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Original articles

Quality of life, perception and knowledge of dentists on noise

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ABSTRACT

Purpose: to analyze the perception and knowledge of dentists on occupational noise, its prevention, and effects on their health and quality of life.

Methods: a cross-sectional study carried out with 54 dentists of both genders. Two questionnaires were applied: one addressing issues of perception and knowledge on noise and its effects, and another on Quality of Life (SF 36).

Results: the workplace noise was considered within medium intensity, and a health risk. Some professionals (59.2%) reported knowing noise prevention methods, although they do not use them. Complaints and the most frequently reported symptoms were irritability, difficulty in understanding speech and tinnitus. The perception of the Quality of Life was worse among men. There was association between pain and perception of noise intensity.

Conclusion: noise was considered, regardless of gender, harmful to health and associated with perception of musculoskeletal pain. Symptoms and complaints caused by noise have been reported to negatively impact the professional activity of dentists, however, most of them do not adopt preventive measures.

Keywords: Noise Effects; Hearing Loss, Noise-Induced; Quality of Life

INTRODUCTION

Dentistry activity uses different types of equipment with diversified functions, not only in general clinical procedures, but also in the surgical ones, and many of them generate loud noise.

In dentists' offices, loud noise is present in the clinical equipment used, such as dental pens, dental suction machines, amalgamators, air compressors, dental vacuum pumps, autoclave, air conditioners or fans, and external sources, such as vehicular traffic and other kinds of urban noise[1,2]. Study in four public dental offices and four private ones assessed the instantaneous level of sound pressure, finding levels from 56.4 to 83.1 dBA[2]. Another study at three dentist's clinics in the interior of São Paulo State, Brazil, measured the instantaneous sound pressure level with a total of 80 measurements collected five times a week for 20 days; and found mean values from 71.8 to 94.1 dBA[3]. Study in China assessed instantaneous noise levels in a dental clinic at the University Hospital of Taiwan during tooth extractions in 40 patients, and evidenced levels varying from 68.5 to 87.2 dBA[4]. Thus, those environments can be favorable to the development of hearing loss and other health outcomes considering the time of exposure.

Study[5] carried out with 115 dentists evidenced sensorineural hearing loss in 24.3% of them, prevalent in males (33.3%). The authors concluded that tonal thresholds would get worse according to dentists' age and work time. They still observed that after 21 years performing their job, the percentage of hearing dysfunctions was higher among male dentists. Another study held in Paraná State assessed 80 dentists' hearing, mixed genders, and found 15% of sensorineural hearing loss[6].

Besides its effects on hearing, loud noise may also impair other organic systems, such as: behavioral, neurological, vestibular, digestive, cardiovascular disorders, among others[7]. Excessive noise increases stress levels, which increases blood pressure and hormone release, such as adrenaline and cortisol[8].

Noise effects on hearing (Noise-Induced Hearing Loss – NIHL) as well as on general health may affect dentists, hindering communication, negatively impacting their quality of life[9].

Literature conveys many meanings to Quality of Life, considered a social construction, as it depends on subjects' knowledge, values and experiences at a given social context. It is considered, in order to determine it, well-being and social and environmental satisfaction, including physical health, psychological status, the level of Independence, social relations, beliefs and environmental relationship. Thus, the concept of Quality of Life is a subjective one, including the negative aspects of life, such as pain, use of medication, among others; and positive ones, for example: to feel healthy and the degree of social participation [10,11]. Therefore, communication is a significant factor to be considered in the Quality of Life, as it enables social integration[12].

Loud noise may also directly interfere in dentists' activity by reducing their potential for focus, attention, speed and precision of movements[7]; besides the reduction of speech clarity, hindering professional and patient's communication, irritability and decrease in work productivity, among others [7,8]. Dentistry is an occupation which demands knowledge, skill and focus on the part of professionals.

Thus, the objective of this study is to analyze dentists' perception and knowledge about occupational noise, its prevention and outcomes on health and quality of life.

METHODS

The research began after approval by the Ethics Board on Research of the Sociedade Evangélica Beneficente under number 739.215, and by having all the subjects involved signed the Free Informed Consent Form.

It is a crosscut, quantitative study. It was carried out with dentists from the city of Curitiba, Paraná State, Brazil, who accepted to participate in the research study, totaling 54 participants. From those, 32 (59.2%) were female, and 22 (40.7%) were male, most of them working at private offices (39 – 72.2%), and 26 (48.1%) at public outpatient clinics. The invitation was held by means of visits to professionals at their workplace. As an inclusion criterion, dentists should be graduated, clinically working and having signed the Free Informed Consent Form.

Two questionnaires were applied. The first questionnaire (Appendix 1) comprises closed questions, personal data regarding dentists' clinical and occupational history, with questions on their perception and knowledge about occupational noise and its effects. The second questionnaire on quality of life was self-applied. That is the *SF-36 - Medical Outcomes Study 36 Short Form Health Survey*, which is a generic health assessment questionnaire translated and validated for the Portuguese language[13]. The SF-36 comprises 36 items divided by 8 domains or components, as follows:

functional capacity, physical aspects, pain, general health status, vitality, social aspects, emotional aspects, mental health, and one more question for comparative evaluation of current health conditions and the ones in the previous year. Percentual scoring varies from 0 to 100, being zero the worst general health status, and 100% the best one. According to the authors' own criterion, scoring in the domains inferior to 50% was considered negative perception of quality of life, while scoring superior to 50% would be positive perception. The cut point definition of 50 percentiles, defining scoring for high (positive perception) and low (negative perception) quality of life for the domains, was based on some studies which used similar questionnaires. However, in the original instrument, there are not any references to any score dicotomy[13].

Data were analyzed regarding age and working hours until 8 hours per day and over 8 hours per day between the genders. For the analysis of noise knowledge and perception (questionnaire 1), Chi-Square Statistical Test was used. For the score analysis of the SF-36 questionnaire by gender, Student's T-Test was used. Spearman's correlation coefficient was used to analyze the association between perception of noise levels by the dentists and scoring in the SF-36 questionnaire. In all the analyses, significance level of 5% or $p < 0.05$ was considered.

RESULTS

Among all the studied dentists, age ranged from 20 to 65 years, with prevalent age range between 20 and 40 years old (66.7%) for the females, and over 40 years old (66.7%) of age prevalence for the males. There were significant gender differences regarding age (Chi-square Test, $p=0.0166$), being males older than females.

Regarding job length as a dentist, it varied from 5 months to 40 years, with prevalence among males (61.9%) of job length longer than 20 years, and among females (66.7%), job length was inferior to 20 years. There were gender differences in relation to job length (Chi-square Test, $p=0.0394$), with males featuring longer professional time than females. Regarding daily working hours, 53.7% of the dentists worked over 8 hours a day, being 14 (66.7%) males and 15 (45.5%) females, although there were no gender differences (Chi-square Test, $p=0.1275$).

In Table 1, we found the results about noise perception at dental offices and knowledge on the prevention of auditory disorders among dentists, considering that all stated to be noise-exposed.

Table 1. Perception of noise at workplace and knowledge on prevention from hearing disorders by dentists (N=54)

Perception and knowledge	Males (n= 22)	Females (n= 32)	Total	p value
Noise levels:				0.8267
Low	5 (22.7%)	6 (18.7%)	11 (20.3%)	
High	6 (27.3%)	7 (21.8%)	13 (24%)	
Average	11 (50%)	19 (59.3%)	30 (55.5%)	
Consider noise deleterious to health	14 (63.3%)	29 (90.6%)	43 (79.6%)	0.1926
Know preventive ways	15 (68.2%)	17 (53.1%)	32 (59.2%)	0.1466
Know the effects of high noise levels	15 (68.2%)	25 (78.1%)	40 (47.0%)	0.7234

Note: Some subjects refer to more than one answer; Chi-square test with significance level of 5% or $p<0.05$

By means of the Chi-square Test, significance level of 0.05, no difference was verified between genders and the answers about perception and knowledge on noise and prevention.

It was observed that 55.5% of the dentists considered noise of medium-level, and 79.6% said that noise was deleterious to health.

It was evidenced that 59.2% of the dentists somehow knew how to prevent themselves from loud noise. Among these preventive ways, it was mentioned the use of hearing protectors (51.8%). Other ways for noise control (14.8% - 8) were reported, such as: the need of lubricating the hand pieces (1.8% - 1), reduction in the use of the high-speed pen (1.8% - 1), location of the compressor and air vacuum pump distant from the office (1.8% - 1), equipment maintenance (1.8%- 1), acoustic protection for the equipment (3.7% - 2), and less noisy equipment (3.7% - 2).

Table 2 shows the accounts on the use of hearing protectors.

Table 2. Use of hearing protectors by dentists (N=54)

About hearing protectors	Absolute frequency%	Relative Frequency%
Do not use any protection	51	94.4
Reasons for not using them:		
Did not answer	17	33.3
Lack of habit	10	19.6
Difficulty in listening to the patient	4	7.8
Not supplied by the employer	4	7.8
Others	11	20.3

Most professionals do not use hearing protectors (94.4% - 51). It was verified that 33.3% - 18 participants did not answer the reason why they did not use hearing protectors. Among those who justified why they did not use hearing protectors (51 subjects), it can be pointed out lack of habit (19.6 – 10). In the item grouped as "other" reasons for not using hearing protectors, were reported: "I don't consider it necessary, silent environment, inconvenient, I've never thought of that, carelessness, I don't know, I work with radiology, laze, difficulty in setting them, and I wasn't taught about."

Complaints and symptoms possibly related to exposure to high sound levels are described in Table 3.

Table 3. Complaints and symptoms possibly related to noise exposure reported by dentists (N=54)

Reported complaints	Absolute frequency	Relative frequency %
Irritability	25	46.3
Difficulty in speech understanding	22	40.7
Tinnitus	19	35.1
Difficulty in focusing	15	27.7
Headache	11	20.3
Hearing impairment	10	18.5

Note: Some subjects reported more than one complaint

The most reported complaints were noise-related irritability, reported by 46.3% of the dentists, followed by difficulty in understanding speeches (40.7%).

Regarding Quality of Life, it was observed that the Functional Capacity, which refers to the performance of daily activities, such as the capacity to take care of yourself, to get dressed, bathing, and climbing stairs, scored the mean value for both genders. Therefore, it was positively assessed, considering the criterion that a score of over 50% would mean a positive assessment. As for Pain (referring to the level of pain and the impact on the performance of daily or professional activities), it scored less than the mean value for both genders, being negatively assessed by the dentists.

Among females, there is scoring equal to or lower than 50 (considered a negative perception on the quality of life) for the domains: pain, general health status and social aspects. As for the males, in addition to those three domains, there is mean score equal to or lower than 50 for the vitality and mental health domains. However, significant differences were observed between the genders for the mean values in the following domains: pain (p=0.0025), vitality (p=0.0228) and mental health (p=0.0009), featuring worse among the males.

Table 4 shows the results for the perception of Quality of Life per domain, comparing the genders.

Table 4. Mean scores for quality of life per domains and gender among dentists (N=54)

Domains	Males (N=21)		Females (n=33)		p value
	Mean	SD	Mean	SD	
Functional capacity	93.8	8.9	89.2	14.7	0.9446
Physical limitation	84.0	23.2	81.2	29.3	0.7991
Pain	11.8	14.0	29.3	17.8	*0.0025
General health status	40.2	16.2	41.5	10.2	0.6551
Vitality	49.2	4.9	53.1	10.8	*0.0228
Social aspect	44.3	13.9	47.2	10.7	0.5045
Emotional limitation	88.6	24.3	85.4	24.9	0.7707
Mental health	50.0	7.95	55.2	9.0	*0.0009

*Statistically significant values ($p \leq 0.05$) – Student's T-Test

Table 5 shows the relation between the scoring of the Quality of Life questionnaire, per domain, to age, educational level and dentists' noise perception.

By using the Spearman's Correlation Coefficient, it was evidenced the significant correlation only between the Pain domain and the noise perception (p=0.0279). No differences were observed between the genders for the correlation between the perception of quality of life per domains and the perception of sound levels.

Table 5. Correlation between quality of life domains and age, graduation time and noise perception (N=54)

DOMAINS	Age		Graduation Time		Noise Perception	
	R	p	R	p	R	p
Functional capacity	-0.2181	0.1131	-0.1712	0.2159	0.0567	0.6839
Physical limitation	-0.0014	0.9918	-0.0170	0.9027	-0.1471	0.2886
Pain	-0.2093	0.1288	-0.1130	0.4158	0.2994	0.0279*
General health status	-0.0479	0.7309	0.0562	0.6864	-0.0425	0.7601
Vitality	-0.0705	0.6125	0.0205	0.8828	-0.0221	0.8739
Social aspect	-0.0642	0.6445	0.0142	0.9191	-0.0193	0.8899
Emotional limitation	0.0946	0.4965	0.0785	0.5725	-0.1374	0.3219
Functional capacity	-0.2454	0.0737	-0.2146	0.1191	-0.2610	0.0566

Caption: R = Spearman's correlation coefficient; *p<0.05

DISCUSSION

In this study, it was observed that most dentistry professionals are females and worked predominantly in the general practice. The prevalence of female professionals was also observed in a study carried out in the interior of São Paulo State, which evidenced women's increasing participation in this professional category, concluding that education, entertainment and health fields have been attracting a higher number of women[14].

Regarding age range and graduation time, it was reported significant differences between the genders. Males are older and graduated longer than females. However, in spite of a higher percentage of males working over 8 hours a day, no significant differences were observed between the genders in the questions about the perception and knowledge on noise and its prevention (Table 1). Similar results were found in other studies. In a study with dental surgeons, it was evidenced that in the activities carried out by dentists, males worked an average of longer working hours than those recorded by females[15]. It is known that noise effects are more deleterious depending on the sound levels and the daily hours of exposure to them, thus, literature considers that the hazards to noise exposure are higher among males due to their longer working hours if compared to females' working hours[16,17].

As for noise perception at workplace (Table 1), most dentists were observed to consider noise levels of medium range. In relation to the hazards of noise exposure, 16.6% considered noise as harmful to health once it may cause hearing loss. In another research study, similar results were found regarding noise perception at workplace, with 49% (80) of the dentists considering noise levels of medium range. However, no references were made about gender differences[15].

Brazilian labor legislation considers unhealthy environment if sound levels are equal to or higher than 85 dBA for 8 daily working hours. Literature reports sound pressure levels for dental equipment between 56 and 94 dBA[2-4], which would make some activities and situations at a dental clinic as hearing hazards. However, not only sound levels define hearing hazards, but also the exposure time is fundamental[6]. In this study, it was observed that 53.7% of the dentists work over 8 hours, which may increase the risk for hearing loss. However, assuming that dentists are not exposed to the risk of hearing loss, as they are exposed to lower sound pressure levels or the exposure is for shorter periods of time, other consequences may evolve from the presence of noise[18]. The exercise of dentistry requires a high degree of concentration, thus the sound pressure level should not be higher than 30 to 40 dBA, as above such levels, noise causes professionals irritation and loss of focus; and yet, if it is above 65 dB, it may cause hypertension, among other non-auditory outcomes[7,8].

Regarding knowledge on prevention from loud noise-exposure risks, the greatest part of the professionals reported to know some types of prevention, being the use of hearing protectors the most mentioned one. Reports of other preventive devices occurred, such as intervention measures for the equipment or its use. Apart from that evidence, a high proportion of professionals do not know any ways to prevent loud noise. Similarly, another study evidenced that the dental participants admitted to perceive noise, assessed as "no good" in their activities, but they did not use any preventive measures against the noise[19]. Thus, in spite of the noise perception, the majority of the interviewed professionals do not use hearing protectors (Table 2), as evidenced by literature[15,19]. The scarcity of information

related to noise and its outcomes in dentistry hinders its control and prevention. Addressing this subject in dentists' education is important, from Dentistry schools to post-graduation courses, considering information on NIHL, making the use of hearing protectors routine in clinical practice, besides implementing other aspects regarding the Hearing Conservation Program, such as changes at workplace and adoption of less noisy equipment[5,15].

Some studies point out that although dentists are exposed to several hazards in their professional activity, such as ergonomic ones (excessive working hours), chemical ones (mercury), and physical ones (high sound levels, among others), there is still neglect on the part of those professionals toward hearing prevention, and its consequences can only be observed over time[15,19,20].

Investigating complaints and symptoms possibly associated with exposure to loud noise reported by dentists (Table 3), irritability and difficulty in speech understanding were the most reported ones, followed by tinnitus. Another study from Southern Brazil with 158 dentists found as the main complaints: difficulty in understanding speech (64.55%), stress (10.12%), tinnitus (8.22%) and irritability (7.59%)[16]. In addition, in the Northeastern Brazil, a study with 50 dentists found tinnitus (40%), dizziness (32%), intolerance to high sound levels (20%)[18]. That shows how the effects of noise exposure can hinder the activity and relationship to patients at a dental office. Quality of Life at Workplace is related to the improvement of physical conditions, lifestyle, facilities, meeting workers' needs and the expansion of a set of benefits for the satisfactory exercise of their activities, therefore, those conditions are negatively affected by the presence of noise[16,20,21].

By relating the perception on the Quality of Life to gender (Table 4), it was observed that males reported worse perception than females, with average scoring equal to or lower than 50. There are significant differences between the averages for the following domains: pain, vitality and mental health, mainly affecting males. Other studies observed pain and discomfort among dentists, without specifying the gender[19,21]. Another study on dentists' quality of life using SF-36 questionnaire was not found in literature. Study on that theme, but using the WHOQOL 100 assessment instrument of quality of life, found negative factors in dentists' activity related to lack of work organization, and unhealthy workplace with thermal and sound discomfort (70%) and pain (64%) as the main reported complaints[19].

In the current study, maybe for the fact that males are older, and exercising their profession longer than females, that may have impacted on their quality of life[19,22,23]. Another study with male and female dentists concluded that males were older, working longer and featured higher prevalence of hearing loss and tinnitus[15,23].

When the Quality of Life per domains was analyzed, relating it to age, graduation time and noise perception, only the Pain domain was observed to be related to the perception of noise levels (Table 5). Literature reports that exposure to loud noise at workplace is one of the risk factors that can be related to musculoskeletal pain[24]. Study with 115 workers observed that the prevalence of Work-Related Musculoskeletal Disorders (WRMSD) was related, among other factors, to the presence of noise at the workplace (OR=7.9; CI 95% 1.6-38.2). The authors explain that association once noise is perceived as a factor of stress or by the association of noise with the vibration in the manipulation of certain types of equipment[25]. As musculoskeletal pain is a common complaint among dentists due to their stiff posture and the fine repetitive movements of the upper limbs[21,22], and the hint that noise exposure may be associated with the increase in pain[24,25], further studies about that theme are suggested, including other professional categories.

As in the current study hearing was not assessed, it was not possible to relate quality of life to the auditory profile. Further studies are suggested, with a larger sample, in order to analyze it.

The findings in this research enable to formulate suggestions to include the noise theme in Dentistry education, warning future professionals about its health outcomes, and addressing preventive ways, thus encouraging their use.

CONCLUSION

In the current study, it could be observed that most professionals, disregarding the gender, considered noise levels as of medium range, deleterious to health and noise effects are known.

Symptoms and complaints associated with noise exposure were reported, such as irritability and difficulties in speech understanding, which may negatively affect dentists' activity. However, most dentists do not adopt any preventive measures, even though they report to know them.

Regarding Quality of Life, males featured worse perception than females in some domains. Noise levels at workplace were related to pain among dentists.

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APPENDIX 1 - QUESTIONNAIRE APPLIED TO DENTISTS

Professional Field:
( ) General Practice ( ) Cosmetic dentistry ( ) Periodontics ( ) prostheses/braces
( ) others: _____
Workplace:
( ) clinic/private office ( ) public service ( ) university
( ) others: _____
Graduation time: _____ years Daily working hours: _____ hours age: _____

Do you work at a noisy environment so that you have to shout for your workmate to hear you at 1 meter distance from you?
( ) yes, always. ( ) yes, sometimes ( ) no, never
During your Dentistry under-graduation course, were noise outcomes addressed as a curricular content?
( ) yes ( ) no ( ) don't remember

Do you know the deleterious effects of loud noise to your health?
( ) no ( ) yes. Which ones?_____
_____

Do you know any preventive ways from the deleterious effects of exposure to high noise levels at your workplace?
( ) no ( ) yes. Which ones? _____

Do you use any ways to reduce exposure to high noise levels at your workplace?
( ) no. Why? _____
( ) yes. Which one? _____

How do you rate noise levels at your workplace:
( ) there is no noise ( ) low noise ( ) medium-level noise ( ) loud noise

If there is noise at your work facility, what places/equipment below does it occur:
( ) turbine/high speed ( ) micro-motor? Low speed
( ) air compressor ( ) Light
( ) air conditioner ( ) neighborhood traffic ( ) others: _____

What symptoms/complaints below can you report:
( ) hearing impairment ( ) recurring headache
( ) tinnitus ( ) irritability at the end of the day
( ) difficulties in focusing ( ) difficulties in speech understanding in some situations
Have you ever undergone any hearing screening? ( ) no ( ) yes. Reason:_____

Note: _____