Comparative evaluation of slot versus dovetail design in class III composite restorations in primary anterior teeth

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Abstract

The esthetic restorations of primary anterior teeth have always occupied an important part of the pediatric dentist's armamentarium. Various materials have been tried for this purpose and ample materials have been researched in an attempt to fulfill the prerequisites for an ideal esthetic restorative material. Composite resins have been traditionally noted to have decreased bonding ability to primary teeth and the use of secondary retentive features has been advocated to increase bonding. Fifty pairs of anterior class III carious teeth were selected having mirror image lesions on their contralateral proximal surfaces. These teeth were prepared with either a slot or a modified dovetail type of cavity preparation. The patients were then kept on recall to check the clinical characteristics of the restorations at 3, 6, and 12 months. The criteria for evaluation included marginal adaptation, anatomic form, surface discoloration and secondary caries. It was concluded from the results that the both slot and dovetail types of cavity preparations were equally efficacious when clinically reviewed for a period of 12 months. Hence the use of slot type of cavity preparation with reduced loss of the tooth structure is indicated for class III cavities in primary anterior teeth.

Keywords: Composite restorations, Dovetail, Primary anteriors, Slot

Introduction

The concept of composite restorations has been a boon to improving the esthetic value of restoration of destroyed tooth structure. The success of restoring primary teeth depends on far more than the physical characteristics of the material used. The restorative therapy in this age group is influenced by various parameters such as- degree of patient co-operation, isolation techniques possible, difference in primary tooth anatomy and the lifespan of the tooth. A lot of research has been conducted regarding the clinical characteristics of composite restorations. It is important to note that most of the long-term evaluatory studies have been performed on permanent teeth. There are various in vitro studies available to evaluate the bonding mechanism of these restorations to primary teeth.[1,2]

Certain authors have suggested the use of additional means of secondary retention in class III preparations of primary anterior teeth.[3,4] These features of retention range from labial veneering, dovetail preparations and labial and lingual lock and grooves. The purpose of this study is to compare the clinical characteristics of the slot and dovetail design in class III restorations with composite resin. These findings will be a step forward in the dual aim of conserving tooth structure and also ensuring good retention of anterior composite restorations in primary teeth.

Materials and Methods

The present study was conducted in the Department of Pedodontics and Preventive Dentistry, KLES’s Institute of Dental Sciences, Belgaum, with the objective to comparatively assess the quality of the slot and dovetail class III cavity design in primary anterior teeth. Children aged 2.5–9 years were selected from the outpatient department of the Undergraduate and Postgraduate Clinics, Department of Pedodontics and Preventive Dentistry, KLES’s Institute of Dental Sciences, Belgaum. Written informed consent was procured from parents of all children prior to the participation in the study after explaining the procedure, discomforts, risks, and benefits involved.

All children were taken such that they had at least one pair of similar class III lesions on the proximal surfaces of deciduous anterior teeth [Figure 2].

Fifty pairs of class III carious lesions were selected to be restored with composite restorations. The examination and treatment procedure was carried out by the single examiner to avoid interexaminer bias.

The following inclusion criteria were included to select the subjects:

- Class III carious lesions on proximal surfaces of contralateral teeth were taken for the study.
- Lesions with moderate-to-minimal depth were only included.

The mirror image lesions on contralateral teeth were
randomly divided into the slot and dovetail design of cavity preparation by simple random sampling without replacement. Standard instruments and materials were used for the restorative procedures. A small round bur was used to prepare the cavity into the slot or dovetail design [Figure 1]. An access was made from the labial surface. The incisal and the gingival extent of the cavity form were determined by the amount of carious tissue present. A tapered bur was used to make a short bevel on the cavosurface margin.

Clinical evaluation procedure
The restorations were evaluated in intervals of 3, 6, and 12 months on the basis of certain evaluation criteria taken in accordance with the United States Public Health Survey criteria for the evaluation of restorations [Figure 3, 4]. The criteria were grouped according to various parameters such as anatomic form, marginal adaptation, secondary caries, and marginal discoloration. The evaluation was done with a mouth mirror and probe. They were rated according to the modified Ryge criteria. The evaluation was also performed by a single examiner to avoid bias.

Intra-examiner bias was avoided by having the examiner evaluate 10 restorations randomly selected among the sample size for reevaluation 1 week after the recall appointment.

Whenever the restoration was rated unacceptable, the tooth was excluded from the study and retreated. The results of the evaluation were recorded in a basic format (Annexure II, III, IV) which included the patient’s basic information. The results obtained were tabulated and subjected to statistical analysis using the SPSS software (version 9) [Table 1].

Discussion
There are various in vitro studies finding a decrease in the bond strength in composite restorations of primary teeth when compared with that in permanent teeth. The reasons attributed to this finding have varied from difference in morphology to a thicker hybrid layer or less mineral content.

Whatever the reason for the loss of bond strength, secondary retention features play a vital role in increasing the bond strength and hence are to be included in cavity preparation.

The difficulties of conducting clinical studies should also be noted in this regard. The primary teeth have a short span of life, thus excluding a significantly long follow-up. Follow-up studies of up to 11 years are available for composite restorations in permanent anterior teeth, but due to obvious reasons such studies are not possible in primary teeth. To add to the confounding factors is the aspect of age, cooperation, and behavior of the child when greeted with an unfamiliar and alien place such as a dental set-up.

The aim of this study was to evaluate the clinical characteristics of two types of class III design preparations, i.e., the slot and the dovetail designs for various clinical parameters in a follow-up period of 1 year.

It was found in earlier studies that in the long-term follow-up of class III restorations, there was a loss of marginal adaptation and anatomic form on a follow-up of 2 years. Secondary caries was found to be a dominant factor in the failure of restorations while others reported low incidence of secondary caries.

Follow-up evaluation of the above-mentioned cavity designs for a period of 1 year showed that both were equally effacious

| Clinical characteristics | Category of rating | Evaluation criteria | Overall quality |
|--------------------------|--------------------|---------------------|----------------|
| Marginal adaptation      | A                  | No catch or visible evidence of a crevice along the margin | O              |
|                          | B                  | A small catch or ditch but the dentin base or cement is not exposed | a              |
|                          | C                  | Dentin or cement base is exposed | a              |
|                          | D                  | Mobile restoration, fractured, or missing in part or total | U              |
| Anatomic form            | A                  | Restoration contour is continuous with the existing anatomical form | O              |
|                          | B                  | Under contoured but loss does not expose the dentin base or cement | A              |
|                          | C                  | Loss of material exposes the dentin base or cement | U              |
| Secondary caries         | A                  | No evidence of caries at the margin of restoration | O              |
|                          | B                  | Evidence. Catch of the explorer which resists removal with moderate-to-firm pressure | U              |
| Margin discoloration     | A                  | No discoloration penetrated along the margin of the material in a pulpal direction | O              |
|                          | B                  | Discoloration penetrated along the margin of the material in pulpal direction | U              |

A – ideal; B – acceptable but exhibits one or more features which deviate from ideal conditions; C – not acceptable, future damage to tooth/surrounding tissues is likely to occur; D – not acceptable, damage to tooth/surrounding tissues is occurring; O – optimal; a – acceptable, need not be replaced; U – unacceptable, to be replaced.
The data of the study revealed that the difference in the success rate of slot and dovetail class III preparation was not statistically significant. After 12 months, over 72% of both restorations were in an optimal condition. None of the restorations were judged to be unacceptable. Minor restoration defects as pitting and discontinuity of the anatomic form were observed in 28% of the restorations. None of the restorations showed marginal discoloration or secondary caries. The discontinuity of the anatomic form of the restoration could have been caused by an air bubble at the surface of the restoration incorporated during insertion of the composite material; anatomic defects or marginal discontinuity that was seen in the gingival margin could be due to the leakage of the gingival crevicular fluid.
contamination despite the use of a rubber dam.[9]

Nevertheless, these restorations can be considered acceptable clinically. Though considered to be the most frequent cause of failure of composite restorations, recurrent caries was not noticed in this study. It may be possible that review of the increased time span may repudiate this finding.

Traivorakul Chutima et al.[9] have reported in their study the failure rate of their class III restorations after 6 months being 10%. The data available in our study are contrasting to this picture. This may be because of various reasons: different dentists performed the procedure and the rubber dam was not used as a method of isolation in the above-mentioned study. Hence these factors could be cited as causing bias in the interpretation of the results. Our study was done by a single operator to nullify interexaminer variability.

Moreover, the bonding agent ScotchBond™ used in their study is a second-generation bonding agent while Prime and Bond NT™ used in this study is a fifth-generation bonding agent. Each of these aspects may serve as a reason for the differing results observed. The discrepancies observed in this study were probably caused due to the improper restorative procedure more than the insufficiency of the characteristics of the material.

Further research in this regard might be beneficial. A similar study with a longer time span of follow-up and more evaluatory parameters would be the solution.

Conclusions

The present data depict the clinical comparison of the slot-and dovetail-type cavity preparation for composite resin restorations.

With the given data and the observations obtained in the present samples, it may be concluded that

1. There was no statistically significant difference in the clinical performance of slot and dovetail cavity preparation techniques for composite restorations.

2. As the dovetail form necessitates further cutting of the tooth structure, it may be viewed as an unnecessary aid for secondary retention.

To have a better insight into the association between the interplay of various factors involved in the longevity of composite restorations, further research is needed in a larger and more stratified population with thorough and precise details of follow-up evaluation for longer periods of time.

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Source of Support: Nil, Conflict of Interest: None declared.

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