



Evaluation of the Outcome of Modified Open Sandwich Technique and Conventional Composite Resin Restoration: For Managing Class II Cavity of Primary Molars Among 4- 8 years Old Children

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Abstract

Background: Dental caries is the most prevalent disease in humans, especially during early childhood. The restoration of such an extensive carious lesion should be done properly to reestablish their anatomy and hence their masticatory, phonetic, esthetic, and space-maintainer functions in the dental arches. Composite resins are the most commonly used tooth-colored restorative material, but many difficulties occur particularly when used directly in posterior restorations. The objective of the study was to compare the clinical effectiveness of the Modified Open Sandwich Technique and Conventional Composite Resin Restoration for managing class II caries on primary molars. **Material & Methods:** This was a randomized control trial and was conducted in the Department of Pedodontics, Faculty of Dentistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh during the period from October, 2021 to September, 2022. In our study we included 68 patients with proximal dental caries of primary molars with reversible pulpitis. The patients were divided by using random sampling technique into two groups - Group A (The modified open sandwich technique, n=34) and Group B (The conventional composite resin restoration, n=34). **Results:** In total 68 patients from both the groups completed the study. In our study we found mean±SD of age was 5.37±1.24 years. 76.5% of cases of the modified open sandwich technique restorations were & 82.4% of the conventional composite resin restoration were < 6 years. Mandibular primary molars were 64.7% and 53% for the modified open sandwich technique and conventional composite resin restoration respectively. Conventional composite resin restorations showed 32.4% postoperative sensitivity and the modified open sandwich technique restorations showed 11.8%. After 12 months of follow-up, no secondary caries developed. Good marginal adaptation in 100% of cases were found in the modified open sandwich technique and 88.2% for conventional composite restorations. **Conclusion:** In our study we found that postoperative sensitivity developed more in conventional composite restorations in comparison to the modified open sandwich technique. Initially marginal adaptation showed better in the modified open sandwich method technique. So, conventional and modified open sandwich composite resin techniques were acceptable for primary molar teeth considering secondary caries and marginal adaptation.



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INTRODUCTION

Dental caries is the most widespread disease in humans, notably during early childhood. The rehabilitation of such an extended and the boundless carious wound should be done accurately to reestablish their anatomy, the masticatory, phonetic, esthetic, and space-maintainer functions in the dental arches. In addition, besides dental carries, the consequences of premature loss of primary teeth are well known. For instance, damage occlusion, mouth breathing habits, and tongue thrusting can be the sources of future malocclusion. Therefore, good reconstruction of these teeth, along with improving esthetics and managing space and function, has always been a challenge for pediatric dentists. As a result, an ever-increasing demand for esthetics has led dentists to the innovative modification and development of the latest and different kinds of treatment modalities for these problems.^[1] Class II-Cavities are usually seen in the proximal exteriors of molars and premolars.^[2] As suitable glass ionomers are designated for therapeutic indications, luting, sealants, and a base or liner. In the year 1977, McClean first prescribed composite resins with glass ionomer cement lining.^[3] In like manner, the glass ionomer would be allocated to the dental-enamel junction, and more is, the composite resin placed over it illustrated by the fact that this technique employs the glass ionomer as a dentine replacement. Besides, the composite

resin restorative is installed. When early composite resins did not have optimal physical properties to use in restoring posterior teeth, notable advances in resin technology were made in the early 1980s, making the dentin/enamel adhesive the weak link in a resin reconstruction.^[4] In this case, McClean suggested a helpful technique that is, glass ionomers could bond to and also seal dentin. Moreover, it could represent a reasonable way of restoring the following teeth with composite resin. McClean, in 1985, showed that composite resin could be bonded toward acid-treated glass ionomer.^[5] Notably, this so-called "sandwich" of glass ionomer posterior teeth with resin-based restorations indeed by several clinicians as a means for pulpal protection from the acid-etch technique as well as a mechanism for sealing the cavity in the absence of good dentin adhesion available with the materials of the time. In the case of this clinical situation, a part of the reconstruction would have a dentin-only margin, such as a deep class II or a class V on a root surface, where the glass ionomer would be placed to cover the dentin and become the outer material at the dentin margin. This was termed an open sandwich.^[4,6] In recent years, the demand for aesthetics coupled with concerns about potential mercury toxicity and its effect on the environment has been growing. Although not supported by the foremost healthcare organizations, these concerns the American Dental Association, United States Department of Health and Human Services,

FDI, etc. This matter led to the development of dental rehabilitation methods and alternative restorative materials, including composites, glass ionomer types of cement (GICs), resin-modified glass ionomer cement (RMGICs), and compomers. Therefore, the usage of direct placement of resin composite fillings is increasing, illustrated by the fact that good durability has been reported when placed in smaller cavities and under ideal conditions.^[7,8] Some of the clinical obstacles connected to resin composite are related to polymerization shrinkage, which can result in a lack of adaptation to the cavity wall and likewise, increased susceptibility to caries.^[9] Additionally, the RMGIC holds the same component as conventional GICs, yet has resin materials added to provide a matter of strengthening and the possibility of 'command cure' with light-initiated curing of the resin composite component. Therefore, RMGICs offer several advantages over traditional GICs as they have essentially increased the damage resistance and physical strength of teeth.^[10] Additionally, the GIC component proposes fluoride release, whereas the resin component offers strength and better aesthetics than traditional GICs. However, these restorative materials can potentially shrink during polymerization because RMGICs contain resins.^[11]

A modified open-sandwich restoration was suggested to increase the condition and durability of the open-sandwich restoration.^[12] Most of the above studies were done on permanent teeth. This present study was designed to compare the clinical outcome between the modified open sandwich technique

and the conventional composite restoration for managing class II caries on primary molars.

Objectives of the study

General objective

To evaluate and compare the outcome of the modified open sandwich technique with conventional composite resin restoration.

Specific objectives

1. To evaluate and compare the postoperative sensitivity of the modified open sandwich technique and the conventional composite resin restoration.
2. To assess the status of marginal adaptation of the modified open sandwich technique and the conventional composite resin restoration at different time intervals.
3. To detect the presence of secondary caries of the modified open sandwich technique and the conventional composite resin restoration at different time intervals.

MATERIAL AND METHODS

This was a randomized control trial and was conducted in the Department of Pedodontics, Faculty of Dentistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh during the period from October, 2021 to September, 2022. In our study we included 68 patients with proximal dental caries of primary molars with reversible pulpitis. The patients were divided by using random sampling technique into two groups – Group A (The modified open sandwich technique, n=34) and Group B (The conventional composite resin restoration, n=34).

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged 4 -8 years old; b) Patients with class II caries of primary molars with mild to moderate pain; c) Patients with no clinical & radiographic evidence of inflamed pulp; d) Patients with no swelling, sinus tract, resorption, bone destruction etc; e) Patients with written consent were included in the study And a) Patients with severe toothache; b) Patients with grossly damaged tooth & unrestorable tooth ; c) Patients with previously treated tooth; d) Patients with previous surgical history; e) Patients with any history acute illness (e.g., renal or pancreatic diseases, ischemic heart disease etc.) were excluded from our study.

Data collection tools and Techniques

Data were collected through face-to-face interviews with the help of a semi-structured questionnaire. Postoperative sensitivity was recorded. Follow-up visits will be given to each patient at baseline, 3 months, 6 months, and 12 months. During each follow-up visit, conditions of marginal adaptation and secondary caries of the filling were recorded in the data collection sheet.

Statistical Analysis

All recorded data were analyzed and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Associations of categorical data were done using the Chi-square test. Statistical analysis was performed by using SPSS 22 (Statistical Package for Social Sciences) for windows version 10. Probability value <0.1 was considered as level of significance. The study

was approved by Ethical Review Committee of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.

RESULTS

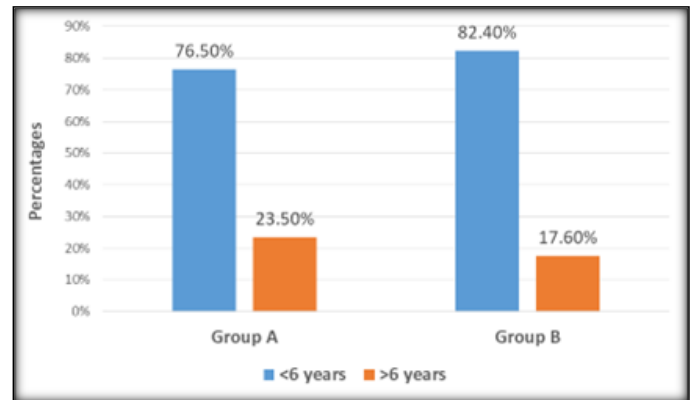


Figure 1: Distribution of Patients by Age in Both Groups (n=34 in each group)

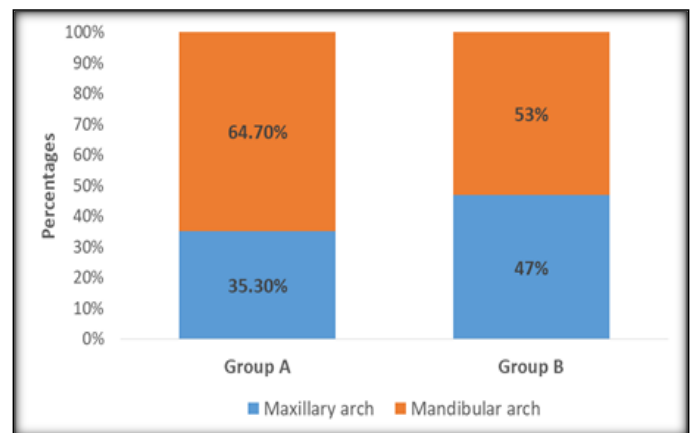


Figure 2: Distribution of patients by arches in both groups (n=34 in each group)

[Figure 1] shows the percentage distribution of patients by age. In both groups, most of the patients are from below 6 years of age group. In Group A, 76.5% (26) and in Group B, 82.4% (28) study sample are from <6 years of age. In Group A and in group B, 23.5% (8) and 17.6% (6) study

subjects are from the age group above 6 years respectively.

[Figure 2] shows the percentage distribution of patients by arches. In both groups, teeth of the mandibular arch are more. In group A, 64.7% (22) are mandibular teeth and 35.3% (12) are maxillary teeth. In group B, 53% (18) are mandibular teeth, and 47% (16) are maxillary teeth.

[Table 1] shows the postoperative sensitivity in both groups. We found sensitivity was present in 4 & 11 patients among group A & B respectively. In group A sensitivity was absent in 30 patients and 23 patients had no sensitivity in group B.

[Table 2] shows percentage of secondary caries. We found that no secondary caries developed in both groups.

[Table 3] shows status of marginal adaptation assessed at baseline, 3 months, 6 months, and 12

months in both groups and comparisons are done by the Chi-square test. At baseline, marginal adaptation was found in 100% of cases of group A and 88.2% of cases of Group B, and lack of adaptation was found in 11.8% of cases in group B. This difference in marginal adaptation at baseline was statistically significant ($p < 0.1$). In group A, the loss of marginal adaptation remains (5.9%) after 3 and (11.8%) after 6 months, after 12 months it increased to 17.6%. In group B, after 3 months, the loss of marginal adaptation increased to 11.8%, after 6 months it is increased to 23.5% and after 12 months 29.4%.

At 12 months follow-up periods, 82.4% of cases of group A had good marginal adaptation, and 70.6% of cases of group B had good marginal adaptation. No significant difference in marginal adaptation was found after 3 months, 6 months, and 12 months follow-up between group A and group B.

Table 1: Comparison of postoperative sensitivity in both groups by Chi-Square test.

Sensitivity	Group A	Group B	Chi-square value	P-value
Present	4	11	4.191	0.077
Absent	30	23		

Table 2: Percentage of secondary caries during different follow-up periods in both groups (n=34 in each group).

Secondary caries	Group A				Group B			
	Baseline	After 3 months	After 6 months	After 12 months	Baseline	After 3 months	After 6 months	After 12 months
Present	00	00	00	00	00	00	00	00
Absent	34	34	34	34	34	34	34	34
	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

Table 3: Status of marginal adaptation during different follow-up periods in both groups (n=34 in each group).

Follow up periods	Marginal adaptation	Group A	Group B	Chi-Square value	P-value
Baseline	Yes	34 (100%)	30 (88.2%)	4.250	0.057*
	No	00	4 (11.8%)		(<0.1)
After 3 months	Yes	30 (88.2%) ³²	(94.1%)	0.731	0.336
	No	2 (5.9%)	4 (11.8%)		(>0.1)
After 6 months	Yes	30(88.2%)	26(76.5%)	1.619	0.170
	No	4(11.8%)	8(23.5%)		(>0.1)
After 12 months	Yes	28(82.4%)	24(70.6%)	1.308	0.196
	No	6(17.6%)	10(29.4%)		(>0.1)

DISCUSSION

Pediatric dentists must choose between amalgam, composite resin, glass ionomer, resin-modified glass ionomer, compomer, and stainless-steel crowns for restoring primary teeth. Resin composites have become popular for the restorations of primary anterior and posterior teeth. They are well-accepted due to their low relative thermal conductivity, preservation of the dental structure in cavity preparation, and continuous progress in the stability of their composition.^[13] In the open sandwich technique, the main reason for using resin-modified glass ionomer cement under composite is the benefit of fluoride release.^[14]

The present study was designed to evaluate and compare the modified open sandwich technique and conventional composite resin restorations in class II cavities of primary molars. The participants of this study were in age between 4-8 years with mean \pm SD being 5.37 \pm 1.245. A total of 68 class II cavities, 34 in each group, of the primary molars of these participants, were restored with composite resin by conventional and modified open sandwich techniques. The most of cases of both groups were from the age group below 6 years. For the modified open sandwich restorations, it

was 76.5% and for the conventional composite restoration group, it was 82.4% [Figure 1]. Mandibular primary molars were 64.7% and 53% for the modified open sandwich technique and conventional composite restoration respectively [Figure 2].

After 12 months of follow-up, no secondary caries developed in conventional composite and modified open sandwich technique restorations of class II cavities of primary molar teeth [Table 2]. In another study, done on permanent molar teeth, showed no secondary caries in permanent molar teeth after 12 months of follow up which supports the finding of this present study. However, it was also concluded that 21% of cases showed secondary caries after a 24-month follow-up period.^[15] Few studies showed the formation of secondary caries after a few years of the follow-up period and concluded that there were several factors for secondary caries formation.^[16]

Marginal adaptation is one of the factors for the survival of restoration into the mouth. The finding of this study regarding marginal adaptation showed that at baseline, the modified open sandwich technique restoration showed significantly good marginal adaptation than that of conventional composite restoration

in class II cavities of primary molar teeth. Good marginal adaptation (100%) was found in the case of the modified open sandwich technique whereas it was 88.2% for conventional composite restoration at the baseline. Though the loss of marginal adaptation was increased during the follow-up periods, no significant difference was found between the two types of restorations [Table 3]. This finding is in agreement with the outcome of other similar studies.¹⁷ However, with time, both types of restorations showed a percentage of inaccuracy in the marginal gap. This difference was not significant as found in other previous studies.¹⁸

The longevity of dental restorations is dependent on many factors. These include the materials and techniques used, patient compliance with oral hygiene and the patient's susceptibility to caries. To ensure that the restorations were performed under the same conditions, consistently one operator placed all the restorations in the cavities in the present study. The researchers, involved in the current study, acknowledge that the duration of this study was insufficient to confirm the long-term suitability of the tested materials.

Limitations of the study

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Our study was a single centre study. We took a small sample size due to our short study period. There are more variables to determine the efficacy of modified open sandwich technique that needs to be evaluated. After evaluating once those patients we follow-up them till 12th months and have not known other possible interference that may happen in the long term with these patients.

CONCLUSIONS

In our study we found that postoperative sensitivity developed more in conventional composite restorations in comparison to the modified open sandwich technique. Initially marginal adaptation showed better in the modified open sandwich method technique. Conventional and modified open sandwich composite resin techniques were acceptable for primary molar teeth considering secondary caries and marginal adaptation.

So further study with a prospective and longitudinal study design including larger sample size needs to be done to identify more clinical effectiveness of the Modified Open Sandwich Technique in managing class II caries on primary molars.

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