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## Evaluation of the performance and problems of general dentists during and after the placement of composite in the posterior teeth in Kerman, Iran, 2016

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Nowadays, resin composites are the preferred material for direct posterior restorations. The present study was conducted to assess the performance and problems of general dental practitioners during and after posterior direct composite restorations in Kerman, Iran.

**METHODS:** 160 general dentists (63% men and 37% women) participated in this analytic-descriptive study. Data were collected using a researcher-made questionnaire. The questionnaire consisted of 13 close-ended questions about the performance and problems of dentists associated with composite restorations in Kerman, in 2016. Data were analyzed by chi square and t-test using SPSS software.

**RESULTS:** The most frequent complaint of patients after composite restorations was food impaction (45.0%), and the most clinicians' problems during composite restorations were achieving tight proximal contact (59.3%) and proper isolation (59.3%). Most of the dentists used traditional metal matrix systems (70.0%), wet polishing technique (81.2%), light-emitting diode (LED) light curing unit (62.5%), packable composites (51.2%) with incremental technique (83.1%), and two-step total etch bonding (70.0%). The main criteria for selecting composite as restorative material was patient request (55.0%), and most of the dentists preferred to restore the small or moderate class I cavities (67.5%), and after it, class V cavities (57.5%) with composite. Moreover, secondary caries (58.1%) was the most common reason for replacement of composite restorations; and in all questions, there were statistically significant differences between the most prevalent answer and the other answers ( $P < 0.05$ ).

**CONCLUSION:** The most frequent problems of dentists (achieving proper contact) and the most frequent complaints of patients (food impaction) are related to the use of traditional metal matrix systems.

**KEYWORDS:** Composite Resins; Isolation; Patients; Dentist

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The posterior composite restorations have a history of using for about 30 years. Nowadays, many improvements in composite materials, bonding technologies, and instruments to place these restorations have occurred,<sup>1,2</sup> and the clinical studies demonstrated annual failure rates between 1%-3% for posterior direct composite

restorations.<sup>1,3</sup>

Due to their esthetic properties, two types of bonding (mechanical and chemical), conservative tooth preparation, no harmful effect like mercury of amalgam, and good clinical service, resin composites are the preferred material for direct posterior restorations in recent years and are becoming increasingly popular among patients and

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clinicians.<sup>3,4</sup> Although marginal leakage, post-operative sensitivity, secondary caries, food impaction, time-consuming procedure, and occlusal wear were considered limitations of composite resins as posterior restorative material.<sup>5,6</sup>

Sarrett categorized the challenges that affect clinical outcomes of composite restorations as those related to the material properties (surface roughness, occlusal wear, etc.), those related to the dentist (handling properties of resin composite that could ensure void free placement, providing a proper isolation and moisture control, improving carving and shaping ability prior to curing and complete curing of composite to achieve its maximum physical properties), and those related to the patient (salivary composition, occlusal bite forces, parafunctional habits, and dietary factors).<sup>2</sup>

It is noticeable that the success of composite restorations relies not only on the improvement of the material properties and handling technique, but also on the clinician's level of experience and training in using the material and knowledge of the material's limitations and properties.<sup>2,7</sup>

In a study conducted by Judi and Abolghasemzade in Babol, Iran, inadequate proximal contact was found to be the most frequent problem of dentists during composite fillings, and food impaction was the most common complaint of patients after composite fillings.<sup>6</sup>

The present study was conducted to assess the performance and problems of general dental practitioners during and after posterior direct composite restorations in Kerman, Iran, in 2016.

## Methods

This cross-sectional descriptive-analytical study (ethical code: IR.KMU.REC.1395.664) was conducted to assess the problems and performance of general dental practitioners during and after posterior composite fillings, that was performed in Kerman, which is one of the biggest cities in the south-east of Iran,

in 2016.

A questionnaire was designed according to a similar study,<sup>6</sup> and was further modified for use in this study. Validity of the questionnaire was evaluated by eight specialists from Kerman dental school. They were asked to express their opinion on each question from totally appropriate to totally inappropriate. According to the experts' opinions, all of the questions were appropriate and three questions were added to the primary questionnaire. To assess the reliability of the questions, the questionnaires were filled by 20 dentists within 2 weeks (retest method). Inter class correlation coefficient was 90% which was acceptable.

250 general dentists were selected by a random systematic sampling method according to the list of Kerman Medical Council. The questionnaires were distributed by a dental student in the dental clinics and offices of Kerman, and finally 160 general dentists completed the questionnaires. The demographic information such as age and gender were recorded. The questionnaire consisted of 13 close-ended questions. Different items and their answers were as follows:

1. The main complaint of patients after composite fillings (a. dental sensitivity to heat changes, b. sensitivity to sugar, c. dental sensitivity while chewing, which is not relieved by occlusal adjustment, d. food impaction)
2. The clinician's problem during composite restorations (a. proper isolation, b. achieving tight proximal contact, c. appropriate tooth anatomy, d. occlusion adjustment, e. finishing and polishing of gingival restorations, f. color selection)
3. The clinician method in order to achieve proper proximal contact [a. pre-wedging, b. use of sectional matrix (pre-contoured thin metal matrix + ring), c. pressing matrix strip toward adjacent tooth]
4. Techniques used for posterior composite fillings [a. using an incremental curing technique, b. using flowable composite as liner, c. using resin modified glass ionomer (RMGI) base in deep cavities, d. using

sandwich technique in enamel less gingival margin of class II and V cavities]

5. The type of used bonding [a. three step etch and rinse (total etch), b. two step etch and rinse (total etch), c. two step self-etch, d. one step self-etch]

6. Techniques used for bonding application (a. etching time, b. drying dentin with cotton pellet, c. manufacturer's instruction)

7. Techniques used for polishing (a. wet, b. dry)

8. Factors affecting the selection of composite as the material of choice in posterior teeth (a. patient's request, b. extension of cavity, c. esthetic demands, d. possibility of isolation, e. patient's occlusion)

9. Preferred cavities for composite placement (a. small to moderate class I, b. large class I, c. small to moderate class II, d. large class II, e. class V, F. endodontically treated posterior teeth, g. replacement of fractured amalgam restoration)

10. The most frequent reason for replacement of composite fillings (a. secondary caries, b. fracture, c. hypersensitivity, d. food impaction)

11. The type of used composite (a. packable, b. conventional or universal, c. low shrinkage)

12. The type of used light curing unit

[a. light-emitting diode (LED), b. quartz-tungsten-halogen (QTH), c. plasma arch]

13. The period of light intensity checking (a. every week, b. every month, c. every six month, d. every year, e. never)

The participants could choose more than one answer for questions 1, 2, 3, 4, 6, 8, 9, and 10.

After collecting the questionnaires, the obtained data were analyzed by SPSS software (version 21, IBM Corporation, Armonk, NY, USA) using descriptive statistics, t-test, and chi-square tests,

with the significance level of  $P < 0.05$ .

## Results

160 dentists (63% men and 37% women) participated in this study. Table 1 demonstrates the frequency and percentage of the most prevalent answers.

Food impaction (45.0%) was found to be the most frequent complaint of patients after composite fillings, and the most clinicians' problems during composite restorations were achieving tight proximal contact (59.3%) and proper isolation (59.3%).

Most dentists used traditional metal matrix systems, and pushed the matrix strip toward the adjacent teeth for proper proximal contact (70.0%).

**Table 1.** The frequency and percentage of the most prevalent answers (It is noticeable that the participants could choose more than one answer for questions 1, 2, 3, 4, 6, 8, 9, and 10)

Questions	The most prevalent answers	n (%)	P
The main complaint of patients after composite restorations	Food impaction	72 (45.0)	0.001
The most clinicians' problem during composite restorations	Proper isolation and achieving tight proximal contact	95 (59.3)	0.001
The clinician method in order to achieve proper proximal contact	Pressing matrix strip toward adjacent tooth	112 (70.0)	0.001
Techniques used for posterior composite fillings	Using an incremental technique	133 (83.1)	0.002
The type of used bonding	Two step etch and rinse (total etch)	112 (70.0)	0.009
Techniques used for bonding application	Drying dentin with cotton pellet	92 (57.5)	0.001
Techniques used for polishing	Wet	130 (81.2)	0.001
Factors affecting the choice of composite as restorative material in posterior teeth	Patient's request	88 (55.0)	0.001
Preferred cavities for composite placement	Small to moderate class I	108 (67.5)	0.001
The most common reason for replacement of posterior composite restorations	Secondary caries	93 (58.1)	0.001
The type of used composite	Packable	82 (51.2)	0.001
The type of used light curing unit	LED	100 (62.5)	0.001

In all questions, the differences between the most prevalent answer and the other answers were evaluated

Most of the dentists used wet polishing technique (81.2%), packable composites (51.2%) with incremental technique (83.1%), and two-step total etch bonding (70%) with drying the dentin with cotton pellet (57.5%).

The main criteria for selecting composite as restorative material in posterior teeth were patient request (55%) and esthetic demands (53.1%). Most of the dentists preferred to restore the small or moderate class I cavities (67.5%) and after it, class V cavities (57.5%) with composite.

Secondary caries (58.1%) was the most frequent reason for replacement of posterior composite restorations.

Most of the dentists used LED light curing unit (62.5%) and checked its intensity (61.3%); and in all questions, there were statistically significant differences between the most prevalent answer and the other answers ( $P < 0.05$ ) (Table 1). There were no significant relation between demographic variables (age and gender) and the performance of general dentists except the type of used composite and the age (packable composites were used by the general dentists with lower age average).

## Discussion

At one time, amalgam was the most commonly used material for restoring posterior teeth; but now, due to the patient and dentist related factors, it is gradually being replaced by composite resins.<sup>5</sup>

In the present study, the most clinicians' problems during composite restorations were achieving tight proximal contact (59.3%) and proper isolation (59.3%), that is consistent with the results of previous studies.<sup>5,6</sup>

Akbar evaluated the attitude and knowledge of general dentists towards composite restorations in Northern Saudi Arabia, and reported that the most clinicians' problems associated with posterior composites were achieving adequate proximal contact (51%) and moisture control (36.0%).<sup>5</sup> In the study conducted by Judi and Abolghasemzade in Babol, inadequate proximal contact (37.2%) and after it, proper

isolation (29.8%) were found to be the most frequent problems of general dentists during posterior composite fillings.<sup>6</sup>

Proper isolation is a prerequisite for composite fillings. According to American Dental Association, composites (or any other bonded materials) should not be used in sites where isolation cannot be maintained.<sup>5</sup>

On the other hand, creating tight contacts in class II composite fillings still remains difficult. This problem is due to several mechanisms, such as the polymerization shrinkage of resin composites and this fact that resin composite cannot be 'condensed' as amalgam can.<sup>8-10</sup> An insufficient contact may lead to food impaction, caries formation, pain, and periodontal diseases.<sup>11</sup> Different matrix systems and techniques of restoration have been introduced to overcome this problem.<sup>5</sup> In this study, this problem is related to the preferred method of clinician in order to achieve proper proximal contact (pressing matrix strip toward adjacent tooth).

In the current study, most dentists used traditional metal matrix systems and pushed the matrix strip toward the adjacent teeth for proper proximal contact (70%), that is related to the most frequent problems of dentists (achieving proper contact) and the most frequent complaints of patients (food impaction).

Based on the findings of Judi and Abolghasemzade, most of dentists applied pressing matrix strip for proper proximal contact.<sup>6</sup> Loomans et al. also reported that most dentists used traditional metal matrix (64%), and sectional matrix systems (15%) were not commonly used.<sup>12</sup>

Using an incremental technique with pressing the matrix strip toward the adjacent teeth provided only small tighter proximal contacts.<sup>11</sup> The use of sectional matrix system showed the best proximal contact in class II composite fillings in a study by Peumans et al.<sup>13</sup> With the use of sectional matrix system, ring separates the teeth effectively and allows a tighter contact to be developed.<sup>14</sup>

In this study, the most frequent

complaints of patients after composite fillings were food impaction (45%) and dental sensitivity to heat changes (33.8%); which is in agreement with the results of previous studies.<sup>6,12</sup> Judy and Abolghasemzade reported that the most common complaints of patients after composite filling was food impaction (33.4%).<sup>6</sup> Loomans et al. also reported that the most common problems experienced by the general dental practitioners were achieving tight proximal contacts (82%) and postoperative sensitivity (POS) (61%).<sup>12</sup>

Several clinical studies indicated that nearly 30% of patients present POS after posterior composite fillings.<sup>7,15</sup> Mainly, class II restorations are associated with the POS.<sup>5</sup> POS may be contributed to several factors such as etching of dentin, incorrect adhesive procedure, bacterial microleakage, cuspal flexure, cavity depth, technique of composite placement, over-drying of dentin, cavity size, occlusal discrepancy, and trauma of cavity preparation.<sup>16,17</sup> The POS can be reduced if proper guidelines and techniques of patient selection and cavity preparations are followed for composite restorations.<sup>5,7</sup>

In the current study, most of the dentists applied incremental curing technique for composite filling (83.1%), which is in agreement with the results of previous studies.<sup>6,18</sup> The use of an incremental technique is commonly performed to overcome the effects of polymerization shrinkage. This method can increase the gel phase, thus improving the flowability of composite and, consequently, the marginal adaptation.<sup>7</sup>

In the current study, the main criteria for selecting composite by the participants were patient request (55.0%) and esthetic demands (53.1%). The result is similar to the findings of Gilmour et al., who found patient preference as the main criteria for choosing posterior composites.<sup>19</sup> Akbar reported that the most common factors for choosing posterior composite restoration were conservative cavity preparation followed by aesthetics and patient's preference.<sup>5</sup> The

ability of isolation (41.8%) was the main criteria reported by Judi and Abolghasemzade to select the composite as the material of posterior teeth.<sup>6</sup>

In the present study, most of the dentists preferred to restore the small or moderate class I cavities (67.5%) and after it, class V cavities (57.5%) with composite. Akbar reported that most of the dentists used composite in small cavities and class I restorations with light occlusal contact,<sup>5</sup> which is consistent with this study. It is noticeable that the use of resin composite in small cavities allows a great preservation of tooth structure.<sup>20</sup> It is estimated that, after 5 years, 10.1% of small-size composite restorations and 19.8% of large restorations have to be replaced; therefore, the use of composite in small cavities is reasonable.<sup>21</sup>

In this study, most of the dentists used packable composites (51.2%). "Packable" or "condensable" composites were introduced in the late 1990s with the expectation that they would condense like amalgam, thereby improving interproximal contacts. Many packable products were less sticky and stiffer than traditional composites. While their handling properties were useful for larger class I and class II restorations, packable composites did not help to achieve better proximal contacts.<sup>14</sup> Peumans et al. also reported that the packability of composites did not influence the tightness of the proximal contact.<sup>13</sup>

Fortunately, in the current study, most of the dentists checked light curing unit intensity (61.3%). It may be due to the higher knowledge of general dentists in Kerman about the importance of light curing unit intensity. Savadi Oskoei et al. evaluated the intensity output of curing lights in private dental offices and clinics of Tabriz, Iran, and reported that the intensities of light curing unit were inadequate for optimum curing, and 96.4% of dentists had never checked the light intensities of their unit.<sup>22</sup> Mirzaei and Moradimajd evaluated the light curing unit intensity of private dental offices and clinics

in Tehran, Iran, and reported that light intensities of about 46% of light curing units were inadequate.<sup>23</sup>

Complete polymerization is one of the main factors of success of composite restoration. Incomplete polymerization is related to more water uptake, lower hardness, more solubility, and lower bond strength.<sup>23</sup>

In the present study, secondary caries (58.1%) was the main reason for replacement of composite fillings, which is consistent with the results of previous studies.<sup>3,5,20</sup>

Asghar et al. reported that the common cause for replacing class I restorations was secondary caries, and for replacing class II restorations the main causes were secondary caries, improper proximal contacts, and gingival irritation.<sup>24</sup> Several studies reported that recurrent caries was the main reason for composite restoration failure.<sup>3,5,20</sup> The composite restoration-related secondary caries have been rated significantly more than amalgam restorations, which can be attributed to the higher amount of *Streptococcus mutans* in the margins of composite restorations and the polymerization shrinkage of composites.<sup>25</sup>

According to the findings of clinical trials, the annual failure rate of posterior direct composite restorations has been reported to

be 1%-3%, depending on different factors like tooth type and position, the age of patients, the knowledge and proper skills of the operator, socioeconomic and behavioral features (caries risk).<sup>4,5</sup>

Some studies suggested that the longevity of composite restorations is under the influence of the knowledge and enough skills of operator.<sup>26,27</sup> However, there are limited data about the direct effects of dentist performance on efficiency of composite fillings.<sup>6</sup>

Weak cooperation of general dentists was the limitation of this study; moreover, some of the dentists might not answer the questions precisely.

### Conclusion

The most frequent problem of dentists (achieving proper contact) and the most frequent complaint of patients (food impaction) are related to the use of traditional metal matrix systems.

### Conflict of Interests

Authors have no conflict of interest.

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