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EVALUATION OF THE OUTPUT INTENSITY OF LIGHT CURING UNITS AMONG PALESTINIAN DENTAL PRACTITIONERS: A CROSS-SECTIONAL STUDY

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Abstract

Aim: The present study aims to evaluate the intensity of light curing units among practitioners in Palestine.

Materials and methods: Present study follows a cross-sectional study design to evaluate the type of curing light used, the tip diameter, presence of remnants on the tip as well as the curing light output measured using a radiometer. Chi-square test was used to evaluate the statistical significance of the frequency of the variables ($p<0.05$).

Results: 93.23% of practitioners used LED light with a tip diameter of 8mm. 82.5% of practitioner had remnants of residual filling on the tip of the light cure unit. 83.5% showed low output intensity of curing light. Chi-square test showed significant difference in the frequency of variables included in the study ($p<0.001$).

Conclusion: The practitioners in Palestine use light curing units with low output intensity as measured with a radiometer.

Introduction

The advent of esthetic dentistry has led to more use of composites, resin modified glass ionomer cements, polyacid modified resin based composites and ceramics for restoration(Rosenstiel et al. 1998). These esthetic restorative materials use heat curing, self-curing or light curing mechanisms to achieve the final set. Out of all the other setting methods, light curing is the most commonly used method to achieve the final setting in most of the widely used esthetic restorations (Asnani 2010).

The success of the restorations largely depends on the efficacy of the curing achieved in the restorations. Studies that evaluate factors like secondary caries, marginal discoloration, micro leakage and wear of the margins are largely caused because of inadequate curing of the restoration (Geurtsen et al. 1999; Mjör & Toffenetti 1992). This makes curing also known as polymerization an important factor in the success of the restoration.

The polymerization can be achieved by using four types of devices, Quartz-tungsten halogen lamps (QTH), light emitting diode (LED), plasma arc lamps and argon ion lasers(Singh et al. 2011). Curing device, the duration of curing, type of mode of

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curing and the intensity of the curing device are the factors that play an important role in achieving adequate polymerization (AlShaafi 2017). The intensity of the curing device is majorly dependent on two types of factors: internal factors and external factors. The internal factors which govern the light intensity include the type of light cure unit, the input and the battery used in the light cure unit, its filters and connections. The external factors which influence the light intensity include distance of the material from the light cure unit, the tip diameter, presence of sleeve and presence of contamination on the light cure surface (Jadhav et al. 2011). A regular check of the intensity is pivotal in achieving proper polymerization of the composite. This intensity of the light can be measured using a radiometer.

A radiometer provides a quantitative measurement of the electromagnetic radiation emitted by the light source. In a dental setting, hand held radiometers can be used to evaluate the intensity of light. Laboratory grade power meters are another method which can be used to assess the intensity (Anon 1992).However; the clinical radiometer can be a handy technique to keep a proper check of intensity for the curing light.

The intensity of the curing unit affects polymerization of the composites, it is essential to keep the intensity in check. No study has been conducted to evaluate the intensity of different curing units in Palestine. Hence the present study aims to evaluate the power of the light cure emitting device using a radiometer along with other factors which influence the light intensity.

Materials and Methods

The present study is a cross-sectional study carried out in different cities of Palestine between April 2019 and July 2019. The present study is a preliminary survey to evaluate if dentists in Palestine are using dental curing light with adequate intensity.

The study was conducted by an intern dentist who visited different dental clinics in different cities of Palestine and explained the nature of the study assessing the confidentiality and anonymity of the dentists participating in the study. Dentists who did not wish to participate were excluded from the study. The type of the curing light device was noted. Additionally the tip diameter of the curing light device was noted into two categories 8mm and 10 mm. A vernier caliper was used to measure the tip diameter. The remnants of the filling on the tip of the curing light were also noted. A magnifying glass was used to examine the tip of the curing light for remnants of fillings. Lastly a handheld radiometer was used to measure the intensity of the curing light. The curing light intensity was divided into two types less than 500 and more than 500.

All the data collected using the survey was recorded using a spreadsheet. The frequency of individual variables was calculated using SPSS software version 22. (IBM Corp. Armont, NY, USA). Chi-square test was done to find association between independent variables and the response recorded ($p<0.05$).

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Results

A total of 301 dental practitioners participated in the present study. Out of these 297 practitioners used LED light for curing whereas only 4 of them used QTH light. Since very few of them used QTH light, this value was not included for further statistical evaluation in the study.

Out of the 297 practitioners using LED light for curing, 93.26% used LED light with 8 mm tip diameter whereas only 6.74% used a larger diameter tip of 10 mm. Chi-square test show a statistically significant difference between the tip diameters. ($p<0.001$) (Table 1)

While evaluating the filling remnants on the tip, 82.5% showed remnants of filling whereas only 17.5% regularly removed the remnants and had clean tips. Chi-square test show statistically significant difference between the two groups ($p<0.001$) (Table 1).

On evaluating the intensity of the curing light unit using radiometer, 83.5% of the LED lights gave a reading below 500, whereas 16.5% gave satisfactory radiometer readings above 500. Chi-square test show statistically significant differences between the radiometer readings of two groups ($p<0.001$) (Table 1).

Discussion

Longevity of esthetic restorations is dependent on various factors which may and may not be in control of the dental practitioner. However, one of the most important factors which are under the control of the dental practitioner and which is usually ignored is achieving adequate polymerization. A study has reported composite failures have largely been associated with the polymerization which is dependent on the intensity and duration of polymerization along with the mode of light used (Jadhav et al. 2011). Since the intensity of light is one of the major factors to achieve longevity in esthetic restorations, the present study was conducted to evaluate the intensity of curing light used.

The present study followed a cross-sectional study design. Since this is a preliminary study in Palestine to evaluate the intensity of light curing devices, a cross-sectional study design was used. This would provide a base data and help to correlate with the failures of esthetic restorations in Palestine.

Most of the practitioners in the present study used LED light for polymerization and very few used the QTH light. Since the number of Palestinian dentists using QTH light was low this could not have achieved significant results for other factors to evaluate the light intensity. Hence it was excluded from the present study. Another study has also reported more number of LED lights in use as compared to QTH light which is a similar result to the present study (Nassar et al. 2018).

Smaller curing light tip provides higher intensity of light. Hence using an 8 mm tip would increase the intensity of curing by providing larger energy, thereby providing better polymerization of the restoration. In the present study more number of dentists used a curing light with a wider tip of 8 mm which would provide better

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polymerization. Similar results of the present study were obtained by another study evaluating the effectiveness of 4mm, 8mm and 10mm of tip diameter (Nitta 2005).

Presence of remnants and contamination of the surface of the curing light decreases the intensity of the curing light. The present study showed more number of practitioners not keeping their tip clean and had remnants on the tip. In addition this would also aid in cross-contamination. Other study has also reported presence of contaminants on the tip decreasing the polymerization effect (Belvedere 2007).

The present study evaluated most of the practitioners to have low intensity of curing light when checked with the radiometer. A low intensity of curing light would not provide adequate polymerization, hence keeping a regular check of the intensity of curing light is pivotal. Presence of remnants would also be a cause to reduce the intensity of curing light as shown in the present study. Another study has also reported a regular check of the curing light intensity using a radiometer (Al Shaafi et al. 2011).

The present study thus provides preliminary data and evaluates the output intensity of light cure units in Palestine. This preliminary data can be used as baseline information to conduct further studies to correlate with the failure of dental restorations in Palestine thereby providing quality care to the patients.

Conclusion

The present study concludes most of the dentists surveyed in Palestine are using curing lights with low intensity output. Most of the dentists in the present study did not even clean the residual restoration material at the tip. However, most of them used a tip with small diameter to achieve more intensity of curing. The present study is thus a baseline study to provide preliminary data to correlate with the longevity of restorations in Palestine.

References

a) AlShaafi, M.M., 2017. Factors affecting polymerization of resin-based composites: A literature review. *The Saudi dental journal*, 29(2), pp.48–58.
b) Al Shaafi, M., Maawadh, A. & Al Qahtani, M., 2011. Evaluation of light intensity output of QTH and LED curing devices in various governmental health institutions. *Operative dentistry*, 36(4), pp.356–361.
c) Anon, 1992. Measuring light intensity. In *Basic Lighting Worktext for Film and Video*. Routledge, pp. 67–75.
d) Asnani, K., 2010. Aesthetic Restorative Dentistry for the Adolescence. *Essentials of Pediatric Dentistry*, pp.223–223. Available at: http://dx.doi.org/10.5005/jp/books/11351_20.
e) Belvedere, P.C., 2007. Light-emitting diode curing light irradiance and polymerization of resin-based composite. *Yearbook of Dentistry*, 2007, pp.36–37. Available at: http://dx.doi.org/10.1016/s0084-3717(08)70324-6.

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f) Geurtsen, W., Leyhausen, G. & Garcia-Godoy, F., 1999. Effect of storage media on the fluoride release and surface microhardness of four polyacid-modified composite resins ("compomers"). *Dental materials: official publication of the Academy of Dental Materials*, 15(3), pp.196–201.
g) Jadhav, S. et al., 2011. Influence of light curing units on failure of direct composite restorations. *Journal of conservative dentistry: JCD*, 14(3), pp.225–227.
h) Mjör, I.A. & Toffenetti, F., 1992. Placement and replacement of resin-based composite restorations in Italy. *Operative dentistry*, 17(3), pp.82–85.
i) Nassar, H.M., Ajaj, R. & Hasanain, F., 2018. Efficiency of light curing units in a government dental school. *Journal of oral science*, 60(1), pp.142–146.
j) Nitta, K., 2005. Effect of light guide tip diameter of LED-light curing unit on polymerization of light-cured composites. *Dental materials: official publication of the Academy of Dental Materials*, 21(3), pp.217–223.
k) Rosenstiel, S.F., Land, M.F. & Crispin, B.J., 1998. Dental luting agents: A review of the current literature. *The Journal of prosthetic dentistry*, 80(3), pp.280–301.
l) Singh, T.K. et al., 2011. Light curing devices-A clinical review. *Journal of orofacial research*, pp.15–19.

ANNEXURES

Table 1: Variables assessing the intensity of curing light.

Variables	Frequency (n)	Frequency (%)	p-value
Tip Diameter			
8mm	277	93.26	<0.001*
10mm	20	6.74	
Filling Remnants on tip			
Present	245	82.5	<0.001*
Absent	52	17.5	
Radiometer Reading			
less than 500	248	83.5	<0.001*
more than 500	49	16.5	

*P-value is considered significant <0.05