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Original Research

The usage of Matrix Band by Dental Students in Class II Restorations

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ABSTRACT
Introduction: In the past10 to 15 years, operative dentistry has been improved to be as needed as possible, with a new development away from GV Black's 'extension for prevention' to the up-to-date minimum intervention concepts, due to understanding of the carious process, the advances of adhesive aesthetic materials and a gratitude of the consequences of the removal of hard tooth structure. There was a huge expansion of resin composite dentistry over the last few decades. During the placement of resin restorations, the resin is polymerized direct in situ. As a consequence of polymerization, resin composite is accompanied by shrinkage. Shrinkage will be directed the stresses to the along restoration interfaces. **Materials and methods:** A questionnaire will be modified. The questionnaire is designed to elicit information from dental students regarding their knowledge about the matrix band placement. The target population from 4th year-6th year dental students. **Results:** The majority of the participants were female (61.3%, n=245). The distribution of the participants by year and University. Almost all the participants (99.0%, n=396) practice restorations for class II cavity. In class II cavities, the majority prefer composite restorative material, use tofflemire matrix band (82.8%, n=372), and place a wedge while doing restorations (95.8%, n=383). **Conclusion:** Amongst dental students and intern in Saudi Arabia, 95% of them practiced on composite class II restoration. They preferred to use matrix band "tofflemire" for restoration. Almost, all of them using wedges and polish of restoration. Also, most of them take 10 to 20 minutes to prepare the class II cavity preparation. Failure of restorations is common, and the commonest failure is Open margin restoration.
Key words: Class II composite restorations, tofflemire retainer, dental students, failure, overhang.

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INTRODUCTION

In the past10 to 15 years, operative dentistry has been improved to be as needed as possible, with a new development away from GV Black's 'extension for prevention' to the up-to-date minimum intervention concepts, due to understanding of the carious process, the advances of adhesive aesthetic materials and a gratitude of the consequences of the removal of hard tooth structure. There was a huge expansion of resin composite dentistry over the last few decades. During the placement of resin restorations, the resin is polymerized direct in situ. As a consequence of polymerization, resin composite is accompanied by shrinkage. Shrinkage will be directed the stresses to the along restoration interfaces. Moreover, these shrinkage forces will lead to marginal discrepancies. It is will be distinguished in Class II gingival margins after the use of dye solutions during examining them. In class II the margins by essential usually end up below the enamel-dentin margin. In the studies of Dye penetration that has been done on Class II resin-composite restorations have, over time, regularly shown that if the margins were placed above the CEJ they will have better performance than those margins placed below the CEJ. [1-4]

Nowadays, Resin composite materials (RC) are progressively used more than amalgam in Class II cavities in posterior teeth. Perfect esthetics and reasonable longevity compared with amalgam restoration, sometimes with larger restorations, longevity may be affected. In the cavities with the cervical margin located at or below the CEJ with poor marginal adaptation significant leakage was shown in vitro. Whatever, the shrinkage of composite is the main disadvantages that happens during polymerization process.

The free curing shrinkage for resin composites varies from 1.0% to 5.0% with post-gel shrinkage values as low as 0.2%–2.0%. The matrix of the resin composite material is stiff after polymerization to resist plastic flow, when

the adhesive bond to the cavity walls blocks the shrinkage. Therefore, it will result in a relatively high stress formation in the restoration, which can lead to separation from the cavity walls or cohesive fractures in tooth substance or filling material. [1]

In the dental institutions and the private practices there is huge differences in the treatment scenarios. There are major differences between the method taught to students of educational institutions and each individual knowledge. In restorative procedures, there is some failed restorations has been recorded. In the twenty first century, there was a massive demand for dentists with the evolution of new materials; it is challenging to identify one best method of practice. Faulty dental restorations and prostheses are common causes of gingival inflammation and periodontal destruction. [5-7]

The preparation for a class II carious lesion can be restored with amalgam, direct, inlays, or onlays (cast metal or tooth colored). The large the preparation (and, therefore, the thinner the remaining tooth structure), the more appropriate a cast metal onlay might be to protect the remaining thin tooth and provide adequate resistance from (figure). Recent improvements in composite restorative material and techniques have resulted in increased use of this tooth colored material for Class II restoration, especially when esthetics is an important factor.)

Extension for prevention (Class II)

To reach Class II lesion, the dentist must, in most cases prepare a proximal box that extends apically through the marginal ridge in order to reach the decay which forms just cervical to the proximal contact. The Class II preparation often extends over some of occlusal surface to include adjacent occlusal pit and fissures as in a Class I preparation, whereas the proximal box might be compared to a stair-step descending gingivally off of the occlusal portion (figure).

The buccal and lingual walls of the proximal box of Class II preparation are extended beyond the proximal contact areas just into the buccal and lingual embrasures. In this way, the margins of restoration can be better evaluated by the dentist and kept clean by the patient.

Retention form (Class II)

For Class II amalgam cavity preparation, the buccal and lingual walls of the occlusal portion and the proximal boxes are prepared so that they converge towards the occlusal to prevent the restoration from dislodging occlusally as in the Class I preparation. Retentive grooves may be prepared buccally and lingually in proximal box as extension of the internal vertical wall of the box that is aligned along the long axis of the tooth, and is therefore called the axial wall.

Cavity Nomenclature (Class II)

Class II lesion involve just one or both proximal surfaces of posterior tooth, but since obtaining access into the proximal lesion normally requires breaking through the occlusal marginal ridge, these restorations involve a minimum of two (occlusal and mesial or occlusal and distal) or three (mesial, occlusal and distal) surfaces. A proximal box has vertical buccal, lingual, and axial walls (the axial wall is along axis of the tooth), and a horizontal gingival wall (or floor).

MATRIX BANDS AND MATRIX RETAINERS

When a restoration involves an interproximal surface, it is not possible to achieve a properly adapted restoration without a matrix band. A matrix band creates a temporary interproximal surface, and, when appropriate, a matrix retainer secures the matrix band in place.

Name

Matrix material.

Function

Used to form a temporary wall where a proximal surface has been removed or is missing

Varieties

(a) Celluloid strip used for anterior restorations with composite materials, also referred to as clear transparent matrix strip. Single use, disposed of in the sharps' container, preformed posterior variety can be available.

(b) T-band matrix (straight and curved) most commonly used in pedodontic. Single use disposed of in the sharps' container.

(c) Stainless steel matrix band (universal) used in conjunction with amalgam restorations and a matrix retainer. Single use disposed of in the sharps' container different sizes and shapes available, Available in pre-contoured shapes.

Name

(a) Tofflemire matrix retainer (b) Siqveland matrix retainer

Function and features

Used to hold a stainless steel matrix band securely, Assembled to fit in a particular quadrant of the mouth, Autoclavable.

Varieties

Can be available in disposable plastic

Name

Sectional matrix, and BiTineTM ring.

Function and features

Used in conjunction with posterior restorations to temporarily replace proximal walls during Class II restorations.

Available in four sizes: pedodontic, bicuspids, smaller molars and standard molars

The matrices are shaped to conform to tooth shape

Varieties

Many different systems available

Name
Hawe Supermat Matrix

Function and features
Used in conjunction with posterior composite and amalgam restorations to temporarily replace proximal walls during restorations
Available in different sizes to adapt to different sized teeth
Available in stainless steel and clear matrix materials
The matrices are shaped to conform to tooth shape

Varieties
Many other different types available from different manufacturers

Name
(a) Wooden wedges (b) Plastic wedges

Functions and features
Used in conjunction with a matrix band, sectional matrix or celluloid strip, Help to support and adapt the matrix to the tooth, Assist in maintaining adequate contact points between two adjacent teeth, Essential for the elimination of overhangs.
Single use, Disposed of in the sharps' container.

Varieties
Various sizes, shapes and materials.

Name
Light-reflecting wedges

Functions and features
Used in conjunction with a matrix band and composite restorations, reflect the light from the curing light onto the composite material, help support and adapt the matrix to the tooth, assist in maintaining adequate contact points between two adjacent teeth, Essential for the elimination of overhangs.
Single use Disposed of in the sharps' container.

Varieties
Various sizes and shapes available.

Failure of class II composite restoration
The insertion of a Class II composite restoration requires proper matching for contact formation, correct placement of enamel and dentin bonding agents, incremental placement of the composite material, and careful finishing. Marginal adaptation and microleakage prevention is most critical at the gingival margin. The formation of an adequate contact during the insertion of a Class II composite restoration can be particularly challenging and several matching systems are available for this purpose.[1,2]
Hybrid resin composite materials are highly filled to provide strength, wear resistance and relatively low polymerization shrinkage as required for restorations in the posterior teeth. The most common reasons for the failure of posterior composite restorations are secondary caries and marginal deficiencies. Studies show that the bond to gingival margins is poorer than to axial margins in Class II restorations. The presence of enamel is still the most effective means of minimizing leakage at the gingival margins. The application of a dentin bonding agent is required to form a resin-infiltrated hybrid layer to form a seal against microleakage and to help retain the restoration.[5] Despite the introduction of simplified adhesives, the 3-step total-etch dentin bonding system remains the gold standard.
Insertion strategies to decrease polymerization shrinkage stresses and microleakage at the tooth margins have been proposed. These include incremental filling techniques, such as the use of diagonal layers to decrease the C factor, and different light application methods such as directed, ramp or pulsed light curing techniques to control the rate of polymerization shrinkage. However, the study results for these techniques are mixed5-8 and there is no strong evidence to support anything other than a careful adaptation technique to avoid marginal gaps and to avoid the development of voids or incremental defects.[6]
It has been hypothesized that a layer of resin-modified glass ionomer at the gingival margin in a "sandwich" technique could reduce the incidence of secondary caries development because of its fluoride release properties9. However, the potential advantage of the glass ionomer layer must be weighed against the increased technique-sensitivity of the additional material layer and possible dissolution of the resin-modified glass ionomer material. [20]The use of flowable composites has also been advocated as an easier material to apply at the gingival margins of proximal boxes. However, flowable composites have greater polymerization shrinkage, weaker mechanical properties, less radiopacity than conventional composites and void entrapment is still possible with the use of flowable composites. No significant advantages in marginal quality or microleakage have been demonstrated to support the routine use of flowable composites as an initial composite increment.[6,7]
An interproximal posterior tooth contact is composed of two adjacent tooth surfaces that are closely approximated to resist food impaction and maintain tooth position in a mesio-distal direction. [13]The contact area is generally 2-3 mm occlusal-gingivally, beginning 1 mm below the crest of the marginal ridges and ending within the middle third of the tooth. The bucco-lingual width of the contact should be broad, approximately 1/3rd the buccolingual width of the tooth. The contact area should be surrounded by and flow into occlusal, gingival, buccal and lingual embrasures.[2,9]
Anatomically correct and tight contacts are difficult to achieve with resin restorations because resin composite materials are not "condensable". [10,11]The use of amalgam matrix bands for resin composite restorations generally leads to straight point contacts that are located in the occlusal third of the tooth. Matrix systems for resin composite materials are designed to create curved proximal surfaces and tight contact areas. These are generally comprised of thin contoured matrix bands and

tooth separators. Tooth separation can be accomplished by rings which have tines that exert separating forces on the teeth, applied instruments and/or wedges. [12,13] A contact forming instrument can also be used for tooth separation. Contact forming instruments should not be used passively. Some force is necessary to press the matrix band against the adjacent tooth and create tooth separation. The resin composite material at the gingival aspect of the contact area is photo-polymerized while the contact forming instrument is held in place. [15,17] This sets the matrix position and tooth separation, and the remainder of the proximal box can then be restored. Technique difficulties associated with the use of contact forming instruments include management problems with the first layer application and control of exuded material, and difficulty in removing the instrument after material set. [14,18,19]

RESULTS:

Table 1. Demographics

		Frequency (n)	Percentage (%)
Gender	Male	155	38.8
	Female	245	61.3
Year	3rd year	21	5.2
	4th year	62	15.5
	5th year	141	35.2
	6th year	132	32.9
	Internship	45	11.2
University	King Saud university	97	24.2
	King Abdulaziz university	96	23.9
	Emam Abdulrahman Al Faisal university	1	.2
	Riyadh Elm university	151	37.7
	Qassim university	27	6.7
	Dar Al Uloom university	29	7.2

Table 2: Perception of dental students

		Frequency (n)	Percentage (%)
Do you practice restorations for class II cavity?	Yes	396	99.0
	No	4	1.0
What type of restorative material you prefer in class II cavities?	Amalgam restoration	19	4.7
	Composite restoration	382	95.3
Which type of matrix band is used for class II restorations?	Mylar strip	21	5.2
	Tofflemire	372	92.8
	Sectional matrix system	8	2.0
Do you place a wedge while doing class II restorations?	Yes	383	95.8
	No	17	4.3
How much time do you require to perform a class II restoration?	<10 mins	11	2.7
	10-20 mins	220	54.9
	>20 mins	170	42.4
Have you encountered any failures during restoration of class II?	Yes	217	54.3
	No	183	45.8
If yes, what is the type of failure?	Overhang restoration	93	41.7
	Fractured restoration	6	2.7
	Open margin restoration	124	55.6
The failure rate in your opinion will be more with?	Amalgam Class II restoration	22	5.5
	Composite Class II restoration	34	8.5
	It depends on the application of the matrix band	343	86.0
What is the survival rate of class II amalgam restoration?	1-3 years	1	.2
	3-5 years	7	1.7
	5-10 years	36	9.0
	>10 years	357	89.0
What is the survival rate of class II composite restoration?	1-3 years	6	1.5
	3-5 years	39	9.7
	5-10 years	343	85.5
	>10 years	13	3.2
Which type of composite do you use for class II composite restoration?	Micro filled	157	39.2
	Conventional	192	47.9
	Nanofilled	48	12.0
	Flowable	4	1.0
Do you use incremental composite placement technique?	Yes	291	72.6
	No	110	27.4

DISCUSSION:

In dental colleges, the students are subjected to various treatment methods and modalities available or recommended for a particular case but in clinical practice, the perception of practitioners varies from case to case. The choice of treatment varies and the cause may be cost, time, method or material etc. In this study, an average of 99% of practitioners practice class II restorations. A majority of the undergraduate dentists and intern use Tofflemire matrix system. In order to be effective in sealing the preparation, Tofflemire matrices provide little help in creating proper interproximal contact, both in the shape and position of the contact or the actual strength of contact, all of which influence the potential for food impaction.

MJ Tyas, et, 2000 said: 'Amalgam has the longest clinical service life, but is associated with more tooth fracture. Secondary caries is the main reason for replacing restorations. The anti-cariogenic effect of glass-ionomer cement is equivocal''.

Andersson-Wenckert IE, et, 2002 said: ''It can be concluded that open sandwich restorations with resin-modified glass ionomer cement showed a high percentage of gap-free interfacial adaptation in vivo. The different curing and application techniques of the resin composite did not influence the interfacial adaptation. Adaptation to dentin and cervical enamel was significantly better for the resin-modified glass ionomer cement than for the resin composite. Long-term clinical evaluations are necessary to further determine the durability of the restorative technique''.

JOHN KANCA III, DMD et, 2009 said: "It was concluded that the finishing procedure itself causes damage to the resin- dentin interface, which allows dye penetration to occur. This could potentially explain why resin adhesive materials have fared so poorly in Class II in vitro investigations, which is not the common clinical experience''.

Sweta.V.R*et, 2016 said: "In conclusion, dentists should have a wide knowledge about the various methods of restoration, materials available and the latest advancements in dentistry to perform successful procedures that benefit both the dentist and the patient''.

The result of our research matched the other result. Most of the students and intern who responded to our Survey were from Riyadh Elm University.

CONCLUSION:

Amongst dental students and intern in Saudi Arabia, 95% of them practiced on composite class II restoration. they preferred to use matrix band "tofflemire" for restoration. Almost, all of them using wedges and polish of restoration. Also, most of them take 10 to 20 minutes to prepare the class II cavity preparation. Failure of restorations is common, and the commonest failure is Open margin restoration. Survival rate of amalgam was mostly more than 10 years and composite restorations was 5-10 years. Conventional composites were being used more than other types. In conclusion, dentists should have a wide knowledge about the various methods of restoration, materials available, and the latest advancements in dentistry to perform successful procedures that will benefit the dentist and the patient.

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