

Dental Resin Composite Restoration Practices amongst General Dental Practitioners of Karachi, Pakistan

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ABSTRACT

Aim: The aim of this cross-sectional study was to identify and analyze the attitudes and practices of general dental practitioners of Karachi, Pakistan while performing dental composite restorations.

Material and methods: A self-applied questionnaire was furnished to 150 general dental practitioners. A total of 125 practitioners filled and returned the filled questionnaire. The questionnaire mainly enquired about the commercial brand of composite resin used, dispensing and curing methods, handling techniques, finishing/polishing practices, and discoloration complaints made by the patients (if any). The results were collected and analyzed statistically.

Results: The response rate was 83% ($n = 125$). The results indicated that 80% ($n = 100$) of the respondents claimed that they use a single paste system and blue light for curing. The number of dentists who covered the lid of single paste composite after usage was 68% ($n = 85$), whereas 72% ($n = 90$) used transparent matrices after placement the final layer of the composite restoration. Majority of the practitioners preferred finishing discs 53% ($n = 66$), and 84% ($n = 105$) of the patients returned with the discoloration complaint after two years.

Conclusion: Majority of the general dental practitioners in Karachi, Pakistan preferred single paste system, blue light for curing, and discs for finishing restorations. Most patients returned after two years with a complaint of discoloration.

Clinical significance: The study is relevant clinically as it deals with the techniques used by general dental practitioners while performing composite resin restorations. The study highlights clinical practices which are in line with evidence-based dentistry and also with techniques adapted by dentists which are obsolete and require an update.

Keywords: Curing methods, Dental composites, Discoloration, General dental practitioners

World Journal of Dentistry, (2019): 10.5005/jp-journals-10015-1618

INTRODUCTION

Resin composites have been available to the dental professionals since last five decades as compared to the silver amalgam, whose usage can be traced back to as long as 150 years.^{1,2} Due to the versatile nature of this material, its usage has seen growth since its introduction.³ Resin composite as a restorative material has been popular to restore anterior as well as posterior teeth.⁴ Their increased use is not limited to restorative dentistry only but now they are being used for several other purposes in dentistry such as for the fabrication of root canal posts, as pits and fissure sealants, as cavity liners, and as a core build-up material.^{3,5} Recently, resin composites have evolved with astonishing changes in their composition resulting in better and improved properties. It can be predicted that the usage of this material will grow further in the coming future in terms of its availability and applicability.⁶

Dental composites are now being used for direct restoration in over 95% of all anterior and 50% of all posterior teeth.⁷ Resin composite restorative materials are used more as esthetic restorations.⁸ With time dental composite has proved that it is more advantageous than silver amalgam especially with regards to its aesthetics, bonding ability, being mercury-free, and to be more in line with minimally invasive dentistry.⁹

There is a deficit in literature which highlights common practices regarding the usage of composite filling material of general dental practitioners from Karachi, Pakistan. Therefore, the aim of this study was to recognize the general dental practitioners' common attitude and practices while performing dental composite restorations.

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How to cite this article: Ali S, Iqbal K, Asmat M, Farooq I, Khan AM, Alam MK. Dental Resin Composite Restoration Practices amongst General Dental Practitioners of Karachi, Pakistan. *World J Dent* 2019;10(2):129-134.

Source of support: Nil

Conflict of interest: None

MATERIALS AND METHODS

Ethical approval was obtained before commencing the study from the institutional review board of Khyber College of Dentistry, Peshawar, Pakistan and all ethical protocols were strictly followed. This cross-sectional randomized convenience study using the nonprobability sampling technique was conducted in the city of Karachi, Pakistan. The questionnaire was developed and piloted with 10 general dentists, who were not included in the study

afterward, and minor modifications were made according to their responses. Participation in this study was on a voluntary basis and informed written consent was taken from all the participants. The data were collected through self-applied closed questionnaire, which was personally distributed to each dentist, and the objectives of the study were explained. Whenever the participating dentist was unable to return their questionnaire in the third visit (a time gap was given between each visit), they were considered as "dropped out". All the respondents completed the questionnaire anonymously, and no personal data of the respondents were collected. The questionnaire was given to 150 general dentists in Karachi, Pakistan, out of which 125 dentists responded. The questionnaire had 9 questions in total covering the commercial brands of composite material used, its dispensing and curing methods, storage technique, and its methods of application. This questionnaire also covered the finishing and polishing practices of dentists and also explored if any of the patients came back with a complaint of discoloration

Statistical Analysis

Statistical package for social science (SPSS) v22 Inc. was used to record and analyze the data. Descriptive statistics (frequency and percentages) were used to summarize the information. Independent sample T-test and chi-square were used to compare the methods used and the association between the influencing factors during the restoration process. p value less than 0.05 was considered as significant statistically.

RESULTS

Out of the 150 questionnaires distributed, 125 dentists responded (response rate = 83%). Concerning composite restoration practices, majority of the dentists kept the distance between the tip of the curing light and cavity at 1 cm. Among all the dentists, 80% ($n = 100$) preferred using single paste composite restorative material,

48% ($n = 48$) used DENTSPLY™ followed by 3MEPSE™ usage by 44% ($n = 44$), and only 8% ($n = 8$) used other brands, while 20% ($n = 25$) used the two paste system ($p = 0.000$). Among the respondents, 80% ($n = 100$) used quartz tungsten halide (blue light) for curing while 20% ($n = 25$) preferred to use the LED method ($p = 0.06$). The most commonly used method of storage used by the study participants was to store the material at room temperature (76%, $n = 95$) followed by storage in the refrigerator (24%, $n = 30$). Majority of study participants (68%, $n = 85$) reported covering the unused composite with an opaque lid at the time of placement of every increment whereas, 72% ($n = 40$) of the dentists used transparent matrices over the final increment of composite restoration during curing (Table 1).

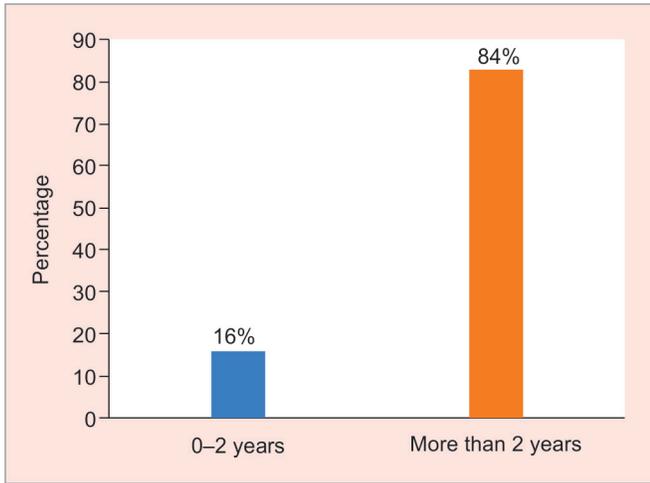
The results obtained indicate that there was a wide variation among the patients visiting the dental clinics with the complaint of discoloration of composite restorations with the majority (84%, $n = 105$) returning after two years of placement (Graph 1, $p = 0.215$). The preferred method used for finishing and polishing of composites were finishing discs (53%, $n = 66$), finishing strips (12%, $n = 15$), burs (6%, $n = 8$), scalpels (2%, $n = 3$), whereas (26%, $n = 33$) used all the methods (Graph 2). The percentage of dentists removing the top layer of the composite before filling was less (47%, $n = 59$) as compared to those who did not remove it (53%, $n = 66$) and the difference was statistically significant (Table 1, $p = 0.06$).

DISCUSSION

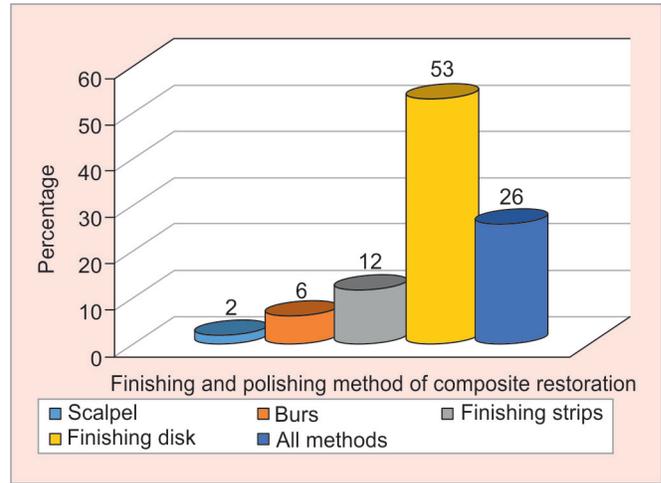
For a questionnaire study to be effective a good response rate is required and it was recommended by Tan and Burke that a 64% response rate is an acceptable percentage.¹⁰ Our study achieved a response rate of 83%. In the context of the light source used for curing, our study showed that polymerizable dental restoratives were cured with blue light selected by 80% over light-emitting Diode (LED) method of curing. In disagreement, Demarco et al., 2013 observed in their study that 70% of the dentists used LED

Table 1: Number and percentage of dentists used the brand, curing light, manipulation, dispensing, and curing methods of composite restoration

Items	Classification	Percentage	Responses
Distance between cavity and tip of cavity unit	0 CM	32	40
	1 CM	52	65
	2 CM	16	20
Type of light used for curing	Blue Light	80	100
	LED	20	25
Dentist cleaned the tip of the light curing after exposure	Yes	76	95
	No	24	30
Double paste composite used	Yes	20	25
Brand of single paste composite used	Dentsply	48	48
	3 MEPSE	44	44
	Other	8	8
Single paste composite storage in the clinics	Room temperature	76	95
	Refrigerator	24	30
Dentist removed the top layer (single paste) of composite before filling	Yes	47	59
	No	53	66
Dentist covered the lid after being used of single paste composite	After every increment	68	85
	After 2nd increment	6%	7.5
	After final increment	26%	33
Dentist used transparent matrices after placement the final layer of composite restoration	Yes	72%	90
	No	28%	35



Graph 1: Percentage of patients who came back with discoloration of dental composite



Graph 2: Methods of finishing and polishing used in composite restorations

light for curing dental composites.⁴ In another previously carried out study in the UK, it was observed that the majority (72.3%) general practitioners in the UK preferred LED over QTH light curing system.⁴ A recent study done by Alquria et al., 2019 also showed trends of LED over QTH in private dental clinics.¹¹

One possible reason for the low usage of LED light could be the outdated knowledge of practitioners in Karachi, as LED lights were introduced at the end of the '90s and many practitioners are still not aware of their superior properties over blue light.¹² The biggest advantage of using LED units is their easy maintenance.

Additionally, LED lights have shown polymerization capacity to be deeper, and lifespan of the lamp to be longer, with minimum heat generation as compared to the blue light.³

Concerning polishing and finishing methods, respondents preferred finishing discs over the rest, with 53% of the sample population using it while scalpel was used by less number of dentists, i.e., 2% only, and about 26% of the sample population used all methods together to get good results. In a study done previously, it was reported that using finer particle disks are very effective in producing an overall gloss with an enhanced surface finish for most of the available composite resins.¹³ This is in agreement to our study where the majority of the respondents preferred finishing disks over the other methods.

In our study, very few dentists maintained the distance between the tip of the curing unit and cavity as shown in Table 1. The curing of composite resin can be in an uneven manner causing softer resin matrix and reduced bond strength, which could cause wearing leaving craters in the surface.¹⁴

It has been reported that lower irradiance may reach the surface of the composite resin and the irradiance received by the tip of the light can be very dissimilar along with some curing lights delivering only 25% of what is measured at its tip. Dentists should not take light curing protocols for granted as its all about sufficient photopolymerization of the resin.¹⁵

Our results also showed that storage of composite by dentists in the refrigerator was less (24%) as compared to its storage at room temperature, i.e., 76% by the operators. These results are in accordance with the dental manufactures recommendations of storing composite at room temperature.¹⁶ Different variables like the variation in temperature, ventilation at storage, humidity, light visibility and radiations, vibration or shocks are important in terms of the performance of composite clinically.¹⁷ Lohbauer

et al. also stated that the use of composite which is stored at room temperature is preferred over the refrigerated one. If the material is refrigerated (which most users do to increase the shelf life) then it's recommended that the composite should be unrefrigerated prior to its use.¹⁸

Performing composite restoration in increments is essential as it impacts its longevity. In our study, 68% of the dentist's claimed that they do composite restoration in increments with covering the lid after each use (Table 1). It is a widely established fact that filling in increments minimizes shrinkage stress due to the material's volume being reduced during polymerization.¹⁹ The majority (68%) of the dentist's from our study reported that they perform composite restoration in increments which is in line with the established protocols for composite restorations. It is also apparent from our study that 72% of the sample population used transparent matrices (Table 1). It has been reported earlier that composite resin's surface hardness is affected by the use of transparent matrices and reflecting wedges.¹⁹ However, recent literature is of the view that clinical success of class II posterior composite restorations is not influenced by the choice of matrix strip.²⁰

There was a wide variation among the patients visiting dental clinics with a complaint of discoloration of dental composites. Only 16% complained of discoloration in the first two years while the majority, i.e. 84% of the sample population came with a complaint of discoloration after two years as shown in Graph 2. Color change is an important parameter for resin-based filling materials. Several factors influence the color of photocuring materials, such as photoinitiator component, resin matrix composition, light curing device, and irradiation times.²¹ Camphor Quinone is the most commonly used photoinitiator in dental restorative resins and although it is used in small amounts, it significantly influences the color of the material. Other photoinitiators used are tertiary aromatic or aliphatic amines, which act as so-called synergists or accelerators. All amines are known to form by-products during photoreaction, which can cause yellow to red/brown discolorations under the influence of light or heat.^{22,23} The clinical success of resin composites is related to the appearance and surface smoothness, however, the reason for its replacement is mostly the development of secondary caries and discoloration.²⁴⁻²⁷ It has been reported in the literature that composite resin material is susceptible to discoloration after prolonged exposure to oral environment.²⁸ But in our study, the dentists reported that some patients came with a

discoloration complaint within first 2 years, which is alarming. The probable reasons for this could be, using a material which is near expiration and using a wrong shade to restore the tooth initially. An important factor which is often ignored during composite restoration is the poor shade harmony (between the material and the tooth). This can also give the appearance of discoloration from the very beginning.²⁹ Therefore, the dentists should be careful while selecting the shade of composite resin.

This study shows the common practice's by dental practitioners when performing dental composite restorations. Keeping in view the results and observations of our study, the following suggestions are made:

- Dental education workshops should be made mandatory for practitioners to keep up with the advancements in dentistry.
- The evidence-based approach should be applied while restoring the teeth.
- Factors affecting the discoloration of dental composites should be explored further and addressed.
- Dentists should be aware of the clinically relevant distances affecting the restoration through irradiance provided by their curing light.

Our study also has some limitations as it was based on a self-applied closed questionnaire survey with convenience sampling (it was easy for the dentists to fill in the questionnaire at their ease). The disadvantage of a self-applied questionnaire is that for the collection, research teams are required to visit the respondents again. Another limitation was the small sample size, which could be expanded in the future to have a clearer picture regarding the attitude and practices of all the dentists regarding composite restorations from this region (Annexure).

CONCLUSION

Majority of the general dental practitioners in Karachi, Pakistan preferred single paste system, blue light for curing, and discs for finishing restorations. Most patients returned after two years with a complaint of discoloration. It could be concluded from the results of our study that some of the techniques and practices of general dentists in Karachi, Pakistan need an update. Furthermore, factors influencing the discoloration of composite resin material should be explored further as quite a high number of patients returned to our respondent's with the complaint of discoloration.

CLINICAL SIGNIFICANCE

The study is relevant clinically as it deals with the techniques used by general dental practitioners while performing composite resin restorations. The study highlights clinical practices which are in line with evidence-based dentistry and also with techniques adapted by dentists which are obsolete and require an update.

ACKNOWLEDGMENTS

The authors are grateful to all the dental practitioners of Karachi, Pakistan who took part in this study and took time off their busy schedules to provide us with the relevant information needed. Special thanks to Mr Faraz Ahmed Farooqi for providing statistical support.

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Annexure: Questionnaire

A. Light curing unit:

1. Distance between restoration placed in a cavity and tip of the curing unit
 - a) Just close to the restoration
 - b) 1cm
 - c) 2cm
 - d) Other, please specify _____
2. Cleaning the tip of light curing unit after exposure:

Yes No

3. Which type of light is used for curing of composite in your clinic
 - a) Blue light
 - b) LED

B. Composite restorative material

- Use of single paste Use of double paste
- Please specify name of the brand _____
1. Storage of composite in clinics
 - a) At room temperature
 - b) Refrigerator
 2. Do you remove the top layer (single paste) of composite before placement in the cavity

Yes No
 3. When do you cover the lid after using single paste composite
 - a. Immediately
 - b) After 1 min
 - c) 2 mins
 - d. Others, please specify _____
 4. Finishing and polishing of composite restoration with
 - a. Knife
 - b. burs
 - c. discs
 - d. stripes
 - e. Others, please specify _____
 5. Use of transparent matrixes /cellulose acetate matrix in composite restoration\

Yes No
 6. Patients visit with a complaint of discoloration of composite restorations after
 - a. 0-2 years
 - b. More than 2 years