrid composites, cervical carious and non carious lesions, pit and fissure caries of the occlusal and the buccal/ labial surface and proximal caries was taken into consideration.

Exclusion Criteria

- Any carious lesion involving pulp.
- Any iatrogenic error causing exposure of pulp.

MATERIALS

Material	Brand	Composition
A. Nanohyvbrid Composite resin	Herculite Precis (Kerr)nanohybrid composite material	7,7,9 -trimethyl-4,13-dioxo-3,14-dioxa-5,12-diazahexadecane-1,16-diyl bismethacrylate. 2,2bis butyl acrylate 3- trimethoxysilylpropyl methacrylate
B. Etchant	Gel Etchant (Kerr)	37.5% phosphoric acid , Cobalt
C. Bonding agent	Optibond S (Kerr)	Ethanol, 2-hydroxyethyl methacrylate, 2-hydroxy-1,3-propanediyl bis methacrylate
D. Flowable composite resin	Dyad flow (Kerr)	glycerophosphoric acid dimethacrylate (GPDM) adhesive Monomer and fillers.
E. Type II Glass Ionomer Cement	GC Gold Label 2 (GC)	Powder :Fluoro Alumino silicate glass, Polyacrylic acid powder Liquid: Distilled water , Polyacrylic acid

METHODOLOGY

Patients participating in the study were divided into following groups:

- GROUP I : Nanohybrid Composite resin.
- GROUP II : Type II Glass Ionomer Cement.

All teeth were treated by a single operator Cavity preparation was limited to removal of carious enamel and dentin. For Class II restorations, metal matrix bands (Toefflemire or Ivory no.1 or saddle matrix) was used along with wooden wedges. Saliva isolation was accomplished by Rubber dam or cotton rolls (in non-compliant patients) and saliva ejectors.

I. Nanohybrid Composite Resin Restoration

Institutional Ethical Committee clearance was obtained. Informed consent was taken from the participating patients. Isolation was obtained using Rubber dam or cotton rolls and saliva ejectors. Shade selection was done using vita classical shade guide Using high-speed handpiece, round bur (no 220) and ample water-cooling the carious enamel and dentin was removed. 37% phosphoric acid (Etching Gel, Kerr, USA) was applied on the surface to be restored for 15 seconds. Bonding agent (Opti Bond S, Kerr, USA) was applied and polymerized for 20 seconds with a LED light generator (Demi Led Light Curing System, Kerr, USA). The cavity was restored by horizontal layering technique and curing was done for 30 seconds. Finishing of the restoration was done using carbide finishing burs. Polishing was accomplished using composite polishing kit (Shofu) and aluminium oxide paste after 24 hours.

II. Glass Ionomer Cement Restoration

Isolation was obtained using Rubber dam or cotton rolls and saliva ejectors. Using high-speed handpiece, round bur (no 220) and ample water-cooling the carious enamel and dentin was removed. All the cavities were conditioned with 10% polyacrylic acid. GIC was manually mixed according to the manufacturer's recommendations. After placement of the material, the excess was burnished against the cavity margins and the contour was roughly modelled. A layer of petroleum jelly was applied on the restoration and finishing and polishing was done after 24 hours.

Score	Alpha	Bravo	Charlie	Delta
Tooth color stability	No change	Change of color compared to the 2-week follow-up (up to 4 shades)	Change of color compared to the 2-week follow-up (up to 8 shades)	Change of color compared to the 2-week follow-up (more than 8 shades)
Surface texture	Sound	Rough		
Anatomical form	Sound	Slight loss of material (chipping, clefts), superficial	Strong loss of material (chipping, clefts), profound	Total or partial loss of the buld
Marginal integrity (enamel)	Sound	Positive step, removable by finishing	Slight negative step not removable, localized	Strong negative step in major parts of the margin, not removable
Marginal discoloration (enamel)	None	Slight discoloration, removable by finishing	Discoloration, localized not removable	Strong discoloration in major parts of the margin not removable
Secondary caries	None	Caries present		
Gingival inflammation	None	Slight	Moderate	Severe
Restoration color stability	No change	Change of color compared to baseline condition		

The restored teeth were evaluated under the Modified USPHS clinical criteria

RESULTS

- All 20 restorations (15 patients) were assessed clinically for color match, marginal discoloration, anatomic form, marginal adaptation, postoperative sensitivity, and secondary caries using the USPHS modified criteria at baseline and at the end of 6 months.
- The data collected was tabulated and statistically analyzed. The statistical test used for the study was the Chi-squared (χ^2) test. *P* value of 0.05 or less was considered for statistical significance.

Comparison of color match scores between the two materials

TIME INTERVAL	GRADE	COMPOSITE	GIC	TOTAL	X^2	P VALUE
Baseline	Alpha	10	5	15	51.515	<0.001
	Bravo		5	5		
6 months	Alpha	8	5	13	32.667	<0.001
	Bravo	2	5	7		

Comparison of marginal discoloration scores between the two materials

TIME INTERVAL	GRADE	COMPOSITE	GIC	TOTAL	X^2	P VALUE
Baseline	Alpha	10	10	20		
	Bravo					
6 months	Alpha	9	5	14	21.418	<0.001
	Bravo	1	5	6		

Comparison of anatomic form scores between the two materials

TIME INTERVAL	GRADE	COMPOSITE	GIC	TOTAL	X^2	P VALUE
Baseline	Alpha	10	10	20		
	Bravo					
6 months	Alpha	9	8	17	3.840	0.050
	Bravo	1	2	3		

Comparison of marginal adaptation scores between the two materials

TIME INTERVAL	GRADE	COMPOSITE	GIC	TOTAL	X^2	P VALUE
Baseline	Alpha	10	10	20		
	Bravo					
6 months	Alpha	9	6	15	11.020	0.001
	Bravo	1	4	5		

Comparison of postoperative sensitivity scores between the two materials

TIME INTERVAL	GRADE	COMPOSITE	GIC	TOTAL	X^2	P VALUE
Baseline	Alpha	9	9	18	0.000	1.000
	Bravo	1	1	1		
6 months	Alpha	10	9	19	0.990	0.320
	Bravo	0	1	1		

Comparison of recurrent/secondary caries scores between the two materials

TIME INTERVAL	GRADE	COMPOSITE	GIC	TOTAL	X^2	P VALUE
Baseline	Alpha	10	10	20		
	Bravo					
6 months	Alpha	9	8	17	0.344	0.558
	Bravo	1	2	3		

DISCUSSION

- In this study, the clinical success of Type II GIC and direct resin composite restorations was evaluated for 6 months.[2]
- The type of direct restoration material affects the clinical performance and longevity. Restorations of the small sized cavities present excellent clinical results due to less amount of material used, reduced cavity margins, easier control of the oral conditions and less chair side time spent.
- The present study used the USPHS criteria for clinical evaluation of the restorations. This system was developed by Cvar and Ryge in 1971 and has been used extensively for clinical evaluation of restorations.[3]
- **Colormatch:** The present study showed a higher percentage of cases in the type II GIC group with mismatch due to an increase in the opacity making the restoration too light. This could be due to the size of glass particles present in the powder.[4]
- **Marginaldiscoloration:** The cavosurface marginal discoloration may be considered as a sign of microleakage, which occurs between the tooth and glass ionomer due to dissolution of smear layer.
- **Anatomicalform:** The main reason for loss of anatomic form is wear. Glass particles are typically large and dense. Under heavy occlusal forces, large surface defects as well as loss of material can occur. In contrast, the nano nybrid composite resin have better wear surfaces have smaller defects and better gloss retention.[5]
- **Marginaladaptation:** The failure in the marginal adaptation of GIC might be the result of sensitivity of GICs to humidity in the early period, which increases the solubility of the cements.
- **Postoperativesensitivity:** The postoperative sensitivity develops because of leakage pathways between the cavity walls and the restoration, resulting in secondary caries. This causes postoperative problemssuch as hypersensitivity and pulpal injury.[6] The present study did not show any significant difference between the two materials with respect to postoperative sensitivity.
- Secondary caries According to modified USPHS criteria, the restoration with secondary caries has to be considered as failure and has to be replaced.[7,8,9] The present study showed that Nanohybrid composite resin was significantly better than Type II GIC over a period of 6 months. However a long-term follow-up of the study is needed.

CONCLUSION

The present study was conducted as a large number of new improved resin as well as glass ionomer cement brands are being released to the market, it is important for dentists to be aware of the probable longevity and likely modes of failure of these materials.

REFERENCES

1. Brunthaler A, König F, Lucas T, Sperr W, Schedle A. Longevity of direct resin composite restorations in posterior teeth. Clin Oral Investig, 2003; 7: 63-70.
2. Manhart J, Neuerer P, Scheibenbogen Fuchsbrunner A, Hickel R. Threeyear clinical evaluation of direct and indirect composite restorations in posterior teeth. J Prosthet Dent., 2000; 84: 289-96.
3. Statement on posterior resin-based composites. ADA Council on Scientific Affairs; ADA Council on Dental Benefit Programs. J Am Dent Assoc., 1998; 129: 1627-8.
4. Opdam NJ, Feilzer AJ, Roeters JJ, Smale I. Class I occlusal composite resin restorations: *In vivo post -operative sensitivity, wall adaptation,* and microleakage. Am J Dent., 1998; 11: 229-34.
5. Van Dijken JW. A 6-year prospective evaluation of a one-step HEMA-free self-etching adhesive in Class II restorations. Dent Mater, 2013; 29: 1116-22.
6. Manhart J, Chen H, Hamm G, Hickel R. Buonocore memorial lecture. Review of the clinical survival of direct and indirect restorations in posterior teeth of the permanent dentition. Oper Dent., 2004; 29: 481-508.
7. Van Dijken JW, Pallesen U. Randomized 3-year clinical evaluation of Class I and II posterior resin restorations placed with a bulk-fill resin composite and a one-step self-etching adhesive. J Adhes Dent., 2015; 17: 81-8.
8. ADA Council on Scientific Affairs. Direct and indirect restorative materials. J Am Dent Assoc., 2003; 134: 463-72.
9. Opdam NJ, Bronkhorst EM, Roeters JM, Loomans BA. A retrospective clinical study on longevity of posterior composite and amalgam restorations. Dent Mater, 2007; 23: 2-8.