

Comparative Assessment of Conventional Composites and Coloured Compomers in Permanent Molars of Children with Mixed Dentition: A Pilot Study

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ABSTRACT

Introduction: Early treatment of carious lesions in children is important for the maintenance of oral health. Multicoloured restorations could be the impetus for an extremely nervous or defiant child to take dental treatment.

Aim: The aim of this study was to assess and compare the clinical success of conventional composites and coloured compomer material in first permanent molars of children with mixed dentition.

Materials and Methods: A total of sixty sites, divided into two groups, with thirty subjects in each group using split mouth design were chosen amongst patients reporting to Department of Pedodontics and Preventive Dentistry. In control group conventional composites were placed, similarly coloured

compomers were placed in experimental group under standard operating protocol. Patients were recalled for assessment of clinical success amongst control as well as experimental group at regular intervals of one; three and six months follow up based on Modified Ryge's Criteria. Statistical analysis was done using Chi-square test using SPSS version 20.0 (Chicago, USA).

Results: Both conventional composites and coloured compomers had comparable retention rates in terms of anatomical form, marginal integrity, secondary caries and marginal discoloration.

Conclusion: The coloured compomer material showed promising results in this six month follow up study in permanent molars and had properties comparable to that of conventional composites.

Keywords: Clinical success, Marginal integrity, Twinky star

INTRODUCTION

With globalisation on the rise, there is an ever increasing rate of caries seen in children. Oral health is integral to general health and essential for well-being. Dental caries are most common among the spectrum of oral diseases and are still a major public health burden in developing countries, affecting 60%-90% of school children and a number of adults [1]. This could be attributed to poor oral care compliance, fear of dental treatment and difficulty in motivating children of this age group to receive any dental treatment. One way of rousing them is to use restorative material of their choice. Some children like fancy tooth coloured, indiscernible dental restorations, while others enjoy a vibrant restorative material for their teeth [2]. When it comes to providing an enticement to those children who are nervous and who simply refuse treatment, the deciding factor can be the rainbow restorations [3].

Composites being the pioneer materials for permanent teeth, more new materials have come to the limelight which could be used in permanent teeth. A new generation of glass ionomer, now available are called compomers, which are resin reinforced glass-ionomer cements. The filler content of the coloured compomers is comparable to the conventional composites and are available in gold, silver, blue, green, red, pink, berry, lemon and orange shades with glitter particles [4,5].

There have been no previous studies in India to compare conventional composites and coloured compomers on first permanent molars. The aim of the present study was to compare and assess the six month clinical success of conventional composites and coloured compomers in first permanent molars of children aged six to twelve years. The null hypothesis tested was that there is no difference between the clinical success of conventional composites and

coloured compomers when used in permanent first molars of children aged six to twelve years tested over six month evaluation. The alternate hypothesis states that there was a difference between the clinical success of conventional composites and coloured compomers when used in permanent first molars of children aged six to twelve years tested over six month evaluation.

MATERIALS AND METHODS

An in vivo study was conducted at the Department of Pedodontics and Preventive Dentistry for a duration of six months. A total of 30 healthy subjects between six to twelve years were identified by clinical and radiographic examination for having at least two permanent molars with detected caries for class one restorations. Hence sixty sites, divided into two groups, with thirty samples in each were selected from those reporting to the outpatient department of the Department of Pedodontics and Preventive Dentistry of the institute. The purpose and clinical procedures of the study were explained and a signed informed consent was obtained from the children's parents. The Institutional Ethical Committee in Human Research approved the study.

Selection of the subjects: Children with first dental visit, having mixed dentition (6-12-year-old), with maxillary or mandibular first permanent molars with occlusal caries involving enamel or dentin (Indicated for Type A and Type B Preventive Resin Restoration). Patients with high risk of caries (having more than four carious lesions), proximal caries in the selected teeth, patients undergoing orthodontic treatment, who had any systemic diseases, and with special health care needs were excluded from the study.

Where the confidence level was 0.70, the probability was 0.05. Thus the sample size derived was 23.5. Considering the dropout, the sample size chosen was 30 [6].

The estimated sample size (n=60) was further divided into two groups of thirty each. Using split mouth design technique sixty restorations were placed - thirty conventional composite restorations (3M ESPE, St. Paul, Minn., USA) as control group (Group A) and thirty coloured compomer restorations (Twinky Star, Voco, Cuxhaven, Germany) as experimental group (Group B) in the selected patients.

Clinical Procedure: Children fulfilling the inclusion criteria were selected for the procedure and by using lottery method, they were allotted to the control and experimental group. After comfortably seating them on the dental chair, the procedure was completely explained to the parents as well as the children by the principal operator. Selected teeth were isolated using rubber dam and fluoride free pumice prophylaxis was done on the concerned tooth. The tooth preparation was carried out to receive the restorations using high speed round diamond points according to the principles of minimum invasive dentistry under standard operating protocol. A self-etching bonding system (Futurabond NR, Voco) was used according to the manufacturer's instructions in both the groups. Restorations were placed according to the manufacturer's instructions in horizontal layers not exceeding a thickness of 2 mm to allow proper polymerisation of the material; each layer was polymerised for 40 seconds in both the groups. Occlusion was evaluated with an articulating paper. The restorations were polished using diamond finishing burs and discs (3M ESPE, St. Paul, Minn., USA). The baseline or immediate evaluation of all the restorations was done by an experienced examiner (Paediatric dentist) in the Department of Pedodontics and Preventive Dentistry.

Anatomic form	
1.	Restoration is continuous with the existing anatomic form.
2.	Restoration is discontinuous with the existing anatomic form but missing material is not sufficient to expose dentin.
3.	Sufficient material missing to expose dentin.
Marginal integrity	
1.	Explorer does not catch or / and no crevice is visible.
2.	Explorer catches and crevice is visible but no exposure of dentin or base and restoration is not mobile.
3.	Explorer penetrates crevice, defect extends to dentino enamel junction.
4.	Restoration is fractured, mobile or missing, either in part or in toto.
Marginal discolouration	
1.	No visual evidence of marginal discolouration.
2.	Marginal discolouration has not yet penetrated in pulpal direction.
3.	Marginal discolouration has penetrated in pulpal direction.
Recurrent caries	
1.	No caries present.
2.	Caries present associated with the restoration.
[Table/Fig-1]: US public health service Modified Ryge Criteria [7].	

Follow up period: The participants were recalled for the follow up at one, three and six months interval and a single experienced examiner (Paediatric dentist) who was trained to examine using the US Public Health Service Modified Ryge's Criteria [Table/Fig-1], assessed the restorations under normal clinical conditions with a dental operating light, a mouth mirror and a dental explorer. Score 1 indicated a clinically ideal situation; Score 2 (apart from caries) indicated a clinically acceptable situation; Score 3 indicated a clinically unacceptable situation, which usually required replacement of the restoration, and Score 4 indicated a clinically unacceptable situation because of fracture, mobility or loss of the restoration, which made it necessary to replace it [7].

The data was entered into a standardised format and analysed statistically using Chi-square test using SPSS version 20.0 (Chicago, USA).

RESULTS

A total of 60 restorations were evaluated at six month recall. Statistical analysis revealed no statistical differences in the first month in both Group A (control group) and Group B (experimental group) regarding marginal integrity, anatomic form, secondary caries and marginal discolouration [Table/Fig-2].

After three months, only two restorations (6.7%) showed a Score 2 in Group B for anatomic form; 6.7% showed secondary caries in Group A and 23.3% showed marginal discolouration in group B. When both the groups were compared all the parameters showed clinically insignificant difference except for marginal discolouration which was highly significant. (p=0.005) [Table/Fig-3].

After six months, there was a 13.3% change in marginal integrity for Group A and 10% change in Group B. A 6.7% change in anatomic form was observed in Group A and 13.3% in Group B. On evaluation only Group A showed 10.0% incidence of secondary caries while Group B showed no secondary caries. A 36.6% of marginal discolouration was observed in Group B with no change in Group A. When both the groups were compared for all the parameters there was clinically insignificant difference found except for marginal discolouration (p=0.015) [Table/Fig-4].

DISCUSSION

In the recent years there has been an increasing demand of tooth coloured materials such as glass ionomer, polyacid modified resin composites and resin composites. Composite resin is the universally used tooth coloured direct restorative material. It is because of their properties (aesthetics, and advantages of adhesive technology)

Criteria		Group A				Group B				Chi-square test
		Score				Score				
		1	2	3	4	1	2	3	4	
Marginal Integrity	Subject count	30	-	-	-	30	-	-	-	No statistical difference
	Percentage within the groups	100%	-	-	-	100%	-	-	-	
	Total Subjects	30				30				
Anatomic Form	Subject count	30	-	-	-	30	-	-	-	No statistical difference
	Percentage within the groups	100%	-	-	-	100%	-	-	-	
	Total Subjects	30				30				
Secondary Caries	Subject count	30	-	-	-	30	-	-	-	No statistical difference
	Percentage within the groups	100%	-	-	-	100%	-	-	-	
	Total Subjects	30				30				
Marginal Discolouration	Subject count	30	-	-	-	30	-	-	-	No statistical difference
	Percentage within the groups	100%	-	-	-	100%	-	-	-	
	Total Subjects	30				30				

[Table/Fig-2]: Showing clinical success for conventional composite material in control group (Group A) and coloured compomer in experimental group (Group B) at one month interval.

Criteria		Group A				Group B				Chi-square test
		Score				Score				
		1	2	3	4	1	2	3	4	
Marginal Integrity	Subject count	30	-	-	-	30	-	-	-	No statistical difference
	Percentage within the groups	100%	-	-	-	100%	-	-	-	
	Total Subjects	30				30				
Anatomic Form	Subject count	30	-	-	-	28	2	-	-	p = 0.150 $\chi^2 = 2.069$ df = 1
	Percentage within the groups	100%	-	-	-	93.3%	6.7%	-	-	
	Total Subjects	30				30				
Secondary Caries	Subject count	28	2	-	-	30	-	-	-	p = 0.150 $\chi^2 = 2.069$ df = 1
	Percentage within the groups	93.3%	6.7%	-	-	100%	-	-	-	
	Total Subjects	30				30				
Marginal Discolouration	Subject count	30	-	-	-	23	7	-	-	p = 0.005 $\chi^2 = 7.925$ df = 1
	Percentage within the groups	100%	-	-	-	76.7%	23.3%	-	-	
	Total Subjects	30				30				

[Table/Fig-3]: Showing clinical success for conventional composite material in control group (Group A) and coloured compomer in experimental group (Group B) at three month interval.

Criteria		Group A				Group B				Chi-square test
		Score				Score				
		1	2	3	4	1	2	3	4	
Marginal Integrity	Subject count	26	4	-	-	27	3	-	-	p = 0.688 $\chi^2 = 0.162$ df = 1
	Percentage within the groups	86.7%	13.3%	-	-	90.0%	10.0%	-	-	
	Total Subjects	30				30				
Anatomic Form	Subject count	28	2	-	-	26	4	-	-	p = 0.389 $\chi^2 = 0.741$ df = 1
	Percentage within the groups	93.3%	6.7%	-	-	86.7%	13.3%	-	-	
	Total Subjects	30				30				
Secondary Caries	Subject count	27	3	-	-	30	-	-	-	p = 0.675 $\chi^2 = 0.756$ df = 1
	Percentage within the groups	90.0%	10.0%	-	-	100%	-	-	-	
	Total Subjects	30				30				
Marginal Discolouration	Subject count	30	-	-	-	19	11	-	-	p = 0.015 $\chi^2 = 5.963$ df = 1
	Percentage within the groups	100%	-	-	-	63.3%	36.6%	-	-	
	Total Subjects	30				30				

[Table/Fig-4]: Showing clinical success for conventional composite material in control group (Group A) and coloured compomer in experimental group (Group B) at six month interval.

composites have taken over the place that was occupied by amalgam [8]. Polymerisation shrinkage of composite resin is one of the most important limitation, which is because of the volumetric contraction, which further leads to stresses in bonded restorations subsequently resulting in distortion of the cusps, thus producing enamel microcracks, reduction of marginal adaptation, as well as postoperative sensitivity [9].

Compomers are composed of glass ionomer cement and visible light polymerised-resin component. They combine the mechanical and aesthetic properties of composites with the fluoride releasing advantages of glass ionomers [10]. They are widely accepted because of their low thermal conductivity, preservation of dental structure in cavity preparation, stability of their composition, fluoride release, and because of the increasing demand from parents to provide aesthetic restorations for their children [11]. The present study was undertaken to assess the clinical success of the coloured compomer with that of the conventional composite in class I restorations of permanent molar teeth as there was no evidence of this material being used in the permanent dentition. One adhesive system was used with both the materials to eliminate the effect of the adhesive system. The split-mouth design followed in this study helped to overcome the patient bias and to compare efficiency of the two materials under the similar oral conditions.

The results of the present study showed that the clinical success of both restorative materials when measured on the basis of

marginal integrity, marginal discolouration, anatomic form, and secondary caries was acceptable. The statistical analysis revealed no significant differences among the groups at all recalls regarding marginal integrity, anatomic form, secondary caries except for marginal discolouration ($p=0.015$).

Clinical studies have shown that commercially available compomers have high clinical success rates which are comparable to amalgam, and this makes them a suitable alternative to amalgam for restoring primary teeth in children [12-14].

In a scientific report (Twinky Star – 3 Year Clinical Study) [15], it was concluded that it exhibited the properties of an effective restoration with respect to stability and longevity after three years. Although minimum invasive protocols were followed in the present study, higher clinical success could be attributed to proper isolation techniques using rubber dam followed by correct clinical protocol.

The marginal integrity in our study for coloured compomer was acceptable and it was in accordance to the study by Ertugrul F et al., where the clinical success of Twinky star was found to be 93% [11].

Although, examination of the margins showed discolouration with loss of glitter particles there was no incidence of secondary caries. The absenteeism of secondary caries is in accordance with the findings of Peters T et al., who reported only 1% recurrent caries incidence after one year [16]. The non-appearance of secondary

caries at the occlusal margins may be related to the lack of marginal gaps. However, Papagiannoulis L et al., reported a 6% of secondary caries rate in Dyract restorations [17]. The compomer material tested in our study showed no secondary caries as compared with amalgams (9%), cermet cements (9%), conventional glass ionomers (4%) and resin composites (6%) tested in other studies [18,19]. This study has presented that coloured compomer (Twinky Star) could be used as a substitute to tooth coloured compomers because of its high clinical success after six months of evaluation. It has been reported that young patients who are allowed to choose the colour of their restorations are more likely to accept the idea of treatment. The accomplishment of the treatment is aided even further by the dentist's justification to the child that the fillings will continue to look good as long as the patient maintains them well [5]. The limitation of this study was that a small sample size with a shorter follow up interval was targeted.

CONCLUSION

The coloured compomer material showed promising results in this six month follow up study of class I restorations in permanent molars and has properties comparable to that of conventional composites. Also, allowing the child to decide the colour of the filling makes them to participate in the treatment process and helps to reduce the anxiety of the child. Thus, multicoloured restorations do act as a motivational tool for oral hygiene and behavioural management for future visits. Future research is needed for long term durability of these restorations and more clinical data is required regarding parental satisfaction with such restorations. Thus, coloured compomer can definitely be used as an alternative material for restorative purposes in permanent teeth because of its high clinical success rate.

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