

Comparison of Sectional Matrix versus Circumferential Matrix for Reconstruction of Proximal Contact in Class II Restoration

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ABSTRACT

Background: In clinical practice, achieving an ideal contact point replication in class II cavities is crucial. This study aims to assess the impact of two matrix band systems on proximal contacts while reconstructing the class II cavities in permanent posterior teeth.

Patients and methods: This trial was conducted in the Operative Dentistry Department at PIMS Hospital Islamabad. The sample size was 80, with 40 in each group, Group A (circumferential matrix) and Group B (sectional matrix). Supra gingival class 2 cavity limited to dentine with fully erupted permanent posterior teeth were included. Chi-square and Pearson's correlation were carried out to assess the relation between the matrix band and proximal tooth contact, and proximal overhanging margin.

Results: Findings revealed that there was a significant association between the proximal contact points in both groups (p-value = 0.00) and there is no statistically significant link between the presence of an overhanging margin and the occurrence of open, tight, or ideal contact points ($r = 0.19$, $P > 0.088$).

Conclusion: The sectional matrix band proved to be more effective than the circumferential matrix band when it came to repairing the class II cavities proximal contact in permanent posterior teeth.

Keywords:

Band, Matrix, Dental restoration, Tooth, Dental cavity, Dental caries, Permanent Dentition

INTRODUCTION

Posterior restorations are subject to a variety of issues, including incorrect contact sites, proximal overhangs, and so on.¹ Inadequate contact frequently causes food impaction, periodontal disease, and tooth movement.²³

Modern restorative dentistry focuses mainly on three key objectives: maintaining dental structure, obtaining perfect tooth form and, and rebuilding teeth using aesthetically acceptable material.⁴ Diverse ways have been proposed as solutions to these issues, including wedges, separation rings, several matrix systems, and the employment of specialist equipment.⁵

Several different matrix band systems can be used to fill tooth cavities with missing proximal walls, such as flat or pre-contoured bands, circumferential systems fixed to retainers, and sectional matrix bands. However, more newly created matrix, such as sectional matrix band (SMB), have shown to be more clinically effective, particularly for achieving ideal contacts areas between adjoining teeth.⁶ Due to sectional matrices' effectiveness in enhancing proximal contact tightness

and generating structural morphology, this approach has received high commendation and is often referred to as the gold standard.⁷

The restoration of Class II cavities has traditionally been accomplished using a circumferential matrix band technique.⁸ Circumferential matrices was shown to be superior in terms of preference and time efficiency, while sectional matrix was favored for optimal interactions, according to a study on pediatric patients.⁹ Another study shows that thin sectional matrix provide tight proximal contacts but concave contour, while circumferential matrix band produced flat contours.¹⁰

The rationale of the study was to compare the two different types of matrix band system to see proximal contacts and contour, and which is best method for duplicating the natural structure of tooth.

This objective of the study was to compare the effects circumferential and sectional matrix band on the proximal contacts and overhang while restoring class 2 cavity in permanent posterior teeth.

PATIENTS AND METHODS

After receiving ethics board approval (SOD/ERB/2023/18), this randomized control trial was conducted by a postgraduate resident of the School of Dentistry at the Pakistan Institute of medical sciences Islamabad. from

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August 2022 to March 2023. The experiment is identified as (NCT05734027) on Clinicaltrials.gov. The sample size was computed using the WHO calculator to be 80, with 40 in each group with a level of significance of 5%, power of test of 80%, anticipated proportion 18.3 group 1, and anticipated proportion 0%¹¹ for group 2. The research included patients with supragingival class II caries restricted to dentin and fully erupted permanent posterior teeth. Exclusion criteria included teeth with dental caries that reached the pulp and teeth with periapical pathosis; neighboring teeth continuous with the cavity side absent; teeth that were positioned incorrectly; and periodontally compromised teeth.

After validating eligibility requirements, the clinical procedure and related hazards were explained to the patients, and informed permission was acquired. Following the completion of the clinical history, the depth of caries into dentin was verified by an intraoral radiograph. Patients who met the inclusion criteria were allocated into two groups. Group A employed a circumferential matrix system, while Group B employed a sectional matrix band. Local anesthesia was administered, and the whole quadrant containing the offending tooth was isolated by using a rubber dam. After caries removal and cavity preparation, matrix systems were applied by single examiner. Group A Circumferential matrix band system (Tofflemire Retainer Universal 1140, KerrHawe®) fitted around the teeth. To achieve separation, a wooden wedge was implanted at the side of the preparation. When the matrix band and the neighboring tooth were not in direct touch, the contact area of the matrix band was polished in the direction of the neighboring tooth using the proper tool. In Group B, a sectional matrix system with separational ring (Palodent matrix bands®, standard, thickness: 0.038 mm) was used. To best utilize the sectional matrix band's capacity for adaptation in the cervical region, it was placed interproximally and fixed with a wooden wedge. Restorations made of resin composite were carried out according to the manufacturer's guidelines. Scotchbond TM Universal® etchant was used to selectively etch the enamel, and then Single Bond Universal® adhesive was applied to the whole surface of the enamel and dentin. Following

that, a thin coating of Filtek™ Z350XT® flowable (3M ESPE, USA) was placed to ensure adaptation at the gingival margin. Finally, resin composite was used to restore prepared cavities. Using the centripetal approach to construct a proximal wall first, followed by consecutive cusp construction. Restorations were polished and completed using a flame-shaped finishing stone, and occlusal contact sites will be evaluated with articulating paper.

Bitewing radiograph was used to assess the proximal contour and overhang. Dental floss was used to measure the tightness of proximal contacts. Proximal contacts were divided into three categories: tight, optimal, and open, an optimal contact point was defined as the dental floss going through the contact region as the opposite side's natural dentition. When the dental floss flowed through the contact region without obstruction, it was termed open; nevertheless, when it could not be passed at all or tore, it was deemed tight.

The statistical analysis was completed using SPSS 23, a statistical software program. To ascertain the relationship between the matrix band system and proximate contact, a chi-square test was carried out. A Pearson correlation test was performed, with a 95% confidence level set at p-value = 0.05, to rule out the possibility of a relationship between the occurrence of optimal and tight contact sites and overhanging margins.

RESULTS

The study had a total of 80 patients, of whom 50 (63%) were men and 30 (37%) women. The mean age was 32.82±10.24 years. Both band systems were randomly separated into two groups: sectional matrix (40) and circumferential matrix (40). Proximal contact was evaluated with floss. All Optimum contact 25 (62.5%) were present in teeth repaired with sectional matrix band. There was a significant association between the proximal contact points and both groups (circumferential matrix band and the sectional matrix band) as shown in Table 1. Bitewing radiograph was used to assess the overhanging margin. Positive overhanging margins were found in 11 (13.8%). Negative overhanging margin found in 12 (15%).

Table 1: Association of matrix band system with proximal contact points

Matrix band system used	Proximal contacts				p-value
	Open contacts (%)	Tight contacts (%)	Optimum contacts (%)	Total (%)	
Group A (Circumferential)	34 (85%)	6 (15%)	0 (0%)	40 (100%)	000
Group B (Sectional)	10 (25%)	5 (12.5%)	25 (62.5%)	40 (100%)	
Total	44 (55%)	11 (13.8%)	25 (31.2%)	80 (100%)	

Table 2: Association of matrix band system with proximal margins

Matrix band system used	Proximal margins				p-value
	Positive overhangs (%)	Negative overhangs (%)	Absent overhangs (%)	Total (%)	
Group A (Circumferential)	5 (12.5%)	7 (17.5%)	28 (70%)	40 (100%)	0.802
Group B (Sectional)	6 (15%)	5 (12.5%)	29 (72.5%)	40 (100%)	
Total	11 (13.8%)	12 (15%)	57 (71.2%)	80 (100%)	

Table 3: Correlation between presence of overhanging margins and contact points (Open, tight and optimum proximal contact points)

Proximal margins	Proximal contacts				r	p-value
	Open	Tight	Optimum	Total		
Positive overhangs	9 (11.2%)	0 (0%)	2 (2.5%)	11 (13.8%)	0.192	0.088
Negative overhangs	8 (10%)	0 (0%)	4 (5%)	12 (15%)		
Absent overhangs	27 (33.8%)	11 (13.8%)	19 (23.8%)	57 (71.2%)		
Total	44 (55%)	11 (13.8%)	25 (31.2%)	80 (100%)		

Absent overhanging margins were found in 57 (71.2%). There is non-significant association between overhanging margin teeth restored with circumferential and sectional matrix bands (0.08) as shown in Table 2

Tables 1 and 2 show there are greater changes of overhanging margin and faulty contacts in teeth restored with circumferential matrix band. To find the correlation between the proximal contact point and the overhanging margin, Pearson's correlation was done. There was no significant correlation between the presence overhanging margin and the best possible contact points ($r = 0.19$, $p\text{-value} > 0.088$) as shown in Table 3.

A significant association between the sectional matrix system and optimal contact points. The circumferential matrix system is significantly related to both open and tight contacts.

DISCUSSION

It's crucial to master resin composite proximal tooth-colored restoration. The effectiveness of posterior composite restorations is influenced by a number of factors, including the proficiency of the practitioner, the properties of the material, and the application methods employed.¹² Therefore, this study took place to investigate the effects of two matrix band systems on proximal contacts and morphologies while rebuilding the class 2 cavities in permanent posterior teeth. In terms of attaining the best proximal contact and contour in the restoration of class 2 cavities, this study demonstrates that sectional matrix bands with separational rings are preferable than circumferential bands. For proximal restorations, circumferential matrix systems were historically used, but their use has decreased as sectional matrix systems have shown to produce anatomically appropriate contact points.¹³

In this study, sectional matrix bands with separation rings outperformed circumferential

bands in terms of reaching the ideal contact sites for proximal contact. This study found that 25 (62.5%) optimum contact were found with sectional matrix band system and 0 (0%) optimum contact were found with sectional matrix band. Multiple investigations revealed that pre-contoured sectional matrix bands produced resin restorations with the best shapes and contour in relation to traditional circumferential matrix bands.¹⁴ Previous studies have demonstrated that using pre-contoured sectional matrix bands with a separation ring produces superior contact tightness because the ring exerts interdental separation during restoration and because the matrix's contour mimics the proximal contours and emergence profiles of the teeth naturally.^{15,16} One study reported that regardless of operator experience, optimal contacts were strongly correlated with the circumferential matrix system whereas open and tight contacts were strongly correlated with the sectional matrix system.¹⁷

By employing the circumferential matrix system to execute restorations, this randomized clinical investigation found that faulty contact sites and open contact points were closely associated with the circumferential matrix system. The reasons for open proximal contact in the circumferential matrix group could be blamed on inadequate mobility of neighboring teeth caused by wedge placement and a flat matrix band.¹⁸ Wooden wedges swell when exposed to moisture in the mouth cavity; it was thought that this would help with interdental separation and cervical matrix band adaptation. Lesser degree of interdental separation occurs as a result of the fact that wooden wedges become brittle and flexible after absorbing oral fluids and adapt exclusively to the proximal region's natural anatomical contour.¹⁹

In this study, it was observed that on postoperative bitewing radiographs, sectional matrix bands offer a

more favorable proximal margin than circumferential matrix bands on postoperative radiograph. In comparison with circumferential matrix bands, which had 28 teeth with overhanging margins, sectional matrix bands had 29 teeth (72.5%) without them. When the Z test was applied, previous researchers reported a significant relationship between the circumferential matrix band system and negative overhanging margins (p -value = 0.00), and a significant relationship between the absence of overhangs and the sectional matrix band system (p -value = 0.005).²⁰

This study revealed that proximal margin and contacts points are best served by sectional matrix bands. Circumferential matrix band linked to overhanging margin and additional faulty contacts. Our findings are similar with previous research, which revealed that when Class II cavities were repaired utilizing a sectional matrix band and a separation ring, more optimum proximal contacts were observed when compared to a typical Circumferential matrix system without a separation ring.^{21,22}

Another study described new advances in matrix system technology have appeared, including improvements in matrix shape and strategies for interdental separation.²² With the aid of these developments, the dentist is now able to produce the optimum proximal contact surfaces and appropriate anatomical contours, important for the dentition's perfect form and function as well as for stimulating and maintaining the periodontal structures.²³

The study's limitation is the small sample size. A bigger sample size is still required to substantiate the findings of this study.

CONCLUSION

Failure to replicate the contact area will result in periodontal disease and tooth mobility. The sectional matrix band system performs better than circumferential matrix band system statistically in terms of achieving a tighter contact for class II composite restorations. Clinical choices may prioritize sectional matrix systems with separation rings for proximal posterior restorations.

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