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The Influence of Placement Technique and Composite Type on the Proximal Contact in Class II Resin Restorations

Radwa AK. Dabbagh[1*] , Mohammed A. Elyasaky[2], Doaa A . Elsharkawy[3]

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azhardentj@azhar.edu.eg

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ABSTRACT

Purpose: To evaluate the influence of the placement technique and type of composite resin on the restoration of proximal contact in class II resin composite restorations in comparison to amalgam restoration. **Materials and methods:** 100 standardized mesiooclusual (MO) cavities were prepared in 100 artificial mandibular first molars used in the study grouped into four groups according to type of restorations; (co): amalgam restorations (10 specimens),(C1): flowable composite (nanohybrid Z350) (30 specimens),(C2): conventional / regular composite (nanohybrid Z250) (30 specimens), (C3): packable composite (microhybrid P60) (30 specimens).The composite restoration groups were further divided into three groups 10 specimens each according to placement techniques as follows:(P1): Tofflemire matrix system. (P2): sectional matrix system with special rings.(P3): transparent matrix system. Tensometer was used to measure the contact tightness and the length of the contact arc. **Results** Data was analyzed using two way ANOVA. Results showed that using transparent matrix with conventional composite was the only group that showed higher statically significant results to the control group. **Conclusion:** Amalgam is still superior to composite resin in restoring proximal contact, Packable (condensable) composite offers neither advantage nor other composite in restoring contact, Matrix system performance varied according to composite type used.

KEYWORDS

Composite resin,
Matrix systems,
Contact tightness

INTRODUCTION

A major challenge when placing any Class II restoration is the establishment of an anatomically shaped and positioned proximal contact.(1) This challenge is greater with composite resins because of the handling

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1. Dentist at ministry of health, Egypt.
2. Professor of operative dentistry Faculty of dental medicine for Girls, Al-Azhar University, Cairo, Egypt
3. Assistant professor of operative dentistry, Faculty of dental medicine for girls , Al-Azhar University, Cairo, Egypt

* Corresponding author email: radwafloweer@hotmail.com

characteristics and physical properties. There is a direct correlation between the type of proximal contact and food impaction and pocket depth and food impaction [2]. Overhanging restorations are causes of gingival inflammation and attachment loss[3,4] while loose proximal contact are causes of plaque accumulation [5] . On the other hand, the too strong proximal contact causes impaction of dental floss that lead to periodontal trauma by excessive force applied during flossing [6] . To solve these problems; trials like using high viscous composite were proposed to cure the deficiency of being uncondensable to fulfill varying success. The flowable composite has wettability and has improved to be more suitable to posterior restorations after modification. The conventional composite also has successful results in many studies as it becomes nowadays suitable to posterior restorations [7-12]. In addition, there are varieties of matrix systems with wedges and separating rings are used in trials to reach the best results in creating proximal contour [13,14]. This study was performed to know what are the effects of composite types according to viscosity, and matrix types on the proximal contact tightness in class II restorations.

MATERIALS AND METHODS

Standardized mesiooclusual (MO) cavities were prepared in 100 artificial mandibular first molars, first cavity was prepared in one acrylic molar with definite dimensions; The proximal box: 1.5mm mesio- distally, 4mm occluso- gingivally and 4mm bucco- lingually. The occlusal part: 2.5mm mesiodistally, 2mm occluso- pulpally and 2mm buccolingually. Then the prepared molar was used to create a metallic cast guide by taking impression of this cavity and fabricating the metallic cast. This metallic cast was used for replication of 100 molar with identical class II cavities by preparing the 100 cavities through the metallic cast. The 100 specimens were first divided into four groups according to restorative materials as group (C0) received dental amalgam (10 specimens) serve as a positive control group. (C1) received flowable composite (nanohybrid Z350) (30 specimens). (C2) received conventional / regular composite (nanohybrid Z250) (30 specimens). (C3) received packable composite (microhybrid P60) (30 specimens). Then the composite restoration groups were further divided into three groups 10 specimens each according to placement techniques as (P1) restored using tofflemire matrix system, (P2) restored using sectional matrix system with special rings and (P3) restored using transparent matrix system. All specimens were restored after were placed properly in the corresponding sockets in order to be filled; a little pressure was done on their occlusal surface to assure their stability in the arch. A number of wooden wedges were tried till the suitable size was selected which was the medium size was placed in the embrasure from the lingual aspect. The group (C0) was restored with dental amalgam using Cavex capsules which were mixed in amalgamator for 15 seconds according to manufacturer. Amalgam was condensed first against the metal matrix using metal condenser and against the pulpal wall, buccal and lingual walls in the proximal box, then it was condensed against the roof of the pulp and walls of class I cavity. Then slight burnishing and carving was done. The group C1 was restored with flowable composite (Filtek™ Z350 XT) using flowable restorative dispensing tip the composite was injected first in the proximal box up to the level of the pulpal floor of 2 mm thickness in an increment. This layer was cured for 20 seconds. Then the rest of the proximal box of thickness 2 mm occluso-pulpally along with the occlusal part of class I with the same thickness in the same horizontal level was filled by injection one time and cured for 20 seconds one time. The group C2 was restored with (Filtek ™ Z250 XT) composite. The composite was placed into the cavity in three layers using metal composite applicator. The first layer was pushed towards the matrix to build the proximal surface of the restoration with a mesio-distal thickness of 1mm.Then the cavity was completed with restoration up to the level of the pulpal wall. The thickness of the cervico pulpal wall was 2 mm. The rest of the cavity was filled with one layer (occlu-

so-pulpal) was 2 mm. Each layer was cured for 20 seconds. The group C3 was restored with (Filtek™ P60) composite. It was inserted into the cavity in the same manner as the conventional/ regular composite and light cured. Every time when teeth get measured, pressure was done on the occlusal surfaces to assure stabilization.

Measuring procedure

This procedure was done in the National Institute for Standards (NIS) in Egypt. An apparatus called Tensometer was used to measure the contact tightness and the length of the contact arc. Tensometer consisted of a custom-made setup. The custom made setup was a metal tray with a central hole where a screw was inserted to fix the manikin model in a stable position. The setup was fixed onto a testing machine (Tensometer). The forces were applied by this machine in vertical direction on the interdental areato be measured. A custom made retainer was designed to fit the other end of the tensometer where an orthodontic wire was mounted. It helped to maintain the wire at a horizontal position throughout the movement. The wire was placed under the contact area in a bucco-lingual direction and moved at a speed of 5 mm/minute in the occlusal direction using a load cell of 1 KN. The resistance forces of the wire during movement in contact area of interest were recorded through a digital sensor attached to a computer. This sensor measured these forces in Newton during the movement. The maximum value was recorded representing the tightest contact. Each proximal contact was measured one time and the wire was changed after only three consecutive movements during measuring.

RESULTS

The two way ANOVA analysis was used to compare between the groups and analyze the data. The out coming results were obtained and presented (table 1 &2) and (fig.1). Contact tightness: Contact tightness was evaluated by measuring resistance force of the wire passing through contact with means of Newton. The data showed the types of composite showed a statistical significant difference on mean Resistance force (N). Amalgam was consistently higher in means of contact tightness. Additionally the matrix techniques had a statistical significant difference on mean Resistance force. These data showed that resistance force regardless of other variables, conventional composite (C2) showed significant difference when tofflemire circumferential matrix was used. On using sectional matrix, no significant difference was found between all composite types. However, using transparent matrix with conventional composite was the only group that showed higher statically significant results to the control group.

Table (1): *Mean and SD for Resistance force (N) between different Composite types regardless of other Variables:*

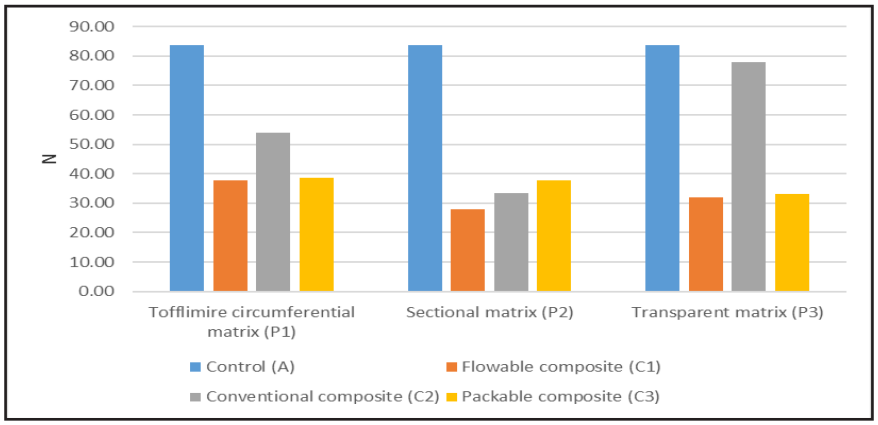
		Composite type								*P*-value
		Control (A)		Flowable composite (C1)		Conventional composite (C2)		Packable composite (C3)		
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Resistance force (N)	Tofflimire circumferential matrix (P1)	83.60[a]	8.82	37.80[c]	5.17	54.00[b]	5.57	38.60[c]	3.65	≤0.001*
	Sectional matrix (P2)	83.60[a]	8.82	28.00[b]	1.73	33.33[b]	3.51	37.67[b]	1.53	≤0.001*
	Transparent matrix (P3)	83.60[a]	8.82	32.00[b]	7.11	77.80[a]	6.14	33.20[b]	3.27	≤0.001*

NS= Non-Significant **= Significant at p≤0.001*

Table (2) *Mean and SD for Resistance force (N) between different Placement techniques Regardless of Other variables*

	Placement technique						p-value
	Tofflemire circumferential matrix (P1)		Sectional matrix (P2)		Transparent matrix (P3)		
	Mean	SD	Mean	SD	Mean	SD	
Resistance force (N)	53.50[a]	19.83	33.00[b]	4.69	47.67[a]	22.69	≤0.001*

*NS= Non-significant, *=Significant*



Figure(1) Bar chart showing the mean Resistance force (N) between different Composite types within other Variables.

DISCUSSION

Composite consistency is claimed to have an effect on the tightness of the contact area. Due to its physical properties, it is difficult to be condensed against the matrix band. This study used packable, conventional and flowable composites. Also many studies have concluded that the type of the matrix system has a significant difference in the results. This lead to many trials to design different matrices in terms of material, design and wedge systems in an attempt to improve construction of composite contact area. In this study metal circumferential, metal sectional and transparent matrices were used. The results of the study showed that amalgam to have highest values of tightness and contact area. This was agreement with other authors[15]. This is due to the heavy consistency of amalgam alloy that help the condensation against the matrix. In regards to the type of composite, the conventional composite was the only composite to be affected by the placement technique. It showed the highest values of contact tightness and area in most of the specimens followed by flowable composite. This was in agreement with the belief of other studies [16] who found that conventional composite gives more significant results than packable composite. The transparent matrix showed increase in values more than the sectional especially with conventional composite. This was in agreement with a study [17] and in disagreement with another study.[18] This may be due to the similarity of the omni matrix holder to that of the tofflimire. Also this may be due to the small thickness of the transparent omni matrix as it is fabricated from celluloid thin material.

CONCLUSION

With limitation of this study, packable (condensable) composite offers no advantage nor other composite in restoring contact. Matrix system performance varied according to composite type used.

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