

Assessment of noise and perceived discomfort during dental hygiene procedures

Lorenzo Bevilacqua¹, DDS, MS; **Alessia Fabro¹**, RDH; **Michele Maglione¹**, MD, DDS; **Marco Rizzo²**, MSc; **Federico Ronchese³**, MMed

¹Clinical Department of Medical Sciences, Surgery and Health, University of Trieste, Trieste, Italy

²Degree Course in Prevention Techniques in the Environment and Workplaces, University of Trieste, Trieste, Italy

³Clinical Operational Unit of Occupational Medicine, University of Trieste, Trieste, Italy

Corresponding author: Prof. Lorenzo Bevilacqua

Department of Medical Sciences, Surgery and Health

University of Trieste

Piazza Ospitale 1, 34125, Trieste

Italy

Email: l.bevilacqua@fmc.units.it

Statement of Authorship

All authors have approved the final version of this manuscript before submission and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work were appropriately addressed and resolved.

Conflict of interest and source of fundings

The study was independently designed. The authors declare that they have no conflict of interest in relation of this paper. The study was self-supported by the authors.

Data Availability Statement

The data that support the finding of this study are available from the corresponding author upon reasonable request.

ABSTRACT

Background: Dental hygienists are continually exposed to environmental noise that can lead to adverse effects at both the auditory and extra auditory level for both operator and patient. The objective of the study was to evaluate the extra auditory effects of noise exposures on dental operators and patients during oral hygiene sessions. Methods: Fifty-seven phonometric measurements of environmental and background type were taken and 62 phonometric measurements were performed directly on the operator during professional oral hygiene sessions at differently configured dental stations. One ambulatory clinic was open, consisting of 8 chairs in a row while the second ambulatory clinic was isolated from the other units. Questionnaires were administered to practitioners to evaluate the influence of noise in the dental hygienist's practice. All data were statistically analysed. Results: Thresholds for the development of discomfort, stress, communication and concentration difficulties were exceeded especially in clinics with multiple operating stations. The use of the scaler, slow-speed handpiece and especially the aspirator produced peaks above 110 dB(A) and in 77.2 % of the time, the operator had to increase the tone of voice. Discussion: Dental hygienists are exposed to noise levels below safety thresholds, with some peaks detected, necessitating the reorganization of workspaces to reduce the risk of extra-auditory effects. Environmental noise affects communication and the well-being of operators and patients.

Keywords: dental hygiene; noise-induced hearing loss; occupational noise; ultrasonic scalers

CDHA Research Agenda category: capacity building of the dental hygiene profession

INTRODUCTION

The dental office is a working environment in which it is difficult to limit the presence of noise from staff movement, communication between colleagues and/or patients, and the operation of dental equipment in both operatories and waiting rooms.

Noise is a form of energy that affects the ear from vibratory, arrhythmic and irregular movements that can cause feelings of bother and discomfort to both the clinician and the patient. Anxious and phobic subjects become uncooperative and difficult to manage in uncomfortable and noisy environments. Dental anxiety and nervousness increase in conjunction with loud and sudden noises and can generate uncontrolled and potentially dangerous movements.¹

Given the impossibility of eliminating these noises, to make the environment more pleasant and relaxing, music is often used as an ambient background.²

Dentists and dental hygienists need to communicate with their patients to inform them about the procedures that will be performed as well as motivating and educating them about the importance of home care strategies following their treatment.

Chronic noise exposure above certain levels can lead to negative health consequences, such as auditory problems (hearing loss, changes in sound perception) as well as extra-auditory problems (stress, sleep disturbances, hypertension, cardiovascular diseases, difficulties in communication and concentration, etc.).²

In a 2023 study, Alberti et al. investigated the risk of noise-induced hearing loss among various medical professionals, including dentists, dental hygienists, orthopedic surgeons, and otolaryngologists. The research revealed that approximately 28% of participants (12 out of 42) exhibited hearing deficits consistent with occupational exposure. To mitigate this risk, the authors suggest structural interventions such as the use of sound-absorbing materials and optimized room design, alongside the adoption of quieter instrumentation and the use of personal protective equipment.³

Eighty-two percent (82%) of the studies included in a recent systematic review showed a risk of hearing loss among dental professionals related with the years of clinic experience and noise exposure.⁴

In contrast, Henneberry and colleagues⁵ reported the risk of permanent hearing loss as minimal for dental hygienists, since exceedance of 85 dB(A) in daily activity is rare. However, they indicated that potential temporary effects on hearing such as tinnitus and hearing threshold alterations due to ultrasonic scaler use are more common.⁵

One of the few studies in the literature dealing with the effects of noise on dental hygienists, compared two groups of practitioners; one group with a high rate of ultrasonic scaler use and the other group with a low rate of use of the same instrument. The findings showed no significant statistical differences on dental hygienists' hearing.⁶

Other studies have found that dental staff may have some risk of developing noise-induced hearing loss, particularly in pediatric clinical settings where recommended exposure limits (85dB(A)) occurred.⁷

A US survey found a 40% prevalence of hearing difficulties among dental hygienists with an average age of 56 years and 20 years of experience, which is 23% higher than the national average. The findings suggested that long-term exposure to noise from dental equipment, such as ultrasonic scalers, may contribute to hearing difficulties among experienced dental hygienists.⁸

Numerous investigations have also been conducted in university dental clinics⁹⁻¹² in which various noise values, often close to the lower action value of 80 dB(A), have been detected. In most of the studies, the noise levels detected were related in particular to the configuration of clinic spaces, the type of instrumentation used, and the number of workstations that were close to each other without sound-absorbing systems.

The extra-auditory damage caused by noise involves organs and apparatuses controlled by the autonomic system and can manifest itself progressively with communication difficulties from 45 dB(A), development of discomfort and stress if above 60 dB(A), loss of concentration by exceeding 68 dB(A), and to increased clinical error rate if above 110 dB(A).¹³⁻¹⁵

There are studies in the literature analyzing the influence of noise or unwanted and annoying sounds in operating rooms on work performance or operator *anxiety*¹⁶⁻¹⁷ and the possible beneficial effects of pleasant background music.^{2,18}

However, the well-being of the dental hygienist and their patient in relation to environmental noise during a professional oral hygiene session has never been investigated.

Therefore, the purpose of the present study was to: (1) evaluate the potential emotional-functional effects determined by noise on a cohort of dental hygiene students and patients during nonsurgical periodontal therapy sessions and (2) investigate which dental instruments were used and how the configuration of the workstation could affect the well-being of dental hygienists and patients.

METHODS

The recommendations for strengthening reporting as presented in the Strengthening the reporting of observational studies in epidemiology (STROBE Statement)¹⁹ were followed.

This study observed the Good Clinical Practice (CPMP/ICH/135/95) guidelines, in agreement with the ethical principles of the Declaration of Helsinki (seventh revision, 2013, Brasil) and applicable University of Trieste and ASUGI regulations. The study was approved by the medical ethical committee at CEUR of FVG (092/2018, 23.03.2018).

The study design was observational cross-sectional study performed at the Maxillofacial Surgery and Odontostomatology Clinic of the Maggiore Hospital of Trieste (ASUGI) from April to July 2024. Phonometric measurements were taken as reported in a previous study.²⁰

A Class 1 Precision Integrating Sound Level Meter (SoundTrack LxT, Larson Davis NY, USA) with associated microphone (377B02 SN LW132395 PCB Piezotronics, Inc, NY, USA), previously calibrated using Class 1 Calibrator (CAL200 S/N 9575Larson Davis NY, USA) was placed on a tripod at operator ear height 120 cm above the floor.

Phonometric measurements were performed as required by UNI EN ISO 9612:11 and UNI 9432:2011 standards on an acoustically homogeneous healthy group of 6 of the second- and third-year students enrolled in the course of studies in dental hygiene at the University of Trieste. All participants were informed about the study objectives and provided written informed consent. Random Incidence microphone correction was set in the sound level meter, as noise was coming from multiple directions, with Timer Stop at 5'.

To determine the minimum cumulative duration of measurements based on the number of workers ($n > 40$), the duration needed to be 17h. Therefore, for the present study, since recordings were taken for a minimum of 20 min, at least 51 measurements were needed (expected drop out of 5).

Fifty-seven measurements were taken in the part of the clinic where there was a single operating station.

The room had the following measurements: 220 cm width, 310 cm depth, 340 cm height and was isolated from the rest of the ambulatory clinic consisting of 3 other chairs by a sliding-type door. Figure 1



Please Insert Figure 1 Here



Afterwards, 57 more surveys were carried out in an ambulatory clinic consisting of 8 chairs in a row with the operating space of 270 cm width, 247 cm depth, 410 cm height; parallel to each other, separated by a low wall (293 cm) and connected by an open corridor. Figure 2



Please Insert Figure 2 Here



Phonometric measurements taken during the work activity were defined “environmental”.

Clinical work activities included patient welcoming, oral hygiene assessment with possible use of the air/water syringe, oral hygiene motivation and instruction, mechanical instrumentation with piezoelectric scalers (Newtron® handpiece (28-36 kHz) Newtron Satelec Acteon, Va, Italy) under suction (Dental Units Stern Weber S300, Cefla, Imola, Imola, Bo, Italy), manual instrumentation with Gracey curettes and final polishing with polishing paste cup with micro-motor (Bien Air® max speed: 40000 rpm).

The sessions had an average duration of 25 minutes.

Sound levels were also recorded in the absence of patients or dental hygiene treatments; these measurements were classified as “Environmental Background”.

Subsequently, 62 personal dosimetry measurements classified as “personal” were conducted directly on the operator, in compliance with the guidelines and methodologies established by INAIL (National Institute for Insurance against Accidents at Work) guidelines on risk assessment measured based on tasks. The sound level meter was set in the “free field” mode and the Timer Stop at 25'. The microphone was installed on a special stand worn by the operator, fixed on the shoulder about 10 cm from the opening of the ear canal and at about 4 cm above the shoulder.

Once again, after the patient was accommodated, the nonsurgical periodontal therapy session was performed with the same procedures as described above.

To characterize the acoustic contribution produced by the different instrumentation used by the hygienist, a marker similar to the activation of the air/water syringe, piezo scaler, aspirator, and micromotor was selected in the sound level meter at the time each instrument was used.

For the evaluation of environmental noise levels, the microphone was placed on a tripod in a vertical position at the height of the operator's ear and connected to the sound level meter via an extension cable.

Background noise level measurements were conducted to characterize the acoustic environment in the absence of specific work activities. These measurements help determine the contribution of ambient noise to overall exposure and ensure that personal dosimetry results are interpreted correctly. The microphone was positioned on a tripod at ear height, oriented vertically, and placed at a representative location within the work area, away from reflective surfaces or obstacles that could influence the readings. Measurements were taken over a sufficient time interval to capture typical fluctuations in environmental noise, providing a reliable assessment of baseline sound levels in accordance with applicable acoustic standards.

Background versus environmental measurements were necessary to identify how much of the total acoustic load is attributable to the clinical setting itself and to ensure correct interpretation of personal dosimetry values, which otherwise could be confounded by fluctuating ambient conditions. Similarly, comparing the noise generated by different instruments was essential to understand which specific devices contribute disproportionately to stress inducing or concentration impairing peaks, particularly those exceeding 110 dB(C), which are known to increase clinical error risk and reduce operator performance. Although it is expected that different handpieces produce different noise levels, the extent of these differences—and whether they exceed thresholds associated with discomfort, impaired communication, or loss of concentration—had

never been quantified in the context of nonsurgical periodontal therapy. Finally, comparisons between single station and multi station ambulatories were performed to evaluate how clinical layout influences cumulative exposure, communication difficulty, and operator/patient discomfort. These analyses allow identification of modifiable organizational factors and targeted preventive strategies, such as relocating noise intensive procedures or redesigning shared clinical spaces.

As part of the investigation, in order to assess the risk, the following were evaluated: the equivalent continuous sound level L_{Aeq} expressed in dB(A) of a hypothetical constant noise that, if substituted for real noise for the same time interval, would result in the same total amount of sound energy to the human ear; the peak sound level L_{Cpeak} expressed as the maximum instantaneous or C-weighted peak frequency sound pressure level.

Contextually, after the oral hygiene sessions in which the phonometric survey was performed, questionnaires with standardized multiple choice questions were distributed to patients treated continuously with non-surgical periodontal therapy who had agreed to participate and signed the consent form in the study. Patients with mental and/or physical disabilities reported in their medical history or with hearing impairment or prosthesis were excluded.

The questionnaire included a first anamnestic part (Q1-Q5), followed by an assessment of the MDAS (Modified Dental Anxiety Scale)²², dedicated to the recognition of anxious and dental phobic patients (Q6-Q15). The third part assessed the influence of noise as a source of stress, attempting to analyze the contribution of ambient noise, instruments, the presence of multiple operators and their conversations, and lack of privacy (Q16-Q30).

During the same period as the phonometric surveys (between April and July 2024), a questionnaire was administered to second- and third-year dental hygiene students at the University of Trieste who regularly perform nonsurgical periodontal therapy during the clinical internship at both single and multiple stations.

The questionnaire was designed to allow the analysis of the feeling of discomfort and noise-related stress, the perception and the impact of it on the psychological side of the operators during working hours in the two departments taken under consideration.

It was noted that participation was voluntary, and confidentiality was guaranteed.

The first questions included generalities of the operator and about the work activity (Q1-7), the second part was dedicated to questions aimed at assessing the operators' discomfort during the session (Q8-14). In the third part, information about the instrumentation that creates the most noise disturbance (Q15-20) was investigated and the last part included health issues and extra-auditory noise-related effects (Q21-27).

Statistical analysis

The study was designed with 80% power and an alpha error of 0.05. A sample size calculation, performed using G*Power 3 (version 3.1.9.6), determined that 51 photometric detections were required for environmental noise characterization and 62 for personal dosimetric assessment. Data management was conducted using Microsoft Excel for Windows, and statistical analysis was performed with STATA-17 (StataCorp College Station, Texas).

Prior to analysis, the normality of data distribution was assessed using the Shapiro-Wilk test, and the homogeneity of variances among datasets was evaluated using Levene's test. Given that the data did not follow a normal distribution, non-parametric methods were chosen. The Mann-Whitney U test was then used to compare results between groups.

To further investigate the influence of clinical configurations on noise exposure, a One-Way ANOVA was applied. When the overall ANOVA demonstrated significance, the Games-Howell Post Hoc test ($p < 0.05$) was employed to identify specific statistically significant differences between groups.

Comparisons of categorical variables and percentage distributions among groups such as differences in responses to questionnaires among operators and patients were performed using the chi-square test for independence. Threshold for statistical significance was set at $p < 0.05$.

RESULTS

Phonometric measurements

Figure 3 shows the mean and standard deviations of the background, environmental and personal fonometric measurements distinguished between the single and multiple stations ambulatories.

The limits set by law for the development of auditory impairment for mean LAeq values of 85 dB(A) nor 135 dB for peak LCpeak(max) were never exceeded during all non-surgical periodontal therapy sessions. However, during the normal clinical activity, regardless of single- or multiple-chair dental units, values above 60 dB were consistently recorded, consequently increasing patient and operator discomfort.

Please Insert Figure 3 Here

Statistical analysis showed statistically significant differences between environmental and personal measurements for both LAeq and LCpeak(max) values (environmental LAeq = 66.8 ± 3.46 dB(A) - personal LAeq = 77.2 ± 2.65 dB ($p < 0.01$); LCpeak(max) = 97.3 ± 7.15 dB -

LCpeak(max) = 112.2 ± 5.35 dB(C) ($p < 0.01$)). The latter were statistically higher in the multiple-station dental units (LCpeak(max)= 99.9 ± 6.83 dB) than in the single-station dental unit (LCpeak(max)= 93.9 ± 6.04 dB) ($p < 0.05$).

The different type of ambulatory clinic showed no statistically significant differences between environmental and personal measures ($p > 0.05$).

The mean and standard deviation of the values of noise levels expressed in dB are restated in Table 1.

All instruments once activated exceed noise levels that can generate stress and in some cases with values that can lead to loss of concentration. Some peaks caused by the ultrasonic scaler, low speed handpiece and especially the aspirator exceeding 110 dB increase the chances of clinical errors.

Please Insert Table 1 Here

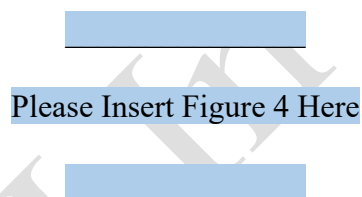
Operator and patient questionnaires

All 57 questionnaires administered to operators were collected, of which 27 related to second year and 30 to third year dental hygiene students while 123 questionnaires were collected from patients referred to the Maxillofacial and Odontostomatology Clinic of Trieste (5 patients did not want to fill out the questionnaire) ($n=49.6\%$ from patients who performed professional oral hygiene in the ambulatory clinic with multiple stations and $n=50.4\%$ in the ward with single stations).

The Mann–Whitney U test showed that operators reported significantly higher annoyance levels in the multiple station ambulatory compared to the single station configuration (3.60 ± 1.12

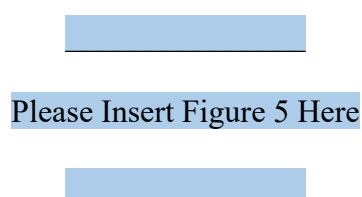
vs. 1.56 ± 0.73 ; $p < 0.001$). This indicates that the distribution of annoyance scores was consistently higher in the noisier, open clinical environment. Similarly, annoyance associated with the fast aspirator (3.13 ± 1.24) was significantly greater than the annoyance reported for other instruments ($p < 0.001$). In contrast, the scaler, micromotor, and air/water syringe produced lower median annoyance scores, reflecting their comparatively reduced subjective disturbance. These findings confirm that both clinic layout and specific high noise instruments have a statistically measurable impact on perceived discomfort among operators.

Communication between operator and patient appears to be affected by noise. 14% of operators always increase their tone of voice to be heard during patient motivation and instruction in the ambulatory clinic with multiple stations (0% for ambulatory clinic single stations). 63.2% often increase their tone of voice (0% for ambulatory single stations). Figure 4

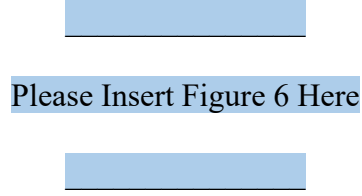


In 54.4% of the working days, the operator is forced to ask the patient to repeat what was said in the multi-station ambulatory, while in the single-station ambulatory, 70.2% of operators reported never having to ask the patient to repeat something.

At the end of the working day in the multi-station ward, operators tended to be more stressed (29.8% often; 50.9% sometimes), while in 70.2% of the times the single-station operators did not report noise-induced stress. Figure 5



Higher peaks of noise tend to negatively affect the level of concentration of operators, specifically 21.1% of operators believe that their ability to concentrate during periodontal instrumentation is affected by noise in the ambulatory with multiple stations while only 1.8% in the ambulatory with single stations. Figure 6



Please Insert Figure 6 Here

The main stressors and discomforts produced by noise reported by practitioners were excessive traffic of people passing by the unit (67.9% multiple stations; 3.4% single stations), environmental instrument noise (64.3% multiple stations; 3.4% single stations) and voices of other people (42.9% multiple stations; 31% single stations).

37.4% of patients felt they were not stressed during a professional oral hygiene session, while the others indicated instrument noise (34.1%), followed by the procedure to be performed (22.8%) and the duration of the treatment (22.8%) as the main stressors.

Analyzing the 4.9% of odontophobia patients and 7.3% of anxious patients according to the MDAS questionnaire, they all reported that the oral hygiene session provided some level of stress. The main stressors were instrument noise (22.2%), the procedure to be performed (44.4%), the duration of treatment (11.1%) and the relationship with the operator (11.1%).

Among the instruments, of which noise is mentioned as a source of stress, the main one is the scaler (26%), followed by the Micromotor (Slow speed handpiece) (10.6%), Aspirator (8.9%), and to a small extent also, the air-water syringe (4.8%).

There is a slight difference between genders, in that males are less affected by instrument noise than females (44% male; 56% female).

Furthermore, 21.1% of patients prefer to perform professional oral hygiene in an ambulatory clinic with single dental unit, only 7.3% prefer the ambulatory clinic with multiple dental units while most patients are indifferent.

71.5% of patients prefer the enclosed environment as it provides more privacy, less ambient noise and fewer people passing through.

Considering dental phobia patients, 50% prefer the single dental unit, 16.7% prefer the multiple dental units, and 33.3% are indifferent.

66.7% of anxious patients don't care about the configuration of the ambulatory clinic, 22.2% prefer the ambulatory clinic with multiple dental units, and 11.1% prefer the ambulatory clinic with a single dental unit.

DISCUSSION

Dental hygienists are exposed to noise levels that remain below both legislative and international threshold limits of 85 dB, with peak values under 135 dB. As a result, they are not considered at risk for permanent hearing damage. Because dental procedures typically last only a few minutes to under an hour—25 minutes on average in our study—this short-term, intermittent exposure does not generate the cumulative acoustic energy (8hour timeweighted averages) associated with permanent threshold shifts or chronic auditory impairment, such as those observed in industrial workers exposed to continuous noise for extended periods.²¹

Nonetheless, even brief exposures can produce nonauditory effects. Both patients and operators are subjected to sudden peaks, fluctuating sound levels, and unpredictable noise patterns, all of which are known to trigger acute stress responses, momentary reductions in concentration, and communication challenges. These short duration peaks are particularly significant for patients, who experience them in a context already linked to vulnerability and dental anxiety. For oper-

ators, although the overall daily noise dose remains below occupational action values, the repeated sequence of short, noisy procedures throughout the workday may contribute to fatigue, temporary threshold shifts, and an increased perception of workload.

Therefore, while the auditory risk profile in dental settings differs markedly from that of industrial environments, the clinical importance of short, intense noise peaks should not be overlooked, as they can meaningfully influence wellbeing, performance, and the quality of communication between patient and practitioner.

These values have also been confirmed by previous studies²² and are similar to those found in previous studies conducted in other countries.²³⁻²⁴

While the onset of occupational hearing loss requires chronic exposure to high intensity levels, extra-auditory effects stem rather from the intermittent nature of noise and the variability of its peaks, even over short durations.²⁵ In this study, peaks were recorded that exceeded the recommended level to avoid discomfort, stress, and decreased concentration. These considerations made it necessary to make organizational change in appointments.

The findings from this study highlight the critical importance of deactivating all dental equipment during patient-practitioner communication. Furthermore, it is recommended that suction units remain powered off when not strictly necessary to minimize unnecessary noise exposure. In ambulatory clinics with multiple operating stations, significantly higher noise peaks were detected, exceeding the limits for the development of extra-auditory effects. For this reason, we moved the hygiene sessions to single workstations while all the services that do not involve the continuous use of aspirators, scalers and micromotors such as orthodontia were transferred to the multiple operating stations.

However, noise levels analyzed regardless of the configuration of the ambulatory clinic, are close to these limits, which may be why operators report the development of extra-auditory

effects such as discomfort, stress, communication difficulties and loss of concentration as suggested in other studies.²⁶⁻²⁷

Environmental noise can be limited by reducing the unnecessary presence of operators, their movements, and paying more attention to reducing the communication and tone of voice used. The operator's noise exposure during the non-surgical periodontal therapy session does not differ between right and left ears and is not affected by the type of ambulatory configuration. Furthermore, it must be considered that variations in the operator's perceptual sensitivity during prolonged work sessions can be attributed to phenomena such as "Temporary Threshold Shift" or auditory adaptation.²⁸ These conditions may compromise the critical judgment capacity recorded in this study, frequently leading to subjective responses that would not occur under rested conditions.

Patients link their anxiety to the dental procedure, but instrument noise also has an important impact. Patients tend to prefer the closed ambulatory clinic, as it features more privacy, less noise and fewer people.

This study, conducted within an Italian university hospital, utilized clinical configurations, procedural protocols, and equipment consistent with those found in numerous academic dental settings globally. This consistency supports the generalizability of our findings to similar contexts worldwide. However, caution is advised when extrapolating these results to private practices, pediatric clinics, or institutions operating within different healthcare systems, as variations in infrastructure, noise control measures, patient throughput, and operator experience may influence outcomes.

Future research should aim to incorporate objective biomarkers, such as salivary cortisol or heart rate variability, to more precisely characterize the physiological impact of environmental noise during dental procedures. Furthermore, multi-center studies encompassing diverse dental care settings could establish broader normative data and uncover contextual factors influencing

the experience of clinical noise. An additional line of inquiry should examine the direct correlation between elevated ambient noise levels and impaired communication, reduced clinical accuracy, or decreased patient compliance, thereby informing the development of improved practice guidelines.

CONCLUSION

In conclusion, although no significant risk of permanent hearing damage was identified for dental hygienists, there is a clear need for clinical environment design focused on acoustic optimization. This approach aims to ensure a safer and more comfortable operational setting, protecting the psychophysical well-being of the practitioner and facilitating better communication with the patient. Crucially, patient consultations should be conducted with all dental devices deactivated. It is recommended to favor individual workstations or, in multi-station environments, to implement structurally isolated quiet zones. Concurrently, implementing periodic audiometric screening programs for healthcare personnel is advisable to ensure early detection of potential deficits and the prevention of chronic occupational pathologies.

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Figures and Tables



Figure 1.



Figure 2.

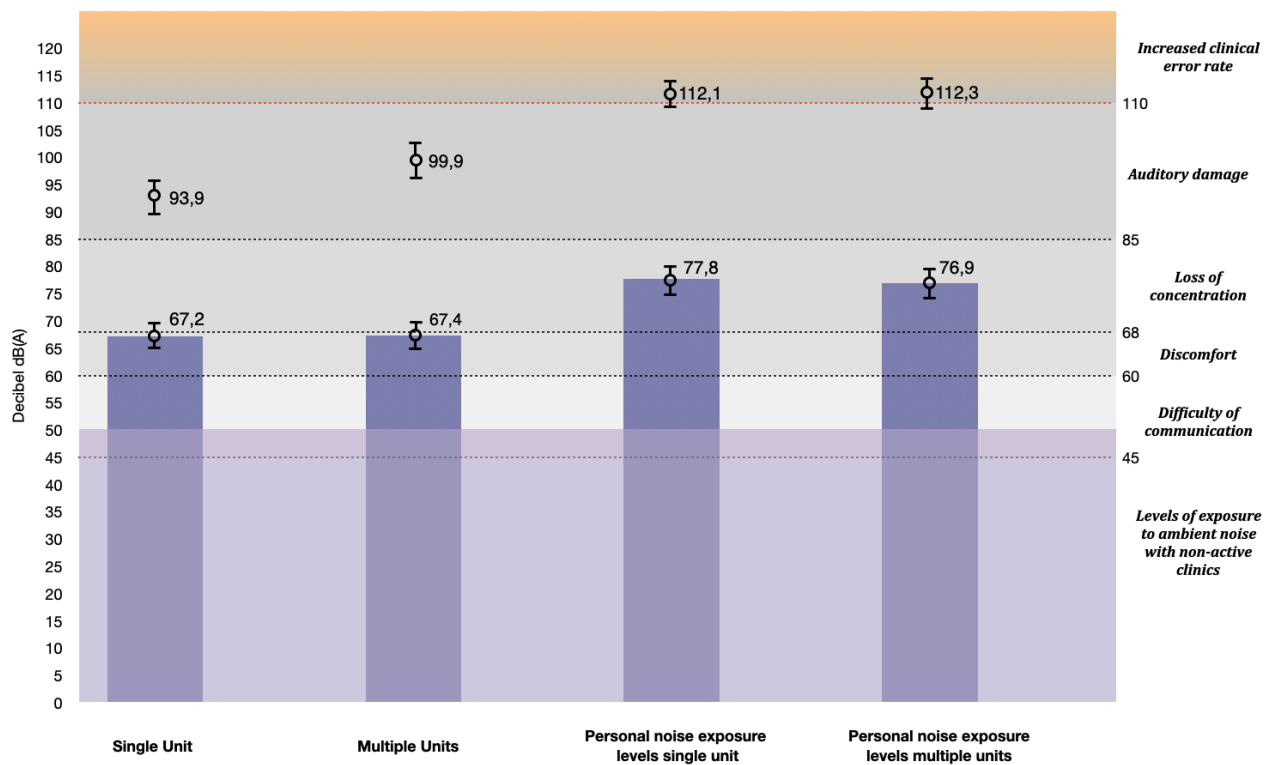


Figure 3. Levels of exposure to ambient noise and personal noise during the dental hygiene session

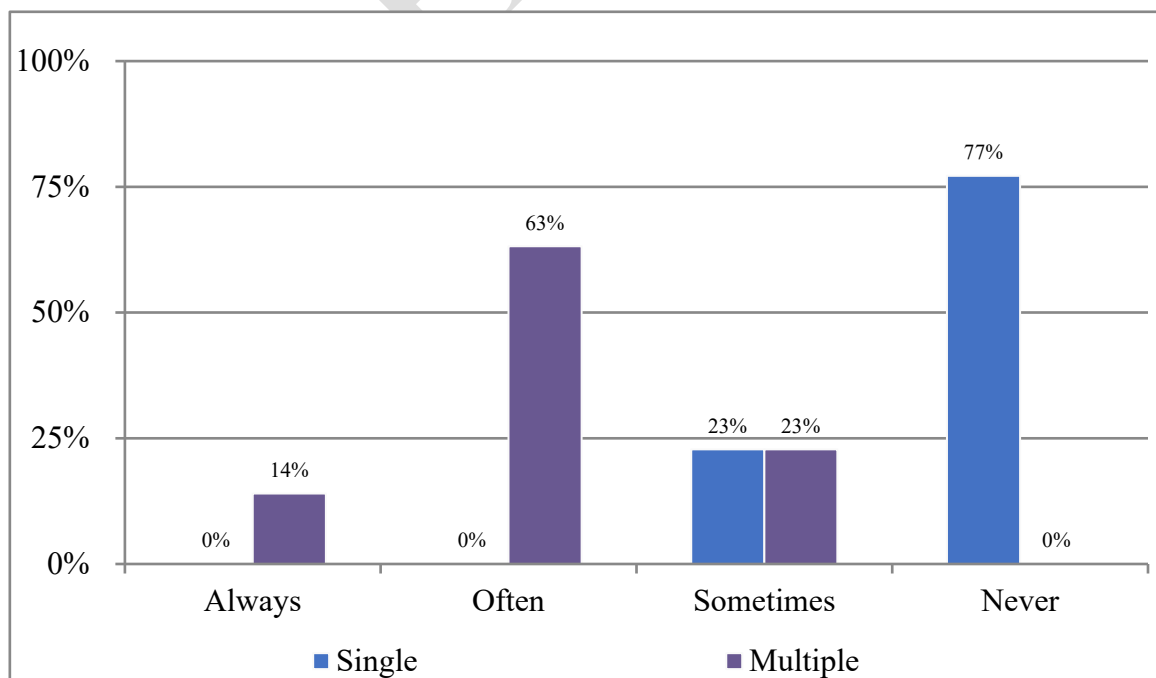


Figure 4. Need to raise the tone of voice by respondents during motivation and oral hygiene education

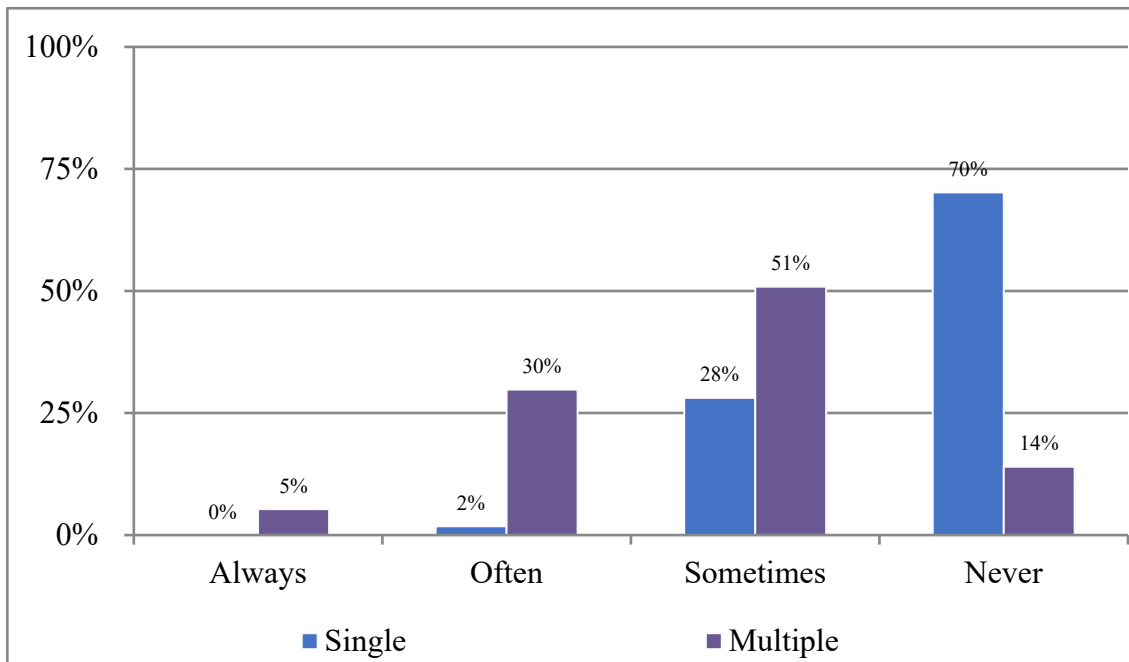


Figure 5. Respondents' perceived stress after a day works

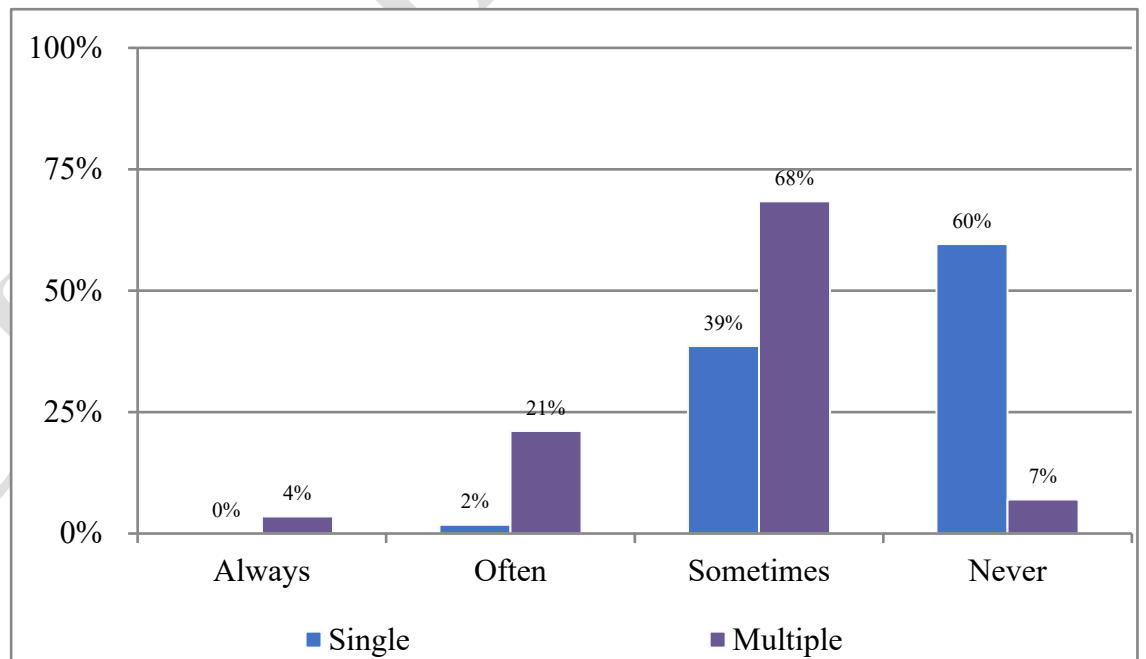


Figure 6. Respondents' perceived a reduction in concentration during the oral hygiene session

Table 1

Instruments	Mean time of use seconds$\pm$ SD	LAeq dB (Mean $\pm$ SD)	LCpeak dB (max)	P-value*
Ultrasonic scaler	1502 $\pm$ 483	71.92 $\pm$ 8.16	115.62	p<0.001
Aspirator	1860 $\pm$ 545	69.68 $\pm$ 5.89	128.57§	p<0.001
Air/water syringe	18 $\pm$ 7	68.46 $\pm$ 7.43	106.85*	p<0.001
Low speed handpiece	146 $\pm$ 58	66.11 $\pm$ 6.54	115.78	p<0.001
P-value*			p<0.01	

*Diff. significance of the difference between Air/water syringe and other instruments;§ Diff. significance of the difference between Aspirator and other instruments (One Way ANOVA test and the Games- Howell Post Hoc test)