



ORIGINAL ARTICLE

Biosecurity in the use of light curing lamps in students of the dentistry career

Bioseguridad en el uso de lámparas de fotopolimerización en estudiantes de la carrera de odontología

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ABSTRACT

Introduction: photopolymerization lamps play an important role in daily dental practice, and eye safety measures must be observed when using them.

Objectives: to determine the prevalence of the use of biosafety equipment against the light emitted by photopolymerization lamps in dentistry students.

Methods: observational, descriptive, cross-sectional study carried out at the Universidad Regional Autónoma de los Andes "UNIANDES". A sample of 59 students was selected in a probabilistic, simple random manner. For data collection, an ad hoc survey was used which allowed obtaining information that gave rise to the variables studied, using descriptive statistics methods for their analysis.

Results: the most common type of eye protection was found in the seventh and eighth semesters (34 % in each case), with 31 % stating that they always use eye protection. 12 % of the students stated that they always avoid looking directly at the emitted light, with 22% providing adequate eye protection to their patients. 19 % always clean the external components of the lamps, with 7 % always protecting the lamps with a barrier. 66 % always follow the manufacturer's instructions regarding the curing time, while 64 % always use the curing lamp following the instructions for its correct use.

Conclusions: the prevalence of the use of biosecurity when dealing with the light emitted by photocuring lamps was adequate, demonstrating the need to know and correctly use the protective filters of these lamps.

Keywords: Containment of Biohazards; Light-Curing of Dental Adhesives; Dentistry; Polymerization.

RESUMEN

Introducción: las lámparas de fotopolimerización representan un papel importante en la práctica odontológica diaria, siendo necesario el cumplimiento de medidas de seguridad ocular para su uso.

Objetivos: determinar la prevalencia del uso de equipo de bioseguridad frente a la luz emitida por las lámparas de fotopolimerización en estudiantes de la carrera de odontología.

Métodos: estudio observacional, descriptivo, transversal efectuado en la Universidad Regional Autónoma de los Andes "UNIANDES". De forma probabilística, aleatoria simple fue seleccionada una muestra de 59 estudiantes. Para la recolección de datos se utilizó una encuesta *ad hoc* la cual permitió la obtención de información que dio salida a las variables estudiadas, empleándose métodos de estadística descriptiva para su análisis.

Resultados: predominaron los estudiantes del séptimo y octavo semestre (34 % en cada caso), refiriendo el 31 % utilizar siempre protección ocular. El 12 % de los estudiantes afirmaron que siempre evitan mirar directamente la luz emitida, proporcionando el 22 % protección ocular adecuada a sus pacientes. El 19 % limpian siempre los componentes externos de las lámparas, protegiendo siempre el 7 % las lámparas con una barrera. El 66 % sigue siempre las instrucciones del fabricante respecto al tiempo de fotocurado, mientras el 64 % siempre utilizan la lámpara de fotocurado siguiendo las indicaciones para su correcto manejo.

Conclusiones: la prevalencia del uso de bioseguridad al enfrentarse a la luz emitida por las lámparas de fotocurado fue adecuada evidenciándose la necesidad de conocer y utilizar correctamente los filtros protectores de estas lámparas.

Palabras claves: Contención de Riesgos Biológicos; Curación por Luz de Adhesivos Dentales; Odontología; Polimerización.

INTRODUCTION

LtoLight curing lights (LFP) are very common devices in dentistry, as they are used to activate photo initiators and polymerize resinous materials. Their proper maintenance, eye protection and correct technique of use are fundamental aspects for their safe and effective use in clinical practice.⁽¹⁾ Second and third generation lights have replaced halogen lights due to their inherent advantages. In clinical routine, dentists use direct light-curing composites, therefore it is crucial that they understand essential elements to achieve optimal and effective curing. Design, connection (whether wired or wireless), light intensity and wavelength are key factors to consider when purchasing a quality light-curing device.⁽²⁾

Early lights used in dentistry had limitations in curing depth due to low transparency of UV light, which could cause damage to vision and soft tissue. In the 1970s, UV radiation was used as a light source, followed by halogen lamps in the 1980s. Today, LED lights offer significant advantages and are suited to various needs thanks to their advanced technologies. A 2001 study by Dawson and his team showed that LED lights emitting blue light exhibit similar levels of toxicity to blue laser in studies with monkey retinas.

Therefore, it is essential for dentists to understand the light emission spectrum in order to take appropriate precautions and differentiate the characteristics of each curing light in restorative procedures. In addition, proper maintenance is crucial to avoid problems during use.^(3,4,5,6)

LED curing lights are the most advanced technology in the field, standing out for their ergonomics, light spectrum, power and wavelength, and have surpassed halogen lamps in popularity. In the workplace, it is crucial to implement biosafety measures to avoid adverse effects and long-term illness. Dentists have an ethical responsibility to stay up to date on innovations in biosafety and practice it effectively, especially in the use of curing lights. A study among dentists revealed that few use and know the necessary protective measures, and only 9 % frequently check their curing lights. Protective methods such as visors, glasses with yellow lenses, avoiding looking directly at the light and using filters on the lamp are essential. A study at the Universidad del Valle in 2014 showed that 92,1 % of students used protective methods and 94,1 % were aware of the eye risks, although without a clear understanding of them.^(7,8,9)

It is essential to keep in mind that students are exposed to various agents that can be harmful to health, and photopolymerization lamps, by emitting high wavelengths, can cause eye problems. For this reason, it is imperative that biosecurity measures are strictly followed to protect eye health during their use.⁽¹⁰⁾ Taking into account the above, the present research is carried out, which aimed to determine the prevalence of the use of biosecurity equipment when facing the light emitted by photopolymerization lamps in seventh to ninth semester dentistry students at the Universidad Regional Autónoma de los Andes "UNIANDES".

METHODS

An observational, descriptive, cross-sectional study was carried out at the Regional Autonomous University of the Andes "UNIANDES". The population consisted of 312 students from the seventh to ninth semester of the Dentistry program who were enrolled during the period from May to September 2023, in said institution. A sample of 59 students was selected by simple random probabilistic method, who met the inclusion criteria (students who use photopolymerization lamps in the seventh to ninth semesters, enrolled in the period from May to September 2023 at the "Corona Gómez Armijos" PhD Dental Specialties Clinic, and who have given their informed consent to participate in the research).

For data collection, documentary analysis was used, using an ad hoc survey (Annex 1), which allowed obtaining information that gave rise to the variables studied. This survey was put online using the Google Forms platform for distribution.

Descriptive analysis of the data obtained was carried out, using the analysis of absolute frequencies and percentages, and graphs were used to represent the data obtained. Medical ethics were respected.

RESULTS

The distribution of students according to the semester they were studying shows a predominance of those who were in their seventh and eighth semester (34 % in each case).

Analysis of Chart 1 shows that 31 % of students say they always use eye protection, either with glasses or protective screens, when exposed to lamplight. On the other hand, 49% say they almost always do so.

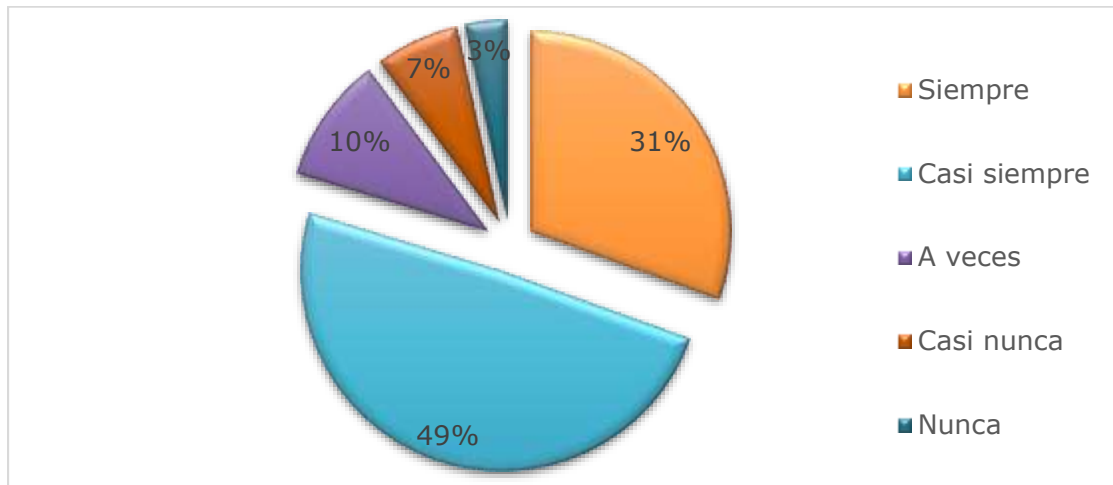


Chart 1. Sample distribution according to eye protection against exposure to light emitted by the lens of the photocuring lamp

It was found in graph 2 that 12 % of the students stated that they always avoid looking directly at the light emitted by the lens of the lamp, while 47 % almost always avoid it, and only 10 % mentioned not avoiding it.

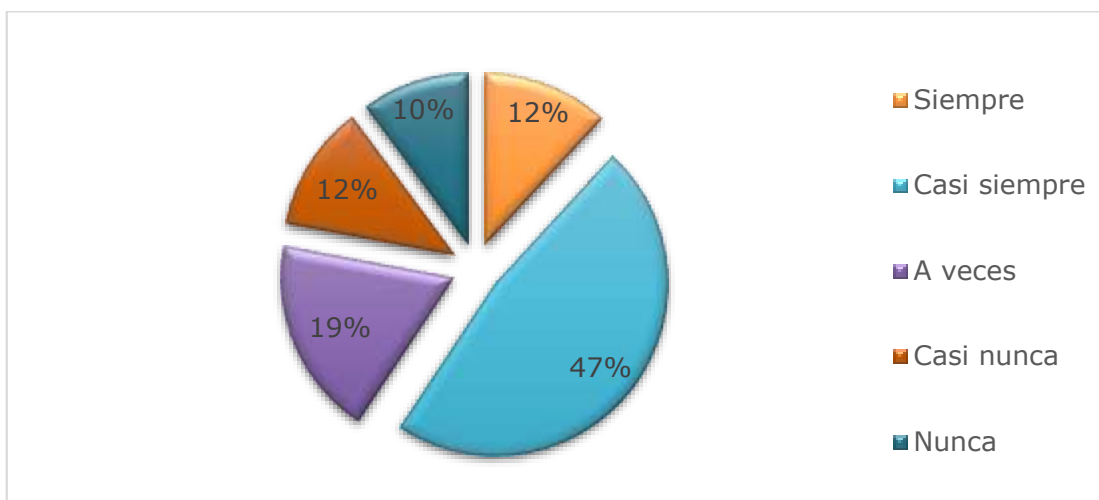


Chart 2. Sample distribution according to direct observation of the light emitted by the lamp lens

It can be seen from Figure 3 that 22 % of students always provide adequate eye protection to their patients, while 44 % (26/59) almost always do so. Only 7 % mentioned that they never provide such protection.

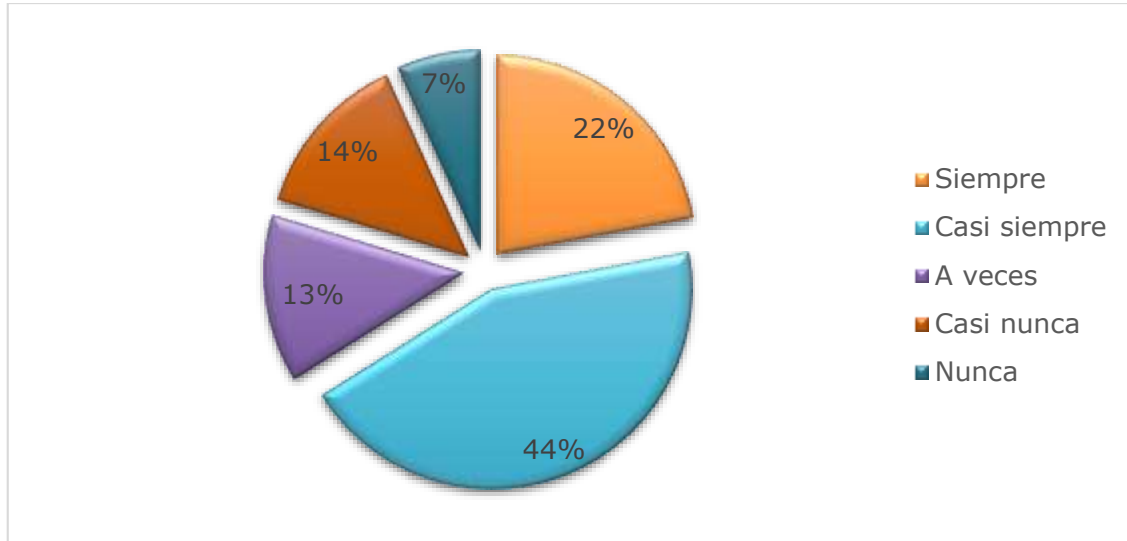


Chart 3. Sample distribution according to appropriate eye protection provision for patients

The study revealed that only 19 % of students always clean the external components of the lamps with disinfectants after use, while 37 % never do so. In addition, only 7 % always protect the curing lamps with a barrier, and 20 % know the type of light they emit. 66 % always follow the manufacturer's instructions regarding curing time, and 48 % are aware of biosafety regulations. Likewise, 51 % always apply protective measures, and 29 % never use the lamp continuously for more than one minute.

Chart 4 highlights how 64 % of students always use the curing light following the instructions for its correct use, while 20 % do so almost always. Only 2 % of students mentioned that they never do so.

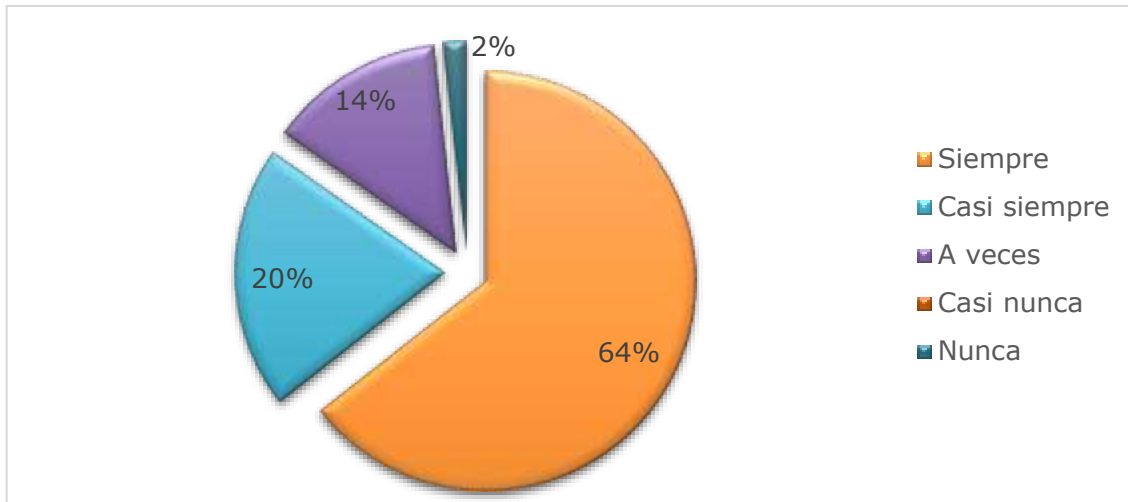


Chart 4. Sample distribution according to the use of the photocuring lamp according to the instructions for its correct handling

20 % of students always use protective glasses when light curing during their clinical activity, and 10 % do so almost always. In contrast, 51% almost never use glasses as protection, and 14 % never use them as a protective measure.

According to the results obtained from graph 5, 15 % of students always use biosafety measures, while 75 % use them sometimes, and 10 % do not use them at all.

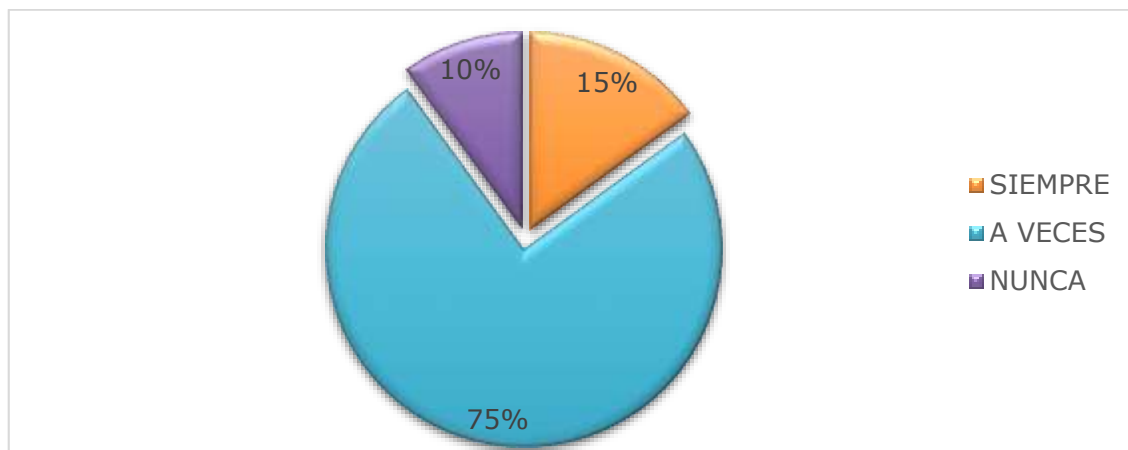


Chart 5. Sample distribution according to the prevalence of the use of biosafety equipment against the light emitted by the photocuring lamps

DISCUSSION

In the present research, the data show that regarding the application of protective measures in general, only 51% always apply them. These results contrast with the research study carried out by Curiel and Eusebio on the level of compliance with biosecurity standards during the use of the photocuring lamp by dentistry students at the University of Carabobo in the period 2007-2008. In this study, the data indicated a relatively low level of compliance and showed that the protection standards were not always met.⁽¹¹⁾

It is important to highlight the use of protective glasses during clinical activity, as it was observed that only 20 % of respondents always use them, while 51 % almost never do so. This lack of use can lead to eye problems, as Romero mentions in his study. The greatest ocular damage can result in permanent retinal injury, which is perceived as a blind spot in the center of the visual field. In addition, degenerative processes can occur in the eye that can trigger corneal injuries. On the other hand, there is photokeratitis, which can disappear within 48 hours and is due to exposure to UV radiation in the range of 180 to 400 nm.⁽¹²⁾

It is important to note that exposure to light emitted by curing lights is different for patients and dentists; studies have shown that it is not necessary for patients to wear eye protection during treatments, as the light guide is approximately 1 cm in diameter and is held inside the mouth for a few seconds. This significantly minimizes the risk of direct eye exposure for patients during dental procedures. However, it is crucial that dental health professionals take adequate measures to protect their own eyes during the use of these curing lights.⁽¹³⁾

In relation to the hygiene of the lamp and its components, as well as the use of barriers to prevent infection, it is crucial to point out that microbial contamination can affect the lamp due to the work environment and handling during procedures. Therefore, it is especially important to carry out a thorough cleaning in the handle area, since it is the most manipulated part. Angelo García Zumbado, in his research, points out that the photopolymerization lamps that used adhesive protection barriers kept the levels of microbial contamination below the permitted limits by 96 %, while those that did not use these barriers presented a level higher than 53 %. Regarding our research, it was shown that only 7 % always protect the lamp with some barrier, and 31 % do so almost always. Therefore, it is important to raise awareness about the importance of these biosecurity measures, since they can help reduce the microbial load in the lamps after each treatment.⁽¹⁴⁾

On the other hand, the proper use of photocuring lamps is recommended for periods of time not exceeding one minute. Regarding this recommendation, a survey was conducted among students, the results of which were as follows: 29 % never use the lamp continuously for more than one minute, 32 % almost always do so, 9 % occasionally do so, and 15 % and 15 % almost never and never do so, respectively. There are investigations that have evaluated the light intensity of LED photocuring lamps by using a radiometer, revealing that 48,5 % of the lamps have a medium intensity, 22,86 % high intensity, 15,71 % low intensity, and 12,86 % very high intensity,⁽¹⁵⁾ It is therefore important to avoid exposing students to the light emitted by the lamp for periods of more than one minute.

This study also shows that 64 % of the students surveyed always use the lamp following the instructions for its correct operation, just as 66 % always follow the instructions of the dental material manufacturer to obtain information on the curing time. According to Jarquín Hernández's research on the temperature increase on the tooth surface during photopolymerization, it was concluded that lamps with high energy output generate a greater temperature increase in the tooth compared to conventional lamps. Therefore, caution is necessary due to the potential thermal risk to the pulp when polymerizing materials.⁽¹⁶⁾ The color of the resin, the presence of porosity in the material, the initial temperature and the thickness of the material are factors that can affect the temperature increase. It is essential to follow the curing and cooling times recommended by the lamps to prevent tissue injury due to overheating.

It is highlighted that the use of biosecurity measures among students regarding the light emitted by photocuring lamps reveals results such as 15 % always using them, 75 % sometimes and 10 % never. Therefore, it is crucial that students know how to address light exposure and understand the type of light emitted by the lamps, the importance of checking the operating status of the lamp, and the possible risks to the eyes. The use of protective screens adapted to the lamp or protective glasses is effective in blocking the light within a safe spectrum range. In addition, it is essential that the operator is familiar with the operation of the photocuring lamp he uses, and must regularly check the components, including the lens through which the light is emitted, as a standard practice between treatments.⁽¹⁷⁾

CONCLUSIONS

In conclusion, this study highlights the importance of using protective glasses or screens as biosecurity measures against the light from photopolymerization lamps, to avoid eye damage such as retinal lesions and photokeratitis. It also highlights the need to know and correctly use the protective filters of these lamps, through the use of radiometers and regular inspections.

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ANEXOS

Anexo 1. Encuesta de bioseguridad en el uso de lámparas de fotopolimerización en estudiantes de séptimo a noveno semestre.

Nº	Pregunta	S	CS	AV	CN	N
1	Me protejo los ojos ante la exposición a la luz emitida por el lente de la lámpara de fotocurado con gafas o pantallas protectoras.					
2	No miro directamente la luz emitida por el lente de la lámpara.					
3	Le brindo a mis pacientes la protección ocular apropiada					
4	Limpio los componentes externos de la lámpara con desinfectantes después de usarla.					
5	Protejo la lámpara de fotocurado con alguna barrera para evitar su infección.					
6	Conozco el tipo de luz que emiten estas lámparas.					
7	Sigo las instrucciones del fabricante del material odontológico para obtener información sobre el tiempo de fotocurado.					
8	Tengo conocimiento de las normas de bioseguridad que se deben utilizar durante el uso de la lámpara de fotocurado.					
9	Aplico las medidas de protección.					
10	No utilizo la lámpara de forma continua durante períodos de tiempo superiores a un minuto.					
11	Utilizo la lámpara de fotocurado siguiendo las indicaciones para su correcto manejo.					
12	Uso lentes de protección al momento de fotocurar durante mi actividad clínica					

S= Siempre CS= Casi siempre AV= A veces CN= Casi nunca N= Nunca