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Chilean dentists' knowledge of hearing loss generated by occupational noise exposure

Conocimiento de odontólogos chilenos sobre la pérdida auditiva generada por exposición ocupacional al ruido

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Abstract

Introduction: Dentists are a population at high risk of hearing loss due to their constant exposure to instruments that can generate noise of up to 100 dB during their practice.
Objective: To determine the level of knowledge of dentists working in Chile regarding hearing loss caused by exposure to noise generated by dental instruments.
Materials and methods: A cross-sectional study was conducted in 114 dentists, who completed a virtual survey of 22 questions regarding the perception and level of knowledge about hearing loss due to exposure to loud noises and about national regulations on occupational noise exposure. Differences between perception and knowledge levels were evaluated taking into account the years of professional practice and the average weekly workload in dental treatment rooms. Descriptive and inferential statistics (Chi-squared test) were used for data analysis.
Results: Most participants were Chilean (99.1%); 58.8% were women, and 72.8% had less than 10 years of professional experience. In addition, 97.4% were unaware of national regulations on occupational noise exposure and 50% of the sample reported having experienced hearing loss; of these, 57.9% (n=32) associated it with their practice.
Conclusions: A very low percentage of participants knew that there are regulations regarding occupational noise exposure. For this reason, it is important that, both during their training and their professional practice, dentists in Chile have greater access to information about these regulations and hearing protection measures.
Keywords: Dentists; Hearing Loss; Occupational Health; Hearing Loss, Noise-induced (MeSH).

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Resumen

Introducción. Los odontólogos son una población con un alto riesgo de desarrollar pérdida auditiva debido a la constante exposición a instrumentales que deben usar en su práctica profesional y que pueden generar ruidos de hasta 100 dB.
Objetivo. Determinar el nivel de conocimiento de odontólogos laboralmente activos en Chile respecto a la pérdida auditiva causada por la exposición al ruido generado por maquinarias dentales.
Materiales y métodos. Estudio transversal realizado en 114 odontólogos, quienes diligenciaron una encuesta virtual de 22 preguntas relativas a la percepción y el nivel de conocimiento sobre pérdida auditiva por exposición a ruidos fuertes y sobre la normativa nacional respecto a exposición ocupacional al ruido. Se evaluaron las diferencias entre percepción y niveles de conocimiento según los años de ejercicio profesional y la carga promedio de trabajo semanal en boxes de atención. Para el análisis de los datos se utilizó estadística descriptiva e inferencial (prueba de chi-cuadrado).
Resultados. La mayoría de participantes eran chilenos (99.1%); el 58.8% fueron mujeres, y el 72.8% tenía menos de 10 años de ejercicio profesional. Además, el 97.4% desconocía las regulaciones nacionales sobre exposición ocupacional al ruido y el 50% reportó haber experimentado pérdida auditiva; de estos, 57.9% (n=32) lo asoció a su profesión.
Conclusiones. Un muy bajo porcentaje de los participantes sabe que hay disposiciones sobre exposición ocupacional al ruido, por lo que es importante que, tanto en su formación, como durante su ejercicio profesional, los odontólogos en Chile tengan un mayor acceso a información relativa a estas normativas y a medidas ocupacionales de protección auditiva.
Palabras clave: Odontólogos; Pérdida auditiva; Salud laboral; Pérdida auditiva provocada por ruido (DeCS).

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Introduction

Hearing is the ability of every living being to perceive, transmit and analyze the sounds of the environment in the cerebral cortex. It is a sensory process relevant to communication and language development.[1,2] This ability may be interrupted temporarily or permanently, and this is known as hearing loss or hypoacusis.

The etiology of hearing loss may be explained by different reasons such as congenital or acquired disorders, autoimmune disorders, infectious diseases, injuries due to ototoxic substances and external factors such as exposure to noise.[3]

Occupational hearing loss, also known as noise-induced hearing loss,[4] mainly affects workers and is caused by high and prolonged exposure to noise in the workplace. This exposure may involve a short but intense noise, or a strong and continuous noise.[5]

Hearing loss directly affects people's quality of life and one of the most important consequences is limited communication,[6] which in turn can affect the social and emotional spheres since poor communication generates social isolation, less contact and social engagement, and even depression. Furthermore, hearing loss has been demonstrated to be a barrier to persons looking for a job, and those who do find one may be assigned to lower-paying positions.

In Chile, 30% of the working population is exposed, during their shifts, to noise levels that could cause damage to the inner ear.[7] There are various professions in which workers are subject to constant exposure to noise; for example, in the industrial sector of the economy, those who work in the food, construction and mining sectors are affected; in the transportation area, truck drivers, cab drivers and other drivers are affected;[8] and in the health area, dentists are the most affected because they must operate machines (dental compressors, periodontal scalers, micromotors, etc.) that produce noise averaging 94.77 dB if they are used together with a suction device, or up to 100 dB if these tools are old.[9]

Currently, despite the modernization of dental instruments, there is no evidence to prove that dentists are at lower risk of exposure to noise.[10] On the contrary, the prevalence of hearing loss in this population varies between 15%[11,12] and 30% according to the relevant literature,[13] that is, these workers are at high risk of suffering from this condition.[14] In this context, the risk of hearing loss is influenced by the accumulation of noise exposure over time, usually for decades,[11,13] so the use of hearing protectors should help reduce its prevalence;[15] however, it has been reported that the use of this type of protection is rare among dentists.[16]

Legislation in force in Chile does not allow any worker, regardless of their profession or occupation, to be exposed to continuous sound pressure levels >115 dB without using hearing protection.[7,16] In the country, it has also been established that no person that works for 8 hours a day can be exposed to occupational noise ≥85 dB,[17] but exposure to these continuous sound pressure levels is allowed for workers using hearing protection if the time of exposure does not exceed the set values.

In spite of these regulations and the existing evidence on noise-induced hearing loss, Ferrando *et al.*[18] found that information on this matter has not been properly disseminated to dentists. On the other hand, there are no guidelines in the country that regulate noise supervision in this area, nor has it been established whether these professionals should receive any kind of training in this regard (either through courses or in undergraduate or postgraduate training) that would allow them to identify such hazards and understand that hearing loss is an occupational health risk.

Worldwide, Lazarotto-Schettini *et al.*[19] conducted a study in 54 dentists that aimed to determine the level of knowledge about hearing loss and the use of hearing protection and found that 47% of participants reported knowing about the consequences and 94.4% stated that they did not use hearing protection. In addition, the study found that the lack of information related to noise and its impact on health hinders control and prevention, so it is necessary to consider these issues at the different levels of dentists' training.

Given the panorama and the importance of knowing the current situation of dental practice in this regard, the objective of this study was to determine the level of knowledge of dentists working in Chile regarding hearing loss caused by exposure to the noise generated by dental instruments.

Materials and methods

Cross-sectional study[20] conducted in 114 dentists of both sexes who were working in Chile during 2018. The study population was obtained by convenience sampling, taking into account the following inclusion criteria: being an active dentist in Chile in 2018, being registered in the National Registry of Individual Health Providers of Chile, agreeing to participate in the study, and completing the survey sent by the researchers.

Groups and colleges of dentists and private institutions were consulted to obtain the contact details of dentists and to invite them to participate in the study. Dentists were also contacted in person and through electronic media such as e-mail and Facebook.

The data were obtained through a virtual survey designed for this purpose, which was reviewed and validated by hearing professionals and a methodologist. The instrument was composed of 22 questions on sociodemographic and occupational information, perception and level of knowledge of hearing loss caused by exposure to loud noises as a result of the use of dental equipment, and level of knowledge of national regulations regarding occupational noise exposure (Annex 1).

The survey was administered online between August and November 2018, for which a link was sent to each subject interested in participating through different platforms.

The data collected was analyzed using descriptive statistics (table with tabulated frequencies and percentages per item) and inferential statistics using the Chi-square test (comparison of the variables under study according to the years of working experience in dentistry and the average weekly work time in dental treatment rooms).

The study took into account the ethical principles for medical research involving human beings established by the Declaration of Helsinki[21] and the health research provisions of Law 10120 of 2006[22] established by the Chilean Ministry of Health. The present research was approved by the Research Ethics Committee of the Universidad Católica de Temuco in accordance with Resolution

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05/19 of April 5, 2019. All dentists signed an informed consent before completing the survey.

Results

A total of 114 dentists were contacted and surveyed, resulting in a 100% response rate. Regarding location, most of the participants were in cities located in the central region of the country.

Table 1 describes the sociodemographic characteristics of the study population and Table 2 consolidates the variables considered in the survey and their analysis. It should be noted that questions 7 (source of information) and 12 (possible aspects affected), which are multiple-choice questions, were not correctly answered by 8 dentists since a previous positive response was necessary. Therefore, quantification varies depending on the total number of correct answers.

Table 1. Distribution of participants according to sociodemographic characteristics.

Characteristics		n	%
Total participants		114	100
Sex	Female	67	58.77
	Male	47	41.22
Nationality	Chilean	113	99.12
	Colombian	1	00.08
Years of practice	<10 years	83	72.81
	>10 years	31	27.19

Source: Own elaboration.

Table 2. Analysis of results according to each survey variable.

Variables		Item	n	%
a. General knowledge	1. Information obtained during undergraduate training on noise exposure standards	Yes	13	11.40
		No	101	88.60
	2. Information obtained during undergraduate training on the noise level (dB) produced by dental equipment	Yes	25	21.93
		No	89	78.07
	3. Information obtained during undergraduate training on hearing loss in dentists	Yes	27	23.68
		No	87	76.32
	4. Information you currently have regarding the occupational noise exposure standard	Yes	3	2.63
		No	111	97.37
	5. Information currently available on the noise level (dB) produced by dental equipment	Yes	11	9.65
		No	103	90.35
	6. Current information on the effects of constant exposure to occupational noise	Yes	60	52.63
		No	54	47.37
b. Sources of information	7. Sources of access to information on noise or occupational exposure (answered by respondents who answered Yes to any of the questions above, n=85)	Undergraduate training	25	29.41
		Postgraduate training	4	4.71
		Research articles	28	32.94
		Talks in the workplace	15	17.65
		Social media	13	15.29
c. Opinion	8. Knowledge about hearing loss due to noise exposure	Yes	112	98.2
		No	2	1.8
	9. Perception of hearing loss after obtaining the professional degree	Yes	57	50
		No	57	50
	10. Possible reasons for hearing loss (n=57) *	Age	15	26.32
		Profession	32	56.14
		Illness	2	3.51
		Recreational activities with loud sounds	16	28.07
		Listening to music at high volume	1	1.75
		Temporomandibular disorder	1	1.75
		Use of headphones	2	3.50
	11. Possible aspects affected by hearing loss (n=57) *	Psychological	9	15.78
		Social	27	47.36
		Communicational	44	77.19
		Emotional	14	24.56
		Work	24	42.10
		Family	19	33.33
	12. Use of hearing protection in the workplace	Yes	0	0
		No	114	100

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Table 2. Analysis of results according to each survey variable. (continued)

Variables		Item	n	%
c. Opinion	13. Dental instruments frequently used †	Micromotor	86	75.43
		Contra-angle	71	62.28
		Turbine	106	92.98
		Ultrasound	92	80.70
		Ejectors	108	94.73
		Compressor	66	57.99
	14. Other instruments †	Dremel	1	0.87
		Straight handpiece	1	0.87
		Vacuum pump	1	0.87

* Multiple-choice questions derived from point 9 (only the answers of those who answered Yes to this question were included).
† Analysis of multiple responses based on the total number of participants.
Source: Own elaboration.

After the analysis, the following results were obtained:

Concerning the knowledge gained by dentists during their undergraduate training about the national standard on noise exposure, the decibels produced by dental equipment, and the hearing loss that may result from their daily practice, there were no significant differences in terms of length of professional practice (p=0.758, p=0.053 and p=0.412, respectively). Moreover, taking into account the previous topics but considering the participants' current knowledge, no significant differences were obtained in terms of length of professional practice (p=0.283, p=0.480 and p=0.120, respectively).

Finally, regarding the perception of general hearing loss since graduation as dentists, no significant differences were observed in terms of length of professional practice and average weekly working time in treatment rooms (p=0.141 and p=0.802, respectively), nor in relation to the perception of hearing loss associated with practice considering the same variables (p=0.634 and p=0.166, respectively).

Discussion

The present study showed that a high percentage of dentists were unaware of the national standard on occupational noise exposure. It was also found that most participants were not informed during their undergraduate training about the sound intensity levels that dental equipment may reach, which is of utmost importance since this noise has an impact on their hearing capacity.[9] On the contrary, a greater understanding of the effects of constant exposure to occupational noise was observed after graduation, the main source of information being autonomous search in research articles. Having this in mind, and considering the reports made by the participants, it could be hypothesized that the dissemination of knowledge on these topics has not changed over time and that it is not sufficiently addressed in undergraduate education or beyond.[18,19]

On the other hand, it was observed that 98.2% of the dentists interviewed are aware of the consequences of exposure to noise; however, only 50% perceived a hearing loss since the beginning of their practice, which differs from what was found by Al-Ali *et al.*[23] in a study that included 733 dentists that found that only 5% of them reported hearing difficulties. Similarly, Ferrando *et al.*[18] reported, from a sample of 70 dentistry professors, that 14.3% of them said they did not hear well and, finally, Gijbels *et al.*[24] found that of the 388 dentists who answered a written questionnaire about possible occupational health problems, only 19.6% reported hearing disorders.

Furthermore, the present study found that none of the dentists used hearing protection, which is similar to the results of other studies such as Ferrando *et al.*[18] and Khan *et al.*[25] Therefore, this is a relevant issue that should be considered in future research, as it is necessary to delve deeper in order to establish actions that promote the use of this type of protection.[6]

The fact that 50% of the participants in this study reported a possible hearing loss and that 57.89% of these attributed it to their profession is consistent with the findings of Myers *et al.*[10] This is relevant because if this condition is self-reported, it is very likely that hearing loss has reached frequencies that are evident for the person and it is affecting some aspect of their life.[26]

On the other hand, it was found that participants did not associate hearing loss with years of practice; thus, it was established that the perception of hearing loss is similar among the dentists surveyed, regardless of the time they have been practicing. This contrasts with other studies that describe that hearing disorders in dentists are correlated with age and years of work experience.[23,24]

With regard to the consequences of hearing loss perceived by dentists, it was found that communicational and social aspects were the most affected areas, which coincides with what has been reported in the literature, where it is also evident that these problems directly impact the quality of life of the people.[7]

It is worth noting that the main limitation of the present study is its sample size, as it does not allow generalizing the results to the sample universe of the study population; in that sense, it is important to corroborate the results obtained here in a sample with a greater statistical power and representativeness.

Consequently, future research should complement the opinion of the professionals with some measurements of quality of life to enrich the description of psychosocial aspects related to the questions of the instrument used in this study. Also, since this survey can only give a subjective impression of hearing loss, it is necessary to corroborate the information obtained with the performance of hearing tests and correlate the loss found to exposure to the noise of the equipment, for which external factors —such as exposure to other sources of noise— must be controlled.

Conclusions

This is the first study carried out in Chile that aims to describe aspects related to the knowledge of dentists about the national noise exposure standard, the decibels generated by dental equipment and the consequences of exposure to this noise. It also takes into account the perception of hearing loss among the interviewees. Thus, it was found that, in general, the population of participating dentists are unaware of this information; however, most of them perceive a decrease in their hearing capacity, which they associate with their professional practice, impacting their communication and social life.

Therefore, dentists in Chile should have better access to information regarding these regulations and occupational hearing protection measures, both in their training and during their professional practice, and further research should be carried out to obtain objective results that corroborate or rule out the hypothesis that associates hearing loss in dentists with practice.

Conflicts of interest

None stated by the authors.

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Annex 1. Information collection instrument.

1. Sex: Male __ Female __
2. Age (in years): _____
3. City: _____
4. Nationality: _____
5. Year of graduation (in years): _____
6. Years of work experience as a dentist (in years): _____
7. University that awarded the dentist degree: _____
8. Average weekly working time in treatment rooms (in hours): _____

During your undergraduate training:

9. Did you receive information on the national noise exposure standard?
   __ Yes __ No.
10. Did you receive information about the noise levels (dB) produced by dental equipment?
   __ Yes __ No.
11. Did you receive information about hearing loss among dentists as a result of the noise produced by dental equipment?
   __ Yes __ No.

Based on the answers above, currently:

12. Do you know the national standard or decree regulating occupational noise exposure?
   __ Yes __ No.
13. Are you aware of the noise levels (dB) that can be reached by the dental equipment used?
   __ Yes __ No.
14. Do you know the effects of constantly being exposed to high-intensity noise in your workplace?
   __ Yes __ No.
15. If you answered Yes to at least one of the above questions, what was your source of information? (Check all that apply):
   __ Undergraduate training
   __ Graduate training
   __ Research articles (autonomous search)
   __ Talks in my workplace
   __ Social networks

Considering your opinion and daily personal activity:

16. Do you think noise exposure can affect your hearing?
   __ Yes __ No.
17. Do you participate in any of the following recreational activities? (Check all that apply):
   __ Hunting (firearms)
   __ Concerts
   __ Nightclubs
   __ I do not participate
   __ Other:
18. Have you noticed that your hearing has decreased since you graduated from the university?
   __ Yes __ No.
19. If you answered **Yes** in the previous question (check all that apply):
   __ "I attribute it to the natural course of aging."
   __ "I associate it with my practice."
   __ "I associate it with a specific disease."
   __ "I associate it with exposure to noise in recreational activities of high noise levels (e.g.: hunting, concerts, nightclubs, others.)"
   __ None of the above
   __ Other:
20. If you answered that your hearing has decreased, do you think it affects you in any of the following aspects? (Check all that apply):
   __ Psychological
   __ Social
   __ Communicational
   __ Emotional
   __ Work
   __ Family
   __ Other:

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Considering your workplace environment:

21. Do you wear hearing protection during your working day?
    __ Yes __ No.
22. Which instruments do you use most often in your practice? (Check all that apply):
    __ Micromotor
    __ Contra-angle
    __ Turbine
    __ Ultrasound
    __ Ejectors
    __ Compressor
    __ Other: