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# Hearing Loss in the Dental Office: The Effects of High Speed Dental Drills on Dentists' Hearing

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# Hearing Loss in the Dental Office: The Effects of High Speed Dental Drills on Dentists' Hearing

# Hearing loss in the dental office: The effects of high speed dental drills on dentists' hearing

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## INTRODUCTION

The earliest dental drills date from ancient Egypt, approximately 9,000 years ago. Scottish inventor James Nasmyth used a coiled wire spring drill in 1829.

The first air-driven drill was introduced in 1868 by American George Green. Plug-in electric drills became available in 1908. Each of these developments increased the speed of the drill. Today's high speed dental drills have a rotational speed of 300,000-400,000 r.p.m. (Hyson, 2002). They sound like high-pitched sirens (Wilson et al., 1990) with the spectrum covering mostly the frequency range from 5 to 10 kHz, and the overall level reaching up to 100 dBA.

Temporary hearing loss may occur after a 6-hour clinical workday (Bali et al., 2007). Permanent hearing loss starts to develop after five years of practicing (Gijbels et al, 2006). Many dental professionals are unaware of the potentially hazardous consequences of noise exposure and it is very rare for any of them to wear hearing protection.

**Purpose**

The study had two purposes: 1. to determine whether dentists experience a temporary threshold shift (TTS) after a common workday in the dental office, and 2. to determine whether ear protection would reduce or eliminate the shift.

## METHODS

**Participants**

Twenty-two (2 females, 20 males) actively-practicing dentists (practice time 5 months to 32 years); age range from 18 to 65 years. Participants were selected based on their hearing thresholds: 35 dB HL or better across frequency range 250-8000 Hz.

**Testing periods**

- Baseline testing: to screen subjects for study.
- Before work/after work testing: to detect possible TTS, and the effects of wearing hearing protection.

**Hearing protection**

DentalEar system: developed by General Hearing Instruments; medical grade silicone; attenuated filter protector system.

## METHODS

**Techniques**

Middle Ear Analyzer: test was used to rule out middle ear abnormality.
Tympanometry: low frequency tympanometry (226 Hz) probe tone;
Acoustic reflexes: 500 Hz, 1000 Hz, and 4000 Hz ipsi and contralateral.

Pure tone air conduction audiometry:
250, 500, 1000, 1500, 2000, 3000, 4000, 6000, and 8000 Hz.

Pure tone bone conduction audiometry:
500, 1000, 2000, and 4000 Hz.

Distortion Product Otoacoustic Emissions (DPOAEs):
DP-grams measured using Mimosa Acoustics HearID hardware/software with $L_1$=65 dB SPL, $L_2$=55 dB SPL, $f_2/f_1$ =1.2, 4 points/oct with $f_2$ in the 0.8-8 kHz range. Data points with S/N>3 dB were considered valid.

Sound level meter RadioShack 33-2055:
Used to measure the peak sound level of dental equipment by the dentists' ear.

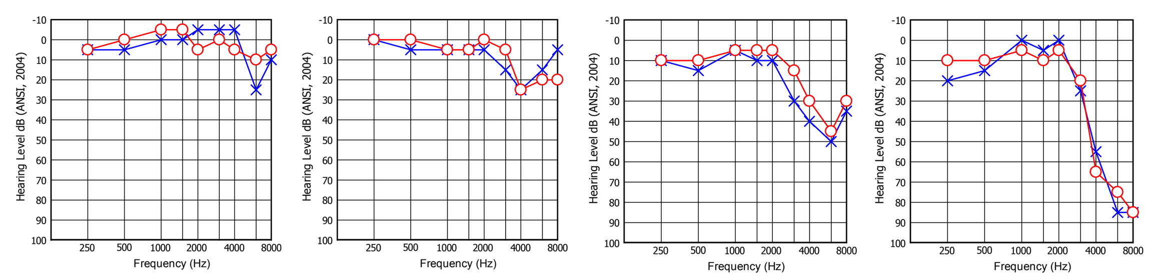
Dosimeter Larson Davis 706 (PCB Piezotronics Group Companies):
Recorded all noise during the day.
Measurements: $L_{eq}$ (equivalent sound level), $L_{peak}$ (peak sound level).

Digital Voice Recorder Olympus VN-8100PC:
Recorded signals during dental procedures.

Audacity (Digital Audio Editor Software):
Used to analyze signals recorded digitally.

## RESULTS

Typical audiograms of right handed dentists: the patterns



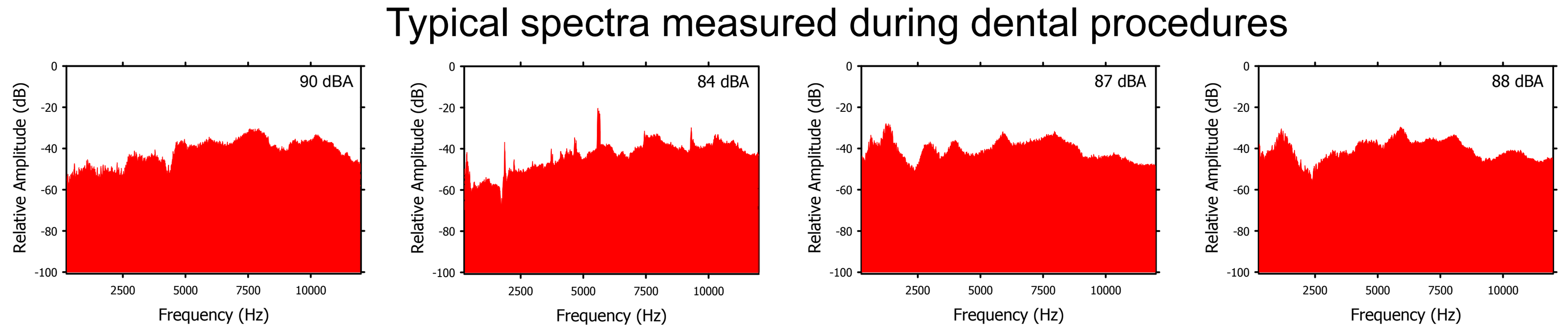
Age: 26 yrs; 4 mos of practice; just finished dental school

Age: 46 yrs; 13 yrs of practice

Age: 58 yrs; 30 yrs of practice; excluded

Age: 77 yrs; 49 yrs of practice; excluded

Typical spectra measured during dental procedures




High-speed drill
High-speed suction
on a natural tooth

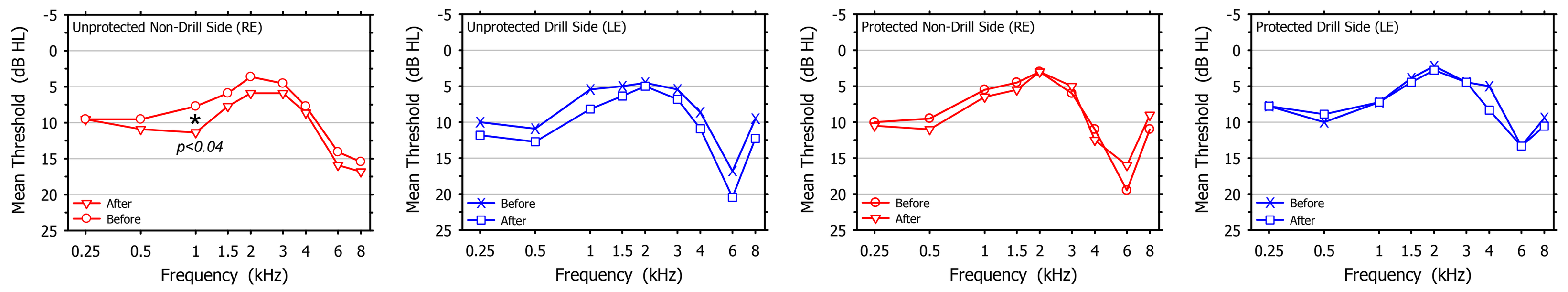
High-speed drill
running free

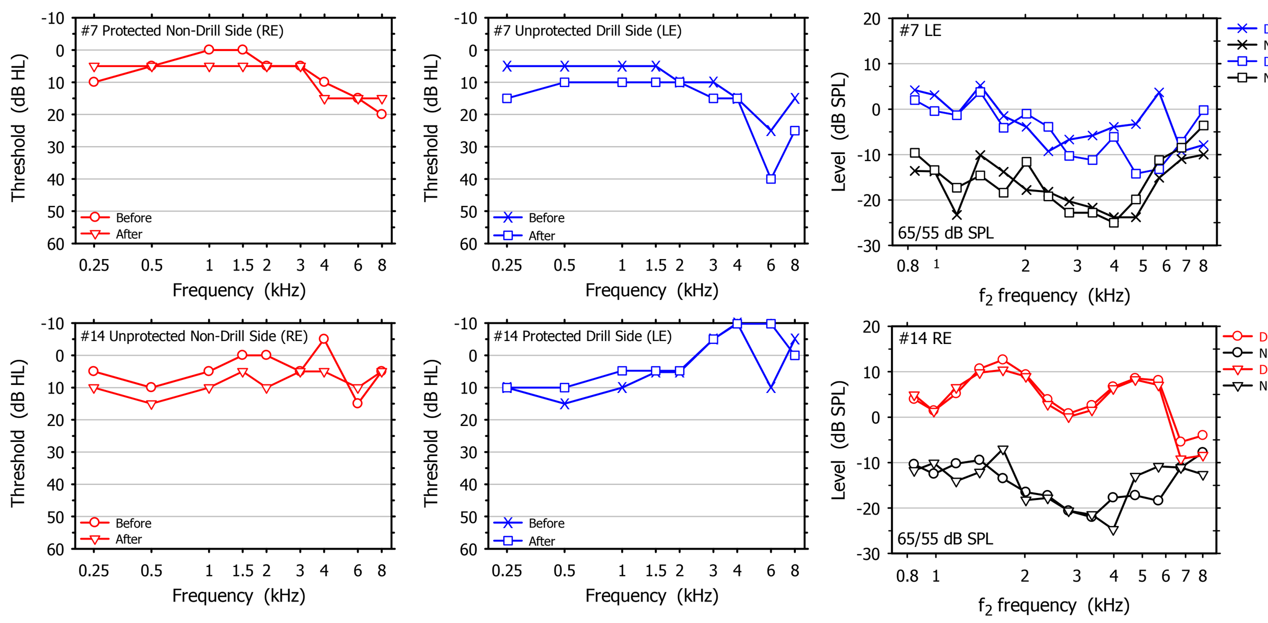
High-speed suction

High-speed drill
High-speed suction
on amalgam filling

## RESULTS

Mean audiometric data



Individual data

Subject #7

Dosimeter reading:
75.5 dB $L_{eq}$ over 8 hrs

Subject #14

Dosimeter reading:
68.9 dB $L_{eq}$ over 8 hrs

## CONCLUSIONS

1) According to OSHA guidelines, employees must use hearing protection when an 8-hour time-weighted average exceeds 85 dBA. However, because some dentists may experience a TTS with exposures well below that average, the Dental Research Center should consider revising those noise exposure guidelines for dental professionals.
2) TTS produced by dental drilling may lead to permanent hearing loss.
3) Routine hearing evaluation and use of hearing protection is recommended.
4) Adoption of electric dental hand-pieces will likely not solve the noise exposure problem, since the high-speed suction was often as intense as the dental hand-piece.
5) Group audiometric data do not reveal a statistically significant TTS. However, some individual data revealed susceptibility to the noise; as we cannot predict susceptibility, all dentists should be encouraged to use hearing protection.

**References**

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