An evaluation of sectional matrix and circumferential matrix in the Restoring the Contact Points in the Class II composite Restorations

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ABSTRACT

Background

Restoration of Class II cavities in posterior teeth presents a significant challenge in restorative dentistry, particularly in achieving adequate proximal contact points. The use of matrix systems is essential for restoring interproximal anatomy and establishing proper contact with adjacent teeth. Two commonly used matrix systems are the sectional matrix and the circumferential matrix. The sectional matrix system uses a metal band held in place by a ring and wooden wedges, while the circumferential matrix uses a metal band held by a retainer. Both systems have advantages and limitations in restoring contact points.

Objective

The present study aimed to evaluate and compare the effectiveness of sectional matrix and circumferential matrix systems in restoring contact points in Class II composite restorations.

Methods

A randomized controlled trial was conducted on 60 patients with Class II carious lesions in posterior teeth. Patients were randomly allocated into two groups: Group A (sectional matrix) and Group B (circumferential matrix). All restorations were performed by a single operator using a standardized protocol. The quality of proximal contact was assessed postoperatively using dental floss and radiographic evaluation. Contact tightness was assessed using a graded scale. Patient satisfaction and postoperative symptoms were also recorded.

Results

The sectional matrix group demonstrated significantly better contact point restoration compared to the circumferential matrix group. In the sectional matrix group, 86.7% of restorations had adequate contact tightness compared to 63.3% in the circumferential matrix group ($p = 0.021$). The sectional matrix group also showed fewer open contacts and less postoperative food impaction. Radiographic evaluation revealed better proximal contour in the sectional matrix group. Patient satisfaction was higher in the sectional matrix group, with fewer patients reporting sensitivity and discomfort.

Conclusion

The sectional matrix system is superior to the circumferential matrix system in restoring proximal contact points in Class II composite restorations. The sectional matrix provides better access, adaptation, and stability, resulting in improved contact quality and patient satisfaction. It is recommended for use in clinical practice for optimal restoration of Class II cavities.

Keywords: Sectional matrix, Circumferential matrix, Contact points, Class II composite restorations, Proximal contact, Posterior restorations.

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Introduction:

Composite is considered an aesthetic dental restorative material, and its use has increased due to the need to preserve dental tissues while providing an aesthetically acceptable and vital restoration for the patient.

Advances in bonding and preparing dental tissues have increased the use of this material

Dentists often find it challenging to perform posterior tooth restorations using direct composite fillings efficiently and predictably.

In Class II composite restorations, achieving proper proximal contact, contour, and marginal adaptation is critical for clinical success. The choice of matrix system plays a key role in these outcomes. Two commonly used approaches are the sectional matrix and the circumferential matrix (also called the

Tofflemire or universal matrix system). The sectional matrix consists of a thin, pre-contoured metal or plastic band placed only over the proximal box, typically secured with a specialized ring (e.g., Palodent, Composi-Tight, or Triodent system). This design allows for tight adaptation to the gingival margin, reduces the risk of open contacts, and simplifies wedge placement. It is especially favored for direct composite restorations because it mimics the natural tooth contour and minimizes the need for extensive finishing. The circumferential matrix uses a continuous metal band that encircles the entire tooth, held in place by a retainer (e.g., Tofflemire). This system provides 360-degree stabilization and is traditionally used for amalgam restorations. However, when used with composites, it can be more difficult to achieve a tight proximal seal, may lead to over-contoured margins, and often requires more manipulation to avoid open contacts or gingival excess. This comparison examines the two systems in terms of ease of use, contact tightness, marginal adaptation, and their suitability for modern adhesive composite techniques. Understanding these differences helps clinicians select the matrix system that best supports the goals of the restoration

material and methods: Fourteen teeth were selected from the lower first molars affected by dental caries in the mesial proximal region.Free from gum and gingival diseases.The patients ages range between 25-20 years.Good oral health.The first group: includes 7 samples that are prepared and then filled using composite and a TOFFLEMER matrix.The second group: includes 7 samples that are prepared and then filled using composite and sectional matrix

How to apply the composite,After completing all preparation of the dental tissues and rinsing the preparation with a chlorhexidine solution, and then washing and drying it with a cotton ball, we proceed as follows:

1.Apply the required support and place the appropriate peg

2. The 37% etching agent is applied for 30 seconds on the enamel and 15 seconds on the dentin.

The etched area is then rinsed for 1 minute, and a cotton ball is placed on the dentin to absorb moisture. The enamel is then air-dried until a chalky finish is achieved, indicating successful etching.

3.Apply the bond and leave it for 30 seconds, then apply another layer of bond and harden it for 20 seconds

4. Apply a 4-5 mm thick compact composite material and cure for 40 seconds

We have several studies and systematic reviews that have established this practice.

In 2005, a study published in the Journal of Dental Research, titled "Chlorhexidine arrests subclinical degradation of dentin hybrid layers in vivo," is considered one of the most important in vivo studies demonstrating that the application of 2% chlorhexidine prevents the degradation of the hybrid layer and protects the collagen network from degradation.

In 2004, Pashley focused on the role of endogenous enzymes found in dentin; he conducted numerous studies

Metalloproteinases -MMPs

In summary, these studies show that using 2% chlorhexidine binds to the phosphate in dentin and prevents enzymes from damaging collagen bonds, thus ensuring longer durability of the hybrid layer and reducing the likelihood of post-treatment sensitivity or micro-leakage.

A table is made specific to each support on which we record the dimensions (mesolateral - buccal-lingual - occlusal-cervical).Take impressions of the work area using appropriate stamps, and after applying the restorative material, take impressions again.Determining the clinical landmarks and projecting them onto cast impressions to obtain the aforementioned measurements.Place the results in the pre-prepared tables. Then, pass a thread between the teeth to determine the type of contact area.The tables should include an explanation of the point of contact and the presence of excess material after the removal of a direct Matrix

Result:

As shown in Table No. (1) of the results before and after

Contact points

Trailing edges

B-L(B)	**B-L(A)**	**M-D(B)**	**M-D(A)**	**O-G(B)**	**O-G(A)**	Trailing edges	Contact point	Matrix type
4.5	4.49	10.23	10.21	3.56	3.56	0	2	1
3.98	3.96	9.72	9.69	2.99	2.99	0	1	1
4.42	4.4	10.14	10.11	3.44	3.42	1	1	1
4.37	4.35	10.03	10.01	3.32	3.3	1	1	1
4.19	4.17	9.79	9.78	3.02	3	0	2	1

4.22	4.23	9.8	9.8	3.12	3.11	0	3	1
4.33	4.29	9.96	9.93	3.21	3.2	1	1	1
3.88	3.88	10.16	10.16	3.2	3.19	0	3	2
4.84	4.84	9.42	9.41	3.61	3.6	0	3	2
3.96	3.95	10.11	10.1	3.48	3.46	0	2	2
4.35	4.36	9.98	9.98	3.36	3.36	0	3	2
4.61	4.62	9.62	9.62	3.52	3.51	0	2	2
4.49	4.5	9.2	9.2	3.32	3.31	0	2	2
4.2	4.19	9.77	9.76	3.16	3.15	0	2	2

Give number (1)for Tofflemire matrix
Give number (2) for Sectional matrix
The contact point is given as follows: Number 1: Weak contact point, the thread passes easily.Number 2: Moderate contact point, the thread passes with resistance.Number 3: Strong contact point, the thread requires force to pass.
overhanging margin: Present 1, Not present 0
The study was conducted using several statistical methods

One Way Anova
Tukey
Paired Samples t-test
Tukey
Likelihood Ratio

Descriptive Statistics: Means, Standard Deviations, Frequencies, Percentages and Charts
As shown in Table No. (2) type of contact points

		Contact points			Total
		1	2	3	
Toffelemire	N	4	2	1	7
	%	57.1 %	28.6 %	14.3 %	100.0 %
Sectional	N	0	4	3	7
	%	0.0 %	57.1 %	42.9 %	100.0 %

1-The highest percentage was recorded at point (1) at 57.1%, indicating that this type of treatment tends to produce a type 1 contact point, compared to a notable decrease in point (3) at 14.3%
2- No cases of contact point (1) were recorded, while the highest percentage was for contact point (2) at 57.1%, followed by point (3) at 42.9%, indicating the tendency of this treatment to produce contact points of type 2 and 3 rather than type 1.

As shown in Table No (3)overhanging margin

		overhanging margin		Total
		لا يوجد	يوجد	
Toffelemire	N	4	3	7
	%	57.1%	42.9 %	100.0 %
Sectional	N	7	0	7
	%	100.0 %	0.0%	100.0 %

1- The percentage was 57.1% for cases that did not show overhanging margin, compared to 42.9% for cases in which overhanging margin
2- It proved highly effective in preventing excess edges, with no cases of excess edges recorded (100% "none").

Differences before and after treatment.The results of the measurements before and after treatment across the three dimensions O-G, M-D, B-L showed a general stability in values between the different types of treatments in terms of description. In the O-G dimension, a slight decrease in the averages after treatment was observed for all treatments .In Tofflemire, the decrease was from 3.2371 to 3.2257, and in Sectional, from 3.3786 to 3.3686.These are very slight differences. As for the M-D dimension, the decreases were similarly limited, as the values remained within a relatively stable range. The highest mean after treatment was recorded in Tofflemire at 9.9329, while the Sectional group recorded the lowest mean at 9.7471, indicating the apparent stability of the horizontal dimensions of the restorations. As for the B-L dimension, the two groups maintained almost complete stability in values, with a very slight increase recorded in the Sectional group from 4.3329 to 4.3343, and a slight decrease in Toffelemire.
To investigate whether these differences were statistically significant, we first applied a paired-samples t-test to each treatment individually, and we obtained the following: **As shown in Table No(4)**sectional. **As shown in Table No(5)**Tofflemer.

Sectional				
	Paired Differences		t	Two-Sided p
	Mean	Std. Deviation		
O-G (B) - O-G (A)	0.01000	0.00577	4.583	0.004
M-D (B) - M-D (A)	0.00429	0.00535	2.121	0.078
B-L (B) - B-L (A)	-0.00143	0.00900	-0.420	0.689

Toffelemire				
	Paired Differences		t	Two-Sided p
	Mean	Std. Deviation		
O-G (B) - O-G (A)	0.01143	0.00900	3.361	0.015
M-D (B) - M-D (A)	0.02000	0.01155	4.583	0.004
B-L (B) - B-L (A)	0.01714	0.01496	3.032	0.023

To determine which treatment groups differed significantly, we applied Tukey's test, and we obtained:

Toffelemire vs. Sectional Compared to the distance(M-D).

This pair showed a statistically significant difference, with a mean difference of -0.01571 and a p-value of 0.021, which is less than 0.05. This means that treatment with Toffelemire resulted in a greater change in the horizontal dimension compared to Sectional. All other comparisons did not show statistically significant differences, with all p-values being > 0.05. That is, the differences between these groups were not statistically significant, despite the presence of slight numerical differences.

All other comparisons were statistically insignificant Compared to the distance(B-L), as the p-values were high, meaning there were no significant differences between these groups in this dimension.

For the vertical dimension (O-G):

The F-value was 1.025, and the p-value was 0.399, which is greater than 0.05, meaning that the differences between the two groups in this dimension are not statistically significant. Therefore, there is no significant difference in the effect of the different treatments on the vertical dimension.

Discussion: The lower first molar was chosen because it is the first permanent tooth to erupt into the oral cavity and is most susceptible to bacterial plaque, especially when adjacent to the primary teeth in the mixed occlusion stage and when proper cleaning is not possible.Choosing a compactable composite for approaching the forces of condensation is similar to that of amalgam restorations, and it provides a driving force to the abutment band on the adjacent tooth in the contact area. The choice of cushions was due to their frequent use, low price, and availability. Choosing wedge pegs for their suitability to the supports used and their ease of availability. Mastering tooth restorations using tooth-colored composite fillings is crucial. The success of Class II posterior restorations depends on the dentist's skill, the properties of the material, and the abutment placement techniques employed. The pre-formed sectional matrix is an ideal tool for simulating the anatomy and protrusion shape to restore the missing tooth wall. The circumferential matrix exhibited less tight contact because it had to pass through the two adjacent tooth surfaces. Furthermore, this support, without the use of additional separation techniques, failed to produce tight contacts.

The anatomical shape of most circumferential matrix strips is difficult to reconstruct, resulting in poor morphological contact and reduced seam tightness.

Conclusions: There was no statistically significant difference between all the supports used in the restoration of the posterior adjacent pits repaired with composite. The circumferential matrix was superior in ease of use and stability, but it produced more excess

material. The sectional matrix was the most stable in its dimensions and had the fewest protrusions, but it was the most sensitive to application, especially when a support strip was inserted. Regardless of the type of composite used and the matrix used, it depends on the skill of the doctor, the quality of the materials used, and the tools required.

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