

## Comparison of Two Different Types of Matrix Systems in Class II Composite Restorations

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### Abstract

**Introduction:** The aim of this study was to evaluate clinical capability of studied matrices in restoring a successful natural contact area with the adjacent tooth and compare the results of class II resin composite restorations of two different matrix systems, in terms of the contact tightness and the simplicity of the application of each one.

**Materials and Methods:** We chose 32 patients in our clinic from February 2014 to April 2015. They had the following entry criteria: 1- Medically fit patients, 2- Nonsmokers, 3- Educated, 4- Have good oral hygiene, 5- Age ranging from 20 to 40 years, 6- Each patient must have two class II caries infected molar teeth or premolar, or one molar and one premolar regardless of the location, 7- The size of the cavity was moderate with 3 mm in depth and 4 mm in width with supragingival margin. The patients served as their own controls; one tooth was restored using the Automatrix system and the other using the Palodent Plus system. Accordingly, there were 64 teeth treated in two groups: group 1 treated with Automatrix system (32 teeth) and group 2 treated with the Palodent Plus system (32 teeth).

**Results:** Restorative procedures were done for 32 patients (20 females and average age  $34.6 \pm 4.0$ ). We found significantly better contact tightness by x-ray, contour by x-ray and direct inspection, contour grading of the restoration, and time consumed in the procedure with less number of retreatments with the use of the Palodent matrix system than with the use of Automatrix system. However, there was only a trend for less open margins with the Palodent system compared with the Automatrix system ( $P = 0.054$ ). The follow-up of the different parameters after restoration procedure, one, three, and six weeks showed stability of the restored teeth without significant changes.

**Conclusion:** Our study found a potential advantage of using the Palodent Plus system in improving the outcome of the restorative procedure of class II cavities than the Automatrix system. A large study is necessary to confirm our results.

**Keywords:** Matrix Systems; Class II Composite; Automatrix System; Palodent Plus System

### Introduction

In the 1990s and 2000s, composites were greatly enhanced and have compression strength sufficient for use in posterior teeth. To be effective and consistently successful when placing posterior composite restorations, the dentist should first comprehend the fundamental cause of various clinical problems, and then use instruments and procedures that are distinctive to this material. Since the toxicity of the amalgam mercury has produced alertness for people, the posterior composite replacing amalgam increased and became widely famous. The protection of the periodontium to avoid food impaction by proximal contact availability is important [1].

However, when applying the composite material, there were many drawbacks that have challenged the dentists with the conventional matrix. Those reasons of struggle in obtaining a tight proximal contact with resin composite had a relevant reason with the intrinsic polymerization contraction and absence of condensability of resin composite materials [2], the use of a rubber dam [3], both cervical-occlusal and buccal-lingual direction of the proximal surface of the convex framework [4], and the matrix band's thickness and elastic displacement [5]. Several techniques and instruments have been proposed in an effort to provide tighter and more anatomic proximal contacts [6]. From the early 18th century, many forms of matrices have been introduced for clinical use. Some of the former matrices are no longer obtainable. However, specific matrices may be more appropriate for a particular application than others. Therefore, acquaintance with the wide range of matrices available is looked-for [7]. The Automatrix system, retainless matrix, comprises of four types of ribbons, which can be adjusted to any tooth, regardless the perimeter [8]. In 2011, DENTSPLY Caulk presented a new generation of Palodent® - Palodent® Plus, provides the concept of the BiTine ring to new levels of performance by merging it with anatomically contoured matrices, wedges, and wedge guards that collaborate to convey precise, tight contacts.

### Aim of the Study

The aim of this study was to evaluate clinical capability of studied matrices in restoring a successful natural contact area with the adjacent tooth and compare the results of class II resin composite restorations of two different matrix systems, in terms of the contact tightness and the simplicity of the application of each one.

### Materials and Methods

#### Patients

We chose 32 patients in our clinic from February 2014 to April 2015. They had the following entry criteria: 1- Medically fit patients, 2- Nonsmokers, 3- Educated, 4- Have good oral hygiene, 5- Age ranging from 20 to 40 years, 6- Each patient must have two class II caries infected molar teeth or premolars, or one molar and one premolar regardless of the location, 7- The size of the cavity was moderate with 3 mm in depth and 4 mm in width with supragingival margin.

The patients served as their own controls; one tooth was restored using the Automatrix system and the other using the Palodent Plus system. Accordingly, there were 64 teeth treated in two groups: group 1 treated with Automatrix system (32 teeth) and group 2 treated with the Palodent Plus system (32 teeth).

Informed consents were obtained from all the patients and the study was approved by the research department of our university.

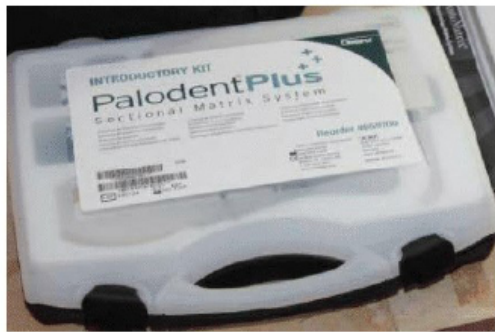
#### Materials

##### Matrix systems

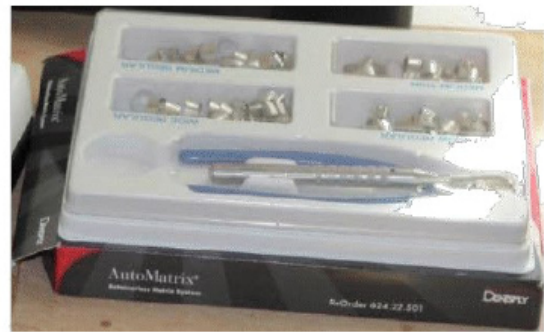
We used two systems: The Palodent Plus sectional matrix system and the Automatrix retainless matrix system (DENTSPLY, Philadelphia, USA).

The Palodent Plus contains universal ring, small, medium and large wedge guards, small, medium and large wedges, matrices (sizes 3.5 mm, 4.5 mm, 5.5 mm and 6.5 mm), forceps, and pin tweezers.

The Automatrix retainless matrix system contains automate III tightening device, pair of snippers, medium-regular bands, medium-thin bands, wide-regular bands and narrow-regular bands.



The Palodent Plus kit



The Automatrix kit

We used the packable composite as the main restorative material.

### Restorative procedure

Initially, we scaled the teeth by ultrasonic system and cleaned with pumice by rotary brush. Then, we anesthetized the targeted tooth topically and locally, isolated it by rubber dam. A wedgeward was applied interproximally and the tooth was prepared. After we entirely removed the caries without any extension; we removed the wedgeward by the tweezers and applied the matrix. Then, we applied the wedge interproximally by tweezers and we held the universal ring by forceps in place around the neck of the tooth supporting the wedge. After we acid etched the tooth for 20 seconds and applied the bonding agent cured for 20 seconds, we placed the composite incrementally, each of which was cured for 40 seconds. Then, we removed the matrix system and finished and polished the final restoration. Finally, we checked the occlusion and flossed interproximally to check the contact tightness. We obtained an x-ray after these procedures to check for gingival contact. Then, we followed up every 1, 3 and 6 weeks.

During the same session in the same patient, we applied the Automatrix system on another molar or premolar tooth following the same restorative preparation steps mentioned above. However, the application of the Automatrix system was different from the Palodent matrix system; we selected the band size from the Automatrix system kit and transferred it around the tooth by the use of pair of snippers and we applied a wedge interproximally. Then, we tightened the matrix by an automated III tightening device.

### Evaluation of the procedure

We measured the following parameters to evaluate the success of the procedure:

1. The contact tightness was measured by the X-ray directly after the procedure with the score of present or absent.
2. The outer contour of each restored tooth by direct inspection and by x- ray with the score of optimal or sub optimal.
3. The time consumed to apply both matrix systems to measure from the start of the application of the matrix to the end of application of the restoration and occlusion checkup. The difficulty of application of any of the two systems was measured by the time consumed for the application.
4. Number of retreatments of failure of restorative procedures with either matrix systems.
5. Presence of open margins on x-ray.

The scores of the measurement:

1. Excellent contact area – perfect contour.
2. Good contact area- acceptable contour.
3. Bad contact area – weak contour.

**Statistical analysis**

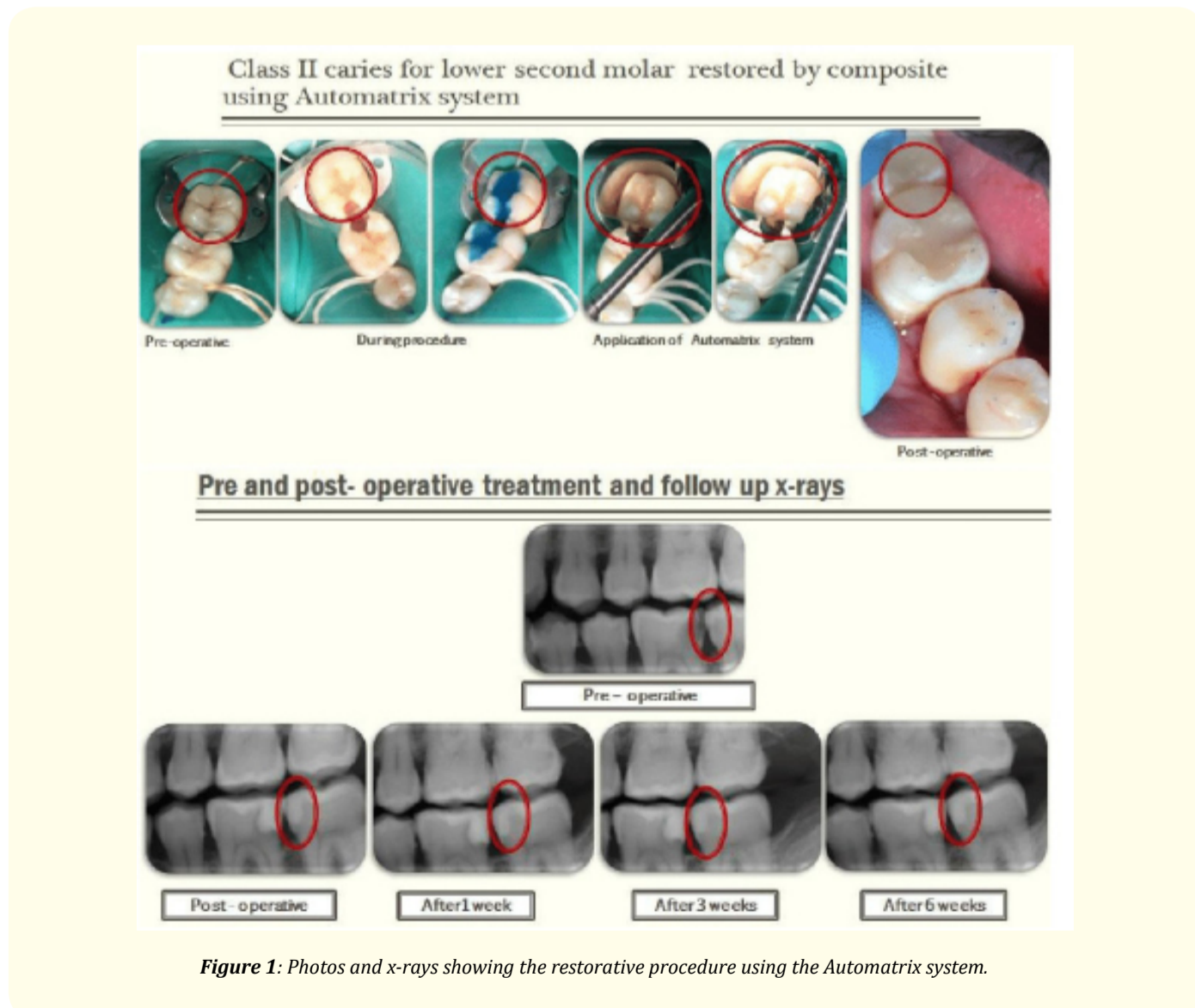
We did statistical analysis to measure the differences of the results by the use of the SSPS system. The values of the continuous parameters were expressed as the mean ± the standard deviation (SD). Comparison of the means was done by using the Student “T” TEST. The non-continuous parameters were compared with the X<sup>2</sup> test. P values < 0.05 were considered significant.

**Results**

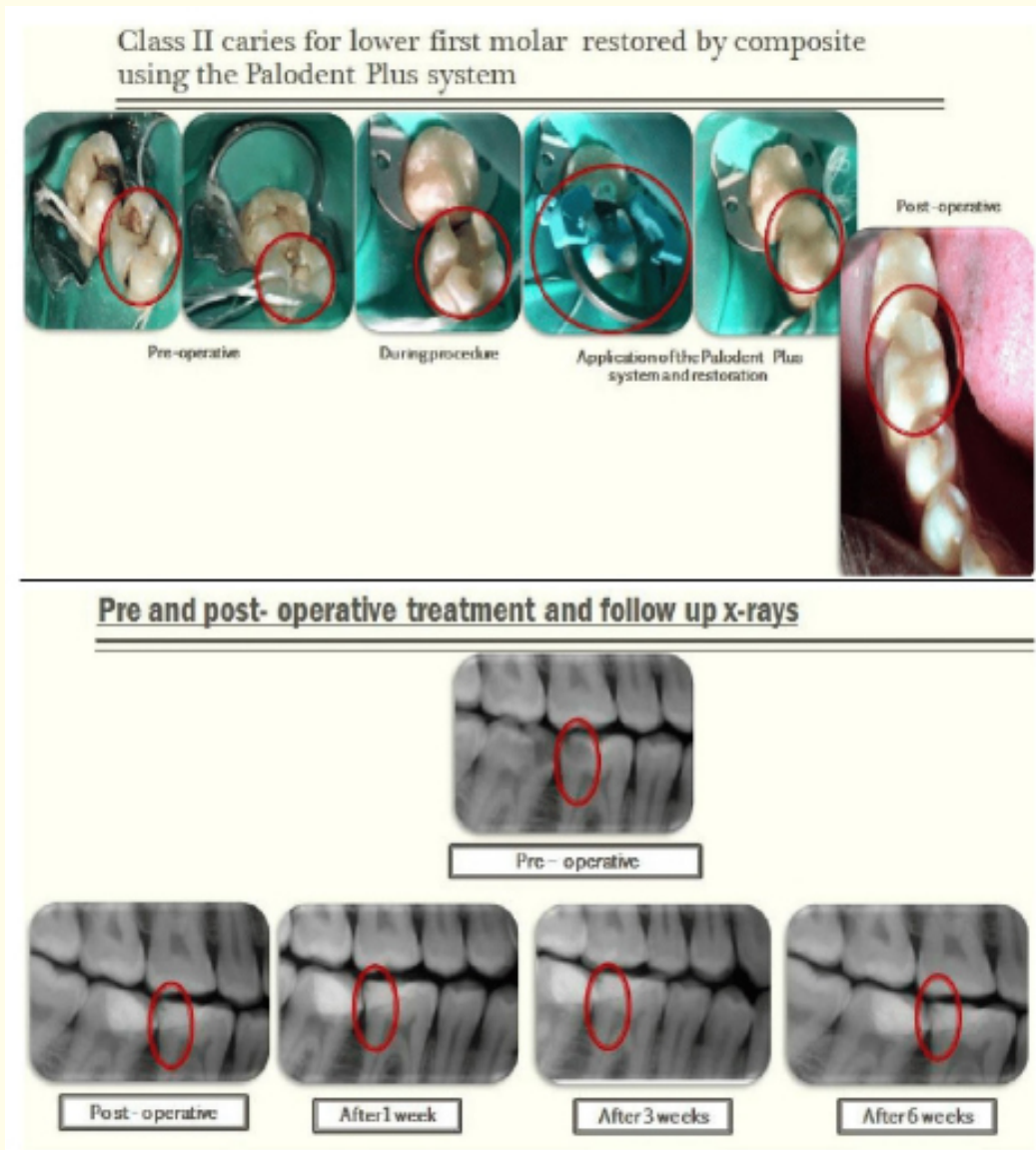
Restorative procedures were done for 32 patients (20 females and average age 34.6 ± 4.0). Table 1 shows significantly better contact tightness by x-ray, contour by x-ray and direct inspection, contour grading of the restoration, and time consumed in the procedure with less number of retreatments with the use of the Palodent matrix system than with the use of Automatrix system. However, there was only a trend for less open margins with the Palodent system compared with the Automatrix system (P = 0.054). Figure 1 shows an example of the restorative procedure using the Automatrix system and figure 2 shows the restorative procedure with the use of the Palodent Plus system.

	Number of patients	Contact tightness by x-ray	Contour by x-ray and direct inspection	Contour grading (excellent)	Contour grading (good)	Contour grading (bad)	Open margins	Timing (min)	Number of retreatments
	N	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		N (%)
Automatrix	32	19 (59)	21 (65)	5 (15)	20 (62)	7 (21)	9(28)	7.70 ± 1.67	10 (31)
Palodent	32	32 (1)	30 (93)	20 (62)	11 (0.3)	1 (3)	3(9)	5.88 ± 1.11	3 (9)
P value		0.00005	0.005	0.0001	0.03	0.02	0.052	0.002	0.03

**Table 1:** The different measured parameters of the restorative procedures in the study patients.



**Figure 1:** Photos and x-rays showing the restorative procedure using the Automatrix system.



**Figure 2:** Photos and x-rays showing the restorative procedure using the Palodent Plus system.

The follow-up of the different parameters after restoration procedure, one, three, and six weeks showed stability of the restored teeth without significant changes.

**Discussion and Conclusion**

Our results showed that Palodent Plus system was superior to the Automatrix system in all the measured parameters and there was a trend for less open margins. The new system of the Palodent Plus in general was easier to use with a shorter learning phase than the Automatrix system. Furthermore, both systems represent a potential advancement in technology of restorative procedures and previous studies of older systems showed less optimal results than these two systems.

The use of the Palodent matrix system was proven better than other matrices in the in-vitro studies. Saber, *et al.* [9] compared the standard Palodent matrix system with Walser matrix system on ivory teeth using the tooth pressure meter and concluded that the use of the standard Palodent system was superior in achieving excellent proximal contact tightness to the other matrix used in the study. Chuang, *et al.* [10] compared, using the morphological analysis, the pre-contoured sectional matrix system with the conventional and the circumferential metal matrix systems using two different types of composites on plastic teeth. All the used matrices produced some deficiency in the contact tightness and contour except the Palodent system which enhanced the contact tightness. Furthermore, even the Palodent system had some concavity in the contour like the other matrices. Kampouropoulos, *et al.* [11] compared the circumferential straight metal matrix with Tofflemire retainer with circumferential pre-contoured metal and circumferential pre-contoured transparent and the sectional pre-contoured metal (Palodent) matrix systems using the manikin model, which was fixed on a tension-meter apparatus and an orthodontic wire to assess the contact tightness. They concluded that the Palodent system was superior to the other matrices. Loomans, *et al.* [12] compared the circumferential matrix combined with either a hand-instrument (PFI49 or OptraContact) or separation ring (Composi-Tight Gold) with sectional matrix (flexible and dead-soft) and separation rings (Composi-Tight Gold, Contact Matrix, and Palodent BiTine). Matrices were secured with wooden wedges and preparations were restored with composite restoration on phantom head teeth. A standardized digital microscope was used for inspection of any overhang of the restoration in the tooth. They concluded that the use of circumferential matrices or sectional flexible matrices resulted in the least marginal overhang when combined with a Contact Matrix separation ring or a Composi-Tight Gold ring.

Furthermore, several *in vivo* studies have proven the effectiveness of the Palodent matrix system in the restorative procedures. Wirsching, *et al.* [13] compared the proximal contact tightness of the restored teeth using the sectional matrix system of the Palodent and the conventional matrix systems on a large number of real patients. They concluded that the Palodent system produced better proximal contact tightness than the conventional matrix system. Moreover, Yong W and Zhang RQ [14] compared two matrix systems, Palodent and circumferential matrix systems on 101 molar and premolar teeth in real patients. They used morphological and clinical evaluation and concluded superiority of the Palodent matrix system to the conventional matrix system in the reduction of the overhang and the production of the proximal contact tightness of the restoration. Finally, Peumans, *et al.* [16] compared three matrix systems (the Automatrix, the Palodent, and the Lucifix matrices) *in vitro*. They found that the Palodent matrix produced a significant larger M-D diameter and a stronger proximal contact area compared to the Automatrix system.

In our study, we compared the Palodent Plus system (more advanced system than the standard Palodent system) to the Automatrix system and found significantly better proximal contact tightness using the morphological evaluation with the advantage of the Palodent Plus system achieving more excellent contour grading and consuming less time of the procedure with less number of open margins and number of retreatments.

We conclude that our study found a potential advantage of using the Palodent Plus system in improving the outcome of the restorative procedure of class II cavities than the Automatrix system. A large study is necessary to confirm our results.

## Disclosure

There was no conflict of interest in this research study. The kits used in this clinical trial were not supplied by the manufacturers. The project was done by permit USRP/2013/87 of research department at Riyadh Colleges of Dentistry and Pharmacy, Riyadh, Saudi Arabia. No grants were contributed by any party other than the research team themselves.

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