RESEARCH ARTICLE

Comparative Evaluation of Clinical Efficiency and Patient Acceptability toward the Use of Circumferential Matrix and Sectional Matrix for Restoration of Class II Cavities in Primary Molars: An *In Vivo* Study

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Abstract

Aim: To compare two matrix systems (circumferential and sectional) based on clinical efficiency and patient acceptability for placement of visible light cure composite resin restorative material in a Class II cavity in primary molars.

Materials and methods: Thirty children with bilateral Class II cavities of age-group 5–9 years were selected. A split-mouth comparative experimental study was conducted at Manav Rachna Dental College, India. Cavities were restored using either circumferential or sectional matrix band system. The child upon completion of the treatment filled the subject preference questionnaire. Time assessment was done for matrix system placement. Contact points were evaluated using dental floss as open or closed.

Results: Time required to place sectional matrices was more (125.30 ± 29.40) than required for circumferential matrices (117.20 ± 38.94). The sectional matrices group has more ideal contacts (23) (76.7%) than the circumferential matrices group (16) (53.3%). About 70% of the children pointed discomfort toward the sectional matrices. Children in this study accepted circumferential matrices to be more comfortable than the sectional matrices group.

Conclusion: The circumferential matrices group was more time efficient compared to the sectional matrices group. However, sectional matrices resulted in a greater number of restorations with ideal contacts. Based on the preference circumferential matrix band system has been found superior to sectional matrix band system.

Clinical significance: This study was conducted to find a better matrix system in case of pediatric patients. Circumferential matrices were found to be more superior with respect to preference and time efficiency and sectional matrices were preferred for ideal contacts.

Keywords: Class II restoration, Contact point, Matrix system.

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Introduction

One of the greatest challenges encountered by most dental clinicians while restoring a Class II cavity is, obtaining anatomically and physiologically correct proximal contacts and contours. The objective is to reproduce a natural proximal contact that is tight enough to prevent food impaction, which is crucial for a healthy periodontium. The food impaction caused due to loose proximal contact can lead to periodontal complications and carious lesions.[1] Matrix bands play a pivotal and a very important role in achieving this. Matrix bands act as pseudo wall while doing restorations in proximal carious lesions. A matrix is a properly contoured piece of metal or other material used to support and give form to the restoration during its placement and hardening/setting.[2] A properly contoured matrix band is adapted gingivally with the help of a properly inserted and contoured wedge. Pre-wedging creates initial separation of teeth, and protects both the rubber dam and the inter-proximal tissue while cavity preparation. With the advent of matrices, gingival overhangs, food lodgement, food impaction, and recurrent caries have declined.[3]

Primary teeth have a marked cervical constriction and also have broader and flatter contact areas than the permanent teeth. This makes placement of a matrix system more difficult in case of primary teeth, as they have every chance of slippage. Moreover, children can't sit still for long as they have short attention span and they have unpredictable behavior. This calls for quick (time measurement) and effective (comfort scale) system in case of children. This study was being undertaken with the aim of suggesting a better matrix system in case of pediatric patients.

Two types of common matrix systems available are circumferential and sectional matrix system. Circumferential matrices are pre-contoured in three dimensions which, when combined with anatomical wedges and separators, result in tight contacts. The retainerless design tends to offer good comfort

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and visibility that quickens the quadrant work to offer proper adaptation. The circumferential matrices used in this study were ReelMatrix (Garrison Dental Solutions, USA).

Sectional matrices improve the retention of the restoration between the teeth to be restored. They ensure good matrix band adaptation. They are anatomically contoured which have a long shelf life. They are used where optimum tooth form, function, and conservation of tooth structure are required. Sectional matrices used in this study were Composi-Tight 3D (Garrison Dental Solutions, USA).

The composite materials, especially posterior composites have good strength and adaptation, especially for Class II restorations. Studies have been done with advances in material sciences and technology to transform the mechanical approach of operative dentistry into a biological philosophy.[4] Optimizing tooth form, enhanced esthetics, and minimum intervention are the triads of modern conservative dentistry. In this study, sectional matrices and circumferential matrices were used and compared, based on their patient acceptance, clinical efficiency, and time.

Materials and Methods

The present comparative experimental study comprised of 30 children of 5–9 years with bilateral Class II cavities. Sample size estimation was based on the study done by Gilmour S et al.;[5] the sample size was calculated by taking absolute mean difference with type I error 5% and type II error 20% and power of the study 80%.

Children were selected from the outpatient department of the Department of Pediatric and Preventive Dentistry, Manav Rachna Dental College, Faridabad, Haryana, India. The study was approved by ethical committee of the University. Parents of the selected children were made aware of the experimental design and a written informed consent was obtained from them.

Children were clinically examined to make sure that the bilateral Class II caries were limited to enamel or dentin, adjacent teeth was present and there was no associated history of pain or swelling. Another key consideration was that the children must be cooperative and fall under the category of positive and definitely positive according to Frankls' behavior rating scale.

Children with partially or ectopically erupted primary molars, children with special health care needs and those who were uncomfortable with the placement of rubber dam were excluded from the study.

The principal investigator performed all the cases and assistance was sought from a clinical assistant to pick up chits. One chit to decide which side would be done first (right or left) and then a second chit to decide which matrix system would be placed first to avoid bias.

Operatory field was isolated using a rubber dam. Pre-wedging (Composi-Tight 3D Fusion Ultra Adaptive Wedges, Garrison Dental Solutions, USA) was done. Class II cavity was prepared following standard techniques using air rotor and diamond burs. On one side, a circumferential matrix was used and on the other side sectional matrix was used. After drying the cavity the matrix band was placed as per manufacturer's instructions. For sectional matrix (Composi-Tight 3D Sectional Matrix Bands- 5.5 mm Molar, Garrison Dental Solutions, USA), matrix band was placed first and held in place with the left forefinger and then the sectional matrix clamp was used to clamp it and a tight contact was obtained (Fig. 1). For circumferential matrix (ReelMatrix, Garrison Dental Solutions, USA), reel was popped into the handle and grippers were retracted to lock the reel in place (Fig. 2). Light cure composite resin was used to restore the cavity. Restoration on one side was completed and verified before beginning cavity preparation on the other side for second matrix system. On completion of restoration, the matrix bands were removed first followed by wedges and the rubber dam. High occlusal points were then checked using articulating paper. Final finishing and polishing was done. Time was assessed from the point where pre-wedging was done till complete verification of placement of matrix system. This was done using a stopwatch. Proximal contacts were assessed using a dental floss. Patient was asked to fill the patient acceptance questionnaire. Radiographs were not used to assess the proximal contacts to prevent radiographic exposure in children.

Results

Statistical analysis was done using SPSS version 24. Chi-square test was used to check differences in proportions. The independent sample *t*-test was used to check mean differences between groups. The statistical significance was set at $p < 0.05$. Mean age (years) of the study population was 7.53 ± 1.40. 53.3% of the sectional matrices were placed on left primary first molar and 53.3% of the circumferential matrices were placed on right primary first molar. The time required to place sectional matrices was more (125.30 ±

Fig. 1: Sectional matrix system

Fig. 2: Circumferential matrix

29.40) than required for circumferential matrices (117.20 ± 38.94) (Table 1). The sectional matrices group has more ideal contacts 23 (76.7%) than the circumferential matrices group 16 (53.3%) (Table 2). About 70% of the children pointed discomfort toward the sectional matrices (Table 3).

Discussion

Direct restoration of a Class II preparation to re-establish form and function requires the use of a matrix system. A well-controlled proximal surface helps prevent food impaction, facilitates interdental cleaning, and helps maintain a healthy interdental papillae. The direct restoration of Class II cavities in the primary dentition is a challenge for the dental surgeon. This could be because of the broad and flat contact area of primary teeth; placement of a matrix band is not so easy as they have a chance of slipping out. The pulp horns of primary teeth are placed higher when compared to that of the permanent teeth. So, there is increased chance of pulpal exposure while doing cavity preparation of primary teeth. So, if not restored properly, a Class II cavity has a bigger chance of going in for pulp therapy. Class II restorations in primary teeth do not stay for long if not restored properly. According to Innes NPT and Evans DJP "minimal intervention" approaches reduce certain consequences associated with restorative treatment and help in conservation of the tooth structure and integrity and maintenance of maximum dentinal thickness of the pulpal floor that reduces pulpal exposure.[6]

The age-group of 5–9 years was selected for this study because at the age of 6 years the first permanent molar erupts. When the first molar erupts, the physiological spaces get closed, the contacts become tight, and they become more prone to dental caries.

This study was a split-mouth study and was carried out in the same arch but different quadrants. This was done to avoid any discrepancy in the mean operating time between both quadrants. According to Lesaffre E et al.,[7] the attractiveness of a split-mouth study is that it removes a lot of intraindividual variability from the estimates of the treatment effect. In the present study, chit system was used to select which side was to be done first, followed by which system was to be done on which side, to eliminate bias. It also enabled us to the patient to conveniently compare both the matrix systems as conducted by Agarwal SK.[8]

In this study pre-wedging was done. According to Alonso de la Peña V, Pernas García R, and Pérez García R,[9] a tight proximal contact was obtained using pre-wedging technique. It prevents damaging the adjacent tooth wall during cavity preparation. A higher separation of the tooth than the matrix to be placed was obtained. It protects the interproximal tissues and the rubber dam. It also protects the soft tissue papilla. It helps to intimately adapt the matrix to the contour of the tooth. Pre-wedging is done prior to cavity preparation. According to Lee Ann Brady,[10] pre-wedging not only separates the tooth but also preserves the soft tissue. Faulty wedging results in concavity at the cervical portion of the proximal box, if rubber dam displaces the wedge or if a large wedge is used. If the wedge is loose, over extension of the material can occur. If there is inadequate wedging pressure, an open contact is obtained. This is contradictory to the studies done by David Clark[11] where no pre-wedging was done and it led to overhang of restorative material.

After pre-wedging, the cavity was prepared using an air rotor hand piece and the matrix system was placed. On one side sectional matrix and on the other side circumferential matrix was placed. The sectional matrix bands of pediatric patients were 5.5 mm in height with a thickness of 0.0015 inches. According to Anfe TEA et al.,[12] the height of the second deciduous molar is 5.501 mm, whereas the height of the sectional matrix bands for adults are 6.4 mm. This means that the pedodontic sectional matrix system height was formulated according to the height of the primary teeth. However, this difference was statistically nonsignificant.

Table 1: Comparison of mean time (seconds) between sectional and circumferential matrices group

Sectional matrices		*Circumferential matrices*		*t-value*	*p-value*
n	Mean ± SD	*n*	Mean ± SD		
20	125.30 ± 29.40	30	117.20 ± 38.94	0.909	0.367

n, number; SD, standard deviation is a quantity expressing by how much the members of a group differ from the mean value for the group; $p < 0.05$ is significant

Table 2: Comparison of contact point between sectional and circumferential matrices group

Matrices	*Ideal contact*		*Tight contact*		*p-value*
	n	%	*n*	%	
Sectional	23	76.7	7	23.3	0.048
Circumferential	16	53.3	14	46.7	S

n, number; all values are expressed in number and percentages, $p < 0.05$ is significant

Table 3: Answer to questions regarding comfortability on placement of sectional and circumferential matrices

Questions	*Answer (inference)*	*n*	*%*
Did you feel any discomfort on placement of the matrix band?	Yes	19	63.3
	No	11	36.7
If yes, which side?	Sectional	14	70.0
	Circumferential	5	30.0
While doing the procedure again, which side was more comfortable?	Sectional	10	33.3
	Circumferential	20	66.7

On evaluating the mean operating time in the current study, it was found to be more in sectional matrices when compared to that of circumferential matrices as shown in Table 1. It shows the mean operating time for sectional matrices was 125.30 seconds with a SD of 29.40 seconds and for the circumferential matrices, it was 117.20 seconds with a SD of 38.94 seconds. The results were in a total contrast to a prior study conducted by Cho SD, Browning WD, Walton KS[13] where the clinical use of a sectional matrix consumed less time.

The difference in the time consumption between the two matrix systems is mainly because in the circumferential matrix system, no clamp was used, while in the sectional matrix system, it consisted of a clamp which was required to hold the matrix in place and the clamp had to be fitted in the cervical region of the primary teeth which normally have marked cervical constriction.

On evaluating the subject preference questionnaire, 63.3% of the children answered that they had discomfort on placement of the matrix band as shown in Table 3. When inquired about the site of discomfort, the children pointed out mainly towards sectional matrices side (70%) whereas only 30% pointed out to the circumferential matrices side. In general, more than half of the patients felt circumferential matrices to be more comfortable (66.7%) as shown in Table 3. The above preferences for the circumferential matrices could be attributed to their convenient design, flexibility, ability to be contoured in a three-dimensional shape, and most important of all, no clamp was necessary for securing the matrix in position as it had a reel handle which pops and puts the matrix in position and lets the matrix go. The discomfort in the sectional matrix system could be attributed to the clamp, which was also placed adjacent to the rubber dam clamp. The circumferential matrices were also preferred compared to sectional matrices because the time consumed for their placement was less. This was also attributed to their convenient design form. These results were contradictory to the previous results given by Sadaf DE et al.[14] and Cho SD, Browning WD, Walton KS.[13]

The contact point between the sectional and circumferential matrices was compared. The restorations done with sectional matrices had more ideal contacts than the restorations done with circumferential matrices. This was attributed to the snap fit of the dental floss when passed through the proximal contact created by the restoration done with sectional matrix system. This was because the sectional matrices had a tight contact with the tooth, which was mainly provided by the clamp so that an ideal contact of the composite restoration was obtained. Thus the ideal contacts were estimated with dental floss and not by radiographs to prevent unnecessary radiographic exposure to the patient as discussed by Sykes LM.[15]

Based on the results obtained, circumferential matrix required less time placement and was more time efficient and also comfortable in comparison with sectional matrices. This clearly indicates that circumferential matrix was a viable matrix system when used in restoring proximal cavities in primary teeth.

Conclusion

Children in this study accepted circumferential matrices to be more comfortable than the sectional matrices group. The circumferential matrices group was also more time efficient compared to the sectional matrices group. Sectional matrices resulted in a greater number of restorations with ideal restorations.

The findings of the study will assist in selecting a more comfortable, a more acceptable, and time efficient matrix system. However, continued research should be conducted on the quality of the matrix systems and dental practitioners' and patients' perspective.

Clinical Significance

This study was conducted to find a better matrix system in case of pediatric patients. Circumferential matrices were found to be more superior with respect to preference and time efficiency and sectional matrices were preferred for ideal contacts.

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