

Knowledge of Pakistani Dentist Towards Light Curing Units- A Cross Sectional Analysis



Beenish Fatima Alam¹

BDS, MSc, MFDS RCS(Ed)

Talha Nayab²

BDS, MSc

Arqam Najmi³

BDS, MSc

Umaima Khan⁴

BDS

OBJECTIVE: To assess the level of knowledge of dentists working in a teaching hospital of Karachi regarding light cure units. **METHODOLOGY:** A cross sectional study was conducted over a time frame of 6 months. A questionnaire was distributed to dentists working in a dental teaching hospital. Survey employed in this study has been adopted and revised from the study lead by Tüloglu et al. Questionnaire focused on the demographic details along with queries related to usage of light cure devices, type of light cure unit used, curing time used for composites and adhesive, light intensity used for sufficient polymerization. Statistical analysis of the study was done using Chi square and Fishers Exact and descriptive analysis done by analyzing frequency and percentage.

RESULT: Over-all 156 dentists participated in this study, which includes 34% (n= 53) males and 66% (n= 103) females participated. Light-emitting diode (LED) was commonly preferred by 66% of the respondents aged 21-29 years, followed by Quartz-Tungsten-Halogen (QTH). 34% of the dentists of age group 30-39 years had knowledge concerning options for irradiation accessible by Light Curing Units (LCU). Conventional mode was most preferred by 60% of 21-29 aged respondents. Majority of dentists advocated using 10-20 sec for curing adhesive and composite restorations. 66% of respondents aged commented using 100-300 mv/cm² intensity of light, while 30-39 years aged used 300-500 mv/cm² for curing 2 mm thick composite.

CONCLUSION: It is apparent that dental practitioners of age group of 21-29 years have less knowledge regarding dental light-curing units, concerning the technical knowledge and correct usage of light curing device.

KEYWORDS: Light-emitting diode, light intensity, Quartz-Tungsten-Halogen (QTH), dentists, composites.

HOW TO CITE: Alam BF, Nayab T, Najmi A, Khan U. Knowledge of Pakistani dentist towards light curing units- a cross sectional analysis. J Pak Dent Assoc 2020;29(2):81-86.

DOI: <https://doi.org/10.25301/JPDA.292.81>

Received: 11 September 2019, Accepted: 10 February 2020

INTRODUCTION

Dental Composites are the most commonly used restorative materials in dentistry for more than three decades.¹ Usage of visible blue light to cure dental composite has increased tremendously. Visible light is used for curing not only composite fillings but also to cure various luting cements, glass ionomer cement, bonding agents and some of the temporary filling materials.^{2,3}

The strength of composite restorations depends upon resin-based composite subjected to visible light source having

appropriate wavelength range (blue or blue and violet) and contains radiant exposure ranging from 8-16 J/cm².^{4,5} Additionally incomplete polymerization can lead to discoloration of restoration, reduces hardness and affects the mechanical strength of composite; likewise it also causes high solubility and water sorption within the composite.⁶ Furthermore there's also likelihood of sensitivity, pulpal involvement and failure of treatment to occur.⁷

Different factors have been identified, playing crucial role during polymerization reaction of composite. These comprises of intensity and wavelength of LCU, site of dental cavity in mouth, duration of irradiation being subjected, path and distance of tip of device, type and formulation of composite used and the width of restoration.⁸ Four different types of light curing units are available for providing adequate polymerization of composites; these include Quartz-Tungsten-Halogen, Plasma Arc Curing, Light-Emitting diode and

1. Assistant Professor, Department of Oral Biology, Bahria University Medical and Dental College.

2. Assistant Professor, Department of Dental Materials, Jinnah Sindh Medical University.

3. Senior Lecturer, Department of Dental Materials, Bahria University Medical and Dental College.

4. Lecturer, Department of Oral Biology, Bahria University Medical and Dental College.

Corresponding author: "Dr. Beenish Fatima Alam" <nish_alam@yahoo.com>

Argon Laser.⁹ Conventional QTH, having wide spectrum are capable of curing camphorquinone and short wavelength photo initiators. It emits blue light having wavelengths of 380-510 nm, and sufficiently cures 2 mm deep composite restorations within 40 seconds¹⁰. However the excessive heat generation has detrimental effect on bulbs of LCU and lifespan of the device.¹¹⁻¹³

Argon LCU generates a wavelength of 488nm adequate for generating polymerization reaction within the composite¹⁴. Added benefits include less time needed for curing, adequately curing deep fillings. Additionally it reduces risk of secondary caries by altering surface anatomy of enamel and dentine.^{15,16,17} Conversely the device is quite bulky, expensive and difficult to use, in case of large fillings due to smaller fiber size.¹⁸

Plasma LCU can efficiently polymerize composite in less time by generating power density of 100 mw/cm².¹⁹ On the other hand its ability to cure thick composite filling is questionable, light source has a 10 second waiting time after each use.²⁰

In 1995 Miller et al proposed using LED to overcome the drawbacks linked with halogen based polymerization. LED has added advantage of less heat production, greater longevity and less heat dissipation. It generates blue light having wavelength of 450-500nm.²¹ Moreover they are cordless and battery operated which provides further benefit.²²

Internationally many researches have been conducted regarding the knowledge of dentists towards the light cure units but similar documentation in our country is insufficient. Previously conducted researches in Pakistan have focused on assessing the quality of light intensity output using the Quartz-tungsten-halogen (QTH) curing units. The current study was commenced to assess the knowledge of Pakistani dentists towards curing light by investigating the adequate usage, types of LCU, duration of usage and maintenance of light units in routine clinical practice. The main objective was to examine the present knowledge of dental practitioners in Bahria University Medical and Dental College and to assess the areas that need to be improved that can be helpful in improving the quality of restorative procedures performed.

METHODOLOGY

This cross- sectional study has been conducted among the dentists working in the dental OPD of Bahria University Medical and Dental College over a period of six months. 170 survey forms were circulated to different dentists, out of which, 156 filled forms while 14 unanswered questionnaires were provided. The dentists were briefly explained regarding the details of questionnaire before asking them to fill the questionnaires. Verbal consent was taken by

all the participants before initiating the study. All the participants were ensured concerning maintaining anonymity of the responses received.

Ethical authorization for the study was formally obtained from the Ethical Review Committee of Bahria University Medical and Dental College (ERC 15/2019) before initiating the study. This research has been directed in accordance with the Declaration of Helsinki. It requires six to seven minutes to totally fill the questionnaires.

Survey employed for this study has been adopted from the study lead by Tüloglu et al²³, as this survey was simple to use and easy to accommodate in our clinical dental setting. House-officers, lecturers and all specialist who were either working in dental OPD of Bahria University or doing private evening clinics giving consent to participate in the study have been incorporated, while dentists who did not give consent and all the undergraduate students were excluded from the study. The mean age of recently graduated dental house officers was 21-24 years, lectures had age range of 25-30 years and specialist/trainees had 30-39 years.

The initial part of survey entailed the details of the dentist such as age, gender, years after graduation and the type of employment. The subsequent segment focused on the queries associated with usage of light curing, type of light cure unit, curing time used for composites and adhesive, light intensity used for sufficient polymerization, and maintenance for light curing.

STATISTICAL ANALYSIS

OpenEpiTM (v-3) has been used for calculation of sample size to be used for the study. Statistical conditions used were 95% confidence interval with 5% margin of error. The required sample size was found to be 170. All the variables were coded and entered in SPSS (v21). Descriptive statistics comprising of frequency and percentages were used to evaluate the responses. Test of significance has been done using Chi square and Fisher's exact test was used to identify differences in responses, $P < 0.05$ was considered to be significant.

RESULTS

Over-all 156 dentists participated in this study, amongst which 34% were (n= 53) males and 66% were (n= 103) females.

Concerning years of professional experience in dentistry, 55% of dentist had experience of 0-2 years; approximately 24% has experience of 2-5 years while 8% had experience of 5-10 years and last 13.5% of the respondents had experience of 10 years. Moreover Only 31% of the

Table 1: Describes Demographic details of the respondents

Demographic Details	n	%
Gender		
Males	53	34
Females	103	66
Age		
21-29 years	118	75.6
30-39 years	38	24.4
Years in Dental Profession		
0-2 years	86	55.1
2-5	37	23.7
5-10 years	12	7.7
More than 10 years	21	13.5

Table 2: Association of age group with Knowledge regarding LCU

Variables	21-29 years	30-39 years	P-Value
Type of light curing			
QTH	25 (21.2%)	21 (55.3%)	0.000
LED	78 (66.1%)	17 (44.7%)	
PLASMA ARC	15 (12.7%)	0	
Modes of Curing			
Soft Cure	15 (12.7%)	17 (44.7%)	0.000
Fast Cure	7 (5.9%)	0	
Conventional Mode	66 (55.9%)	0	
Not Sure	30 (25.4%)	21 (55.3%)	
Curing time for Composites			
15 sec	55 (46.6%)	38 (100%)	0.000
30 sec	50 (42.4%)	0	
1 minute	13 (11%)	0	
Curing time for Adhesives			
15 sec	65 (55.1%)	38 (100%)	0.000
30 sec	53 (44.9%)	0	
1 minute	0	0	
Light Cure Unit Offers radiation			
Yes	45 (38.1%)	13 (34.2%)	0.053
No	27 (22.9%)	16 (42.1%)	
Don't Know	46 (39%)	9 (23.7%)	
Light curing intensity for polymerization			
100-300 mv/cm ²	78 (66.1%)	17 (44.7%)	0.019
300-500 mv/cm ²	40 (33.9%)	21 (55.3%)	

Chi square test, or Fisher's Exact test applied * statistically significant participants had post graduate degrees.

Regarding the knowledge of LCU, 66% of the participant having age range of 21-29 advocated using LED followed

by QTH, while 55% of the respondents aged 30-39 years identified QTH as mostly used followed by LED. 60% of the respondents having age of 21-29 identified using conventional mode for curing. 30 seconds were most commonly used for curing composite and adhesive restorations by both 21-29 years, while all the respondents aged 30-39 years used 15 seconds for curing. Regarding light cure units offering irradiation, 39% of the respondents aged 21-29 years had no knowledge regarding irradiation,

Table 3: Association of Gender with Knowledge regarding LCU

Variables	Females	Males	P-value
Type of light curing			
QTH	13 (12.6%)	33 (62.3%)	0.000**
LED	75 (72.8%)	20 (37.7%)	
PLASMA ARC	15 (14.6%)	0	
Modes for Curing			
Soft Start	32 (31.1%)	0	0.000**
Fast Start	0	7 (13.2%)	
Conventional	54 (52.4%)	12 (22.6%)	
Not Sure	17 (16.5%)	34 (64.2%)	
Curing Time for composites			
15 sec	47 (45.6%)	41 (77.4%)	0.000**
30 sec	43 (41.7%)	12 (22.6%)	
1 min	13 (12.6%)	0	
Curing Time for Adhesives			
15 sec	75 (72.8%)	28 (52.8%)	0.013
30 sec	28 (27.2%)	25 (47.2%)	
1 minute	0	0	
Light Cure unit offers radiation			
Yes	36 (35%)	22	0.000**
No	18 (17.6%)	25	
Not sure	49	6	
Light curing intensity for polymerization			
100-300 mv/cm ²	88	7	<0.000**
300-500 mv/cm ²	15	46	

Chi square test or Fisher's Exact test applied * statistically significant

as compared to 34% of the 30-39 years who had information. When enquired about curing light intensity for polymerization 66% of 21-29 years old identified using 100-300 mv/cm² while 55% of 31-39 years advocated using 300-500 mv/cm².

Statistically significant association was noted among gender with information regarding Light curing units. LED was identified by 73% of females while QTH was recognized by 62% of males. Conventional mode for curing was preferred by 52% of females whereas 64% of males were unsure.¹⁵ seconds was used to cure composite and adhesive restoration by majority of females and males. In response to light cure

intensity used for polymerization 85% of females recognized 100-300 mv/cm² while 87% males commended using 300-500 mv/cm² (Table 2).

DISCUSSION

Satisfactory polymerization reaction of composite plays a fundamental role in providing optimum physical and mechanical properties. Insufficient polymerization can affect the color constancy, strength, toughness, water sorption of the dental composites. This study basically focuses on assessing knowledge of Pakistani dentists towards light cure units and what areas needs to be improved.

Sound evidence of connotation amid professional experience of dentistry and years of practice in the field of dentistry was noted to be statistically significant. These results contrast from the study conducted by Santini and Turner, who found no significant association.²⁴

The findings of the current study specified that LED (72.8%) followed by QTH (12.6 %) were commonly preferred devices by 21-29 years of respondents and females. These results are in accordance with study conducted in India, where three-fourth of dentists preferred LED, while QTH was preferred by one fourth of the dentists. It can be attributed to the fact that life span of LED is quite more than QTH, additionally LED units do not generate heat upon polymerization or on structure of tooth and lastly they are portable that causes ease in use.²⁵

Sufficient understanding regarding the irradiance is vital; that not only ensures accurate curing of restoration but also prevents chances of damage to the oral tissues. In the current study majority of respondents did not have sufficient awareness regarding light cure units offering option for irradiation, these outcomes are in agreement with the study directed by Tüloglu et al, where the respondents had sufficient knowledge. It can be due to lack of understanding of the younger respondents about LCU during undergraduate years and additionally they had no post graduate qualification, which can in long term effect the quality of restorations.²³

With the recent advancements made in the field of dentistry, different modes for curing have been introduced in order to lessen the polymerization shrinkage. These include fast cure, soft cure, pulse-delay mode and conventional mode. According to the female participants aged 21-29 years most common mode utilized for curing was conventional mode, these outcomes are in accord with study ordain by Aguiar et al, who stated that improvement in hardness of composites was observed while using conventional mode.²⁶ However these results contrast from the study lead by Yazici et al who identified soft cure to be more efficient as compared to conventional mode in reducing chances of shrinkage and

improves the marginal fit of material.²⁷ Moreover participants aged 30-39 years had no information hence it can be due to lack of interest and having insufficient knowledge. Manufacturers of composite and LCU provide general recommendations for sufficient amount of time required for curing the material; however these vary according to thickness of material and require an ideal environment to perform the procedure.²⁸ Manufacturers generally recommend curing time of 20-40 seconds, while the dark shades of composites must be subjected to irradiation for longer time to be sufficiently cured.²⁵ The findings of the current study state that majority of participants belonging to different age group and genders preferred curing composites and adhesives for 10-20 seconds. A positive relation was noted in survey conducted by Barghi et al, who noted that most of the dentists cured a 2 mm thick composite resin for 20 seconds.²⁹

Sixty-six percent of the respondents aged 21-29 years answered that curing light intensity at 100-300 mv/cm² is appropriate for curing a 2 mm thick composite restoration, while respondents aged 30-39 years identified using 300-500 mv/cm². These results contrasts with the study performed by Jadhav et al and Rueggeberg et al, who stated that light intensity of 400 mW/cm² is adequately sufficient, to cure a 2mm thick increment 30,31. Researches conducted in past have revealed that LCU having intensities less than 400mW/cm² can lead to insufficient polymerization of the inner most increments of restorations affecting its mechanical properties provoking collapse, wear, enhances formation of secondary caries and increases water sorption.^{32,33} This study is one of the first studies to be conducted in Karachi in assessing the knowledge of dentist towards light cure units. It assess their knowledge regarding the different types of light cure units, adequate curing time and the different modes available for curing composites.

Few limitations that have been identified include small sample size. Additionally it was a single center study, hence incorporating more dental universities and adding respondents having post graduate qualification would tremendously improve the outcomes of the study and will be beneficial in identifying areas that needs improvement.

CONCLUSION

From the present study, it is apparent that awareness of dental practitioners especially aged 21-29 years regarding light-curing units is deficient with respect to the technical knowledge and usage of light curing device for adequate curing. Adequate polymerization of composite plays crucial role in achieving sufficient strength and hardness within composite. Hence knowledge regarding the different types of light cure units and the modes for curing and the intensity

required for adequate curing should be incorporated in the undergraduate curriculum. Workshops and seminars should be also be organised to provide further information to both undergraduates and graduates.

RECOMMENDATIONS

The current study highlights the needs for carrying out multi-centric research in order to identify level of understanding and knowledge of dentist regarding the optimum curing time and irradiation to be utilized. Moreover newly graduated dental student needs to have familiarity regarding the technical cognizance and mode of application of different instruments and equipment's used within the clinical departments of Dental OPD such as ultrasonic scalers, amalgamators. Additionally further proficiency can be provided by means of lectures or workshops.

CONFLICT OF INTEREST

None declared

REFERENCES

1. Barghi N, Berry T, Hatton C. Evaluating intensity output of curing lights in private dental offices. *J Am Dent Assoc* 1994; 125:992-96. <https://doi.org/10.14219/jada.archive.1994.0204>
2. Burgess JO, Walker RS, Porche CJ, Rappold AJ. Light curing - An update. *Compend Contin Educ Dent* 2002;23:889-906.
3. Martin FE. A survey of the efficiency of visible light curing units. *J Dent* 1998; 26:239-43. [https://doi.org/10.1016/S0300-5712\(97\)00004-3](https://doi.org/10.1016/S0300-5712(97)00004-3)
4. Pearson GJ, Longman CM. Water sorption and solubility of resin-based materials following inadequate polymerization by a visible-light curing system. *J Oral Rehab* 1989;16:57-61 <https://doi.org/10.1111/j.1365-2842.1989.tb01317.x>
5. Roulet J-F, Rocha MG, Shen C, Khudhair MM, de Oliveira DCRS. Beam profile characterization of a dental light curing unit using a spectrometer-based method. *Stoma Edu J*. 2018;5:84-91. [https://doi.org/10.25241/stomaeduj.2018.5\(2\).art.1](https://doi.org/10.25241/stomaeduj.2018.5(2).art.1)
6. El-Mowafy O, El-Badrawy W, Lewis DW, Shokati B, Kermalli J, Soliman O, et al. Intensity of quartz-tungsten-halogen light-curing units used in private practice in Toronto. *J Am Dent Association*. 2005; 136:766-73; quiz 806-7. <https://doi.org/10.14219/jada.archive.2005.0260>
7. Heft MW, Gilbert GH, Dolan TA, Foerster U. Restoration fractures, cusp fractures and root fragments in a diverse sample of adults: 24-month incidence. *J Am Dent Assoc* 2000; 131:1459-64. <https://doi.org/10.14219/jada.archive.2000.0057>
8. Fan PL, Schumacher RM, Azzolin K, Geary R, Eichmiller FC. Curing-light intensity and depth of cure of resin-based composites tested according to international standards. *J Am Dent Assoc*. 2002; 133:429-34; quiz 91-3. <https://doi.org/10.14219/jada.archive.2002.0200>
9. Namrata M, Ganapathy D. Light cure devices. *Int J Orofac Res* 2017; 2:37-9.
10. Ontiveros C.J.C., Paravina Rade D. Light-emitting diode polymerization: A review of performance, Part I. *Acta Stomatol Naissi* 2006;22:601-10
11. Martin FE. A survey of the efficiency of visible light curing units. *J Dent* 1998; 26:239-43. [https://doi.org/10.1016/S0300-5712\(97\)00004-3](https://doi.org/10.1016/S0300-5712(97)00004-3)
12. Miyazaki M, Hattori T, Ichiishi Y, Kondo M, Onose H, Moore BK, et al. Evaluation of curing units used in private dental offices. *Oper Dent* 1998; 23:50-4.
13. Leonard DL, Charlton DG, Hilton TJ. Effect of curing-tip diameter on the accuracy of dental radiometers. *Oper Dent* 1999;24:31-7.
14. Blankenau R, Kelsey WP, Kutsch VK. Clinical applications of argon laser in restorative dentistry. In: Miserendino LJ, Pick RM, editors. *Lasers in Dentistry*. Chicago: Quintessence Publishing; 1995: 217-30
15. Harris DM, Pick RM. Laser physics. In: Miserendino LJ, Pick RM, editors. *Lasers in Dentistry*. Chicago: Quintessence Publishing Company Inc.;1995:27-38.
16. Walsh LJ. The current status of laser applications in dentistry. *Aust Dent J* 2003;48:146-55. <https://doi.org/10.1111/j.1834-7819.2003.tb00025.x>
17. Anic I, Pavelic B, Peric B, Matsumoto K. In vitro pulp chamber temperature rises associated with the argon laser polymerization of composite resin. *Lasers Surg Med* 1996;19:438-44. [https://doi.org/10.1002/\(SICI\)1096-9101\(1996\)19:4<438::AID-LSM9>3.0.CO;2-T](https://doi.org/10.1002/(SICI)1096-9101(1996)19:4<438::AID-LSM9>3.0.CO;2-T)
18. Walsh LJ. The current status of laser applications in dentistry. *Aust Dent J*. 2003;48:146-55. <https://doi.org/10.1111/j.1834-7819.2003.tb00025.x>
19. Tarle Z, Meniga A, Knezevic A, Sutalo J, Ristic M, Pichler G, et al. Composite conversion and temperature rise using a conventional, plasma arc, and an experimental blue LED curing unit. *J Oral Rehabil* 2002;29: 662-7. <https://doi.org/10.1046/j.1365-2842.2002.00866.x>
20. Hofmann N, Hugo B, Schubert K, Klaiber B. Comparison between a plasma arc light source and conventional halogen curing units regarding flexural strength, modulus, and hardness of photoactivated resin composites. *Clin Oral Invest* 2000;4:140-47. <https://doi.org/10.1007/s007840000063>
21. Corciolani G, Vichi A, Davidson CL, Ferrari M. The influence of

tip geometry and distance on light-curing efficacy. Oper Dentist. 2008;33:325-31.

<https://doi.org/10.2341/07-94>

22. Mills RW. Blue light emitting diodes-another method of light curing? Br Dent J 1995;178:169 Letter

<https://doi.org/10.1038/sj.bdj.4808693>

23. Tüloğlu N, Ozer S, Tunç N, Canbaz S, Bayrak S. Knowledge and attitudes of dental clinicians regarding light-curing units in northern turkey. Clin Dent Res 2016; 40:26-34

24. Santini A, Turner S. General dental practitioners' knowledge of polymerisation of resin-based composite restorations and light curing unit technology. Brit Dent J. 2011;211:E13.

<https://doi.org/10.1038/sj.bdj.2011.768>

25. Madhusudhana K, Swathi TV, Suneelkumar C, Lavanya A. A clinical survey of the output intensity of light curing units in dental offices across Nellore urban area. SRM J Res Dent Sci. 2016;7:64-68

<https://doi.org/10.4103/0976-433X.182657>

26. Aguiar FH, Braceiro A, Lima DA, Ambrosano GM, Lovadino JR. Effect of light curing modes and light curing time on the microhardness of a hybrid composite resin. J Contemp Dent Pract. 2007;8:1-8.

<https://doi.org/10.5005/jcdp-8-6-1>

27. Yazici AR, Celik C, Dayangac B, Ozgunaltay G. Effects of different light curing units/modes on the microleakage of flowable composite

resins. Europ J Dentist. 2008;2:240-46

<https://doi.org/10.1055/s-0039-1697387>

28. Price RB, Shortall AC, Palin WM. Contemporary issues in light curing. Oper Dentist. 2014;39:4-14.

<https://doi.org/10.2341/13-067-LIT>

29. Barghi N, Berry T, Hatton C. Evaluating intensity output of curing lights in private dental offices. J Am Dent Assoc 1994; 125:992-96.

<https://doi.org/10.14219/jada.archive.1994.0204>

30. Jadhav S, Hegde V, Aher G, Fajandar N. Influence of light curing units on failure of direct composite restorations. J Cons Dent 2011;14:225-27.

<https://doi.org/10.4103/0972-0707.85793>

31. Rueggeberg FA, Caughman WF, Curtis JW Jr. Effect of light intensity and exposure duration on cure of resin composite. Oper Dent 1994;19:26-32

32. Bansal R, Hora BS, Kumar A, Bansal M, Gupta C, Singla S. Are we doing justice? A clinical survey of the output intensity of light curing units in dental offices. Int J Dent Sci 2012;4:9-11

33. Fan PL, Schumacher RM, Azzolin K, Geary R, Eichmiller FC. Curing-light intensity and depth of cure of resin-based composites tested according to international standards. J Am Dent Assoc 2002; 133:429-34.

<https://doi.org/10.14219/jada.archive.2002.0200>