Comparing Noise Production of Pediatric Dental Instrumentation Techniques

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BACKGROUND:

- Sound: Vibrations that travel through the air or medium that can be heard.
- Sound Measurements:
  - Frequency [Hertz]: Pitch of sound (1)
  - Loudness [decibels, dB]: Magnitude of sound pressure/volume a logarithmic ratio
    - A-weighted decibel (dBA): uses A metering which better represents human hearing (1,2).
- Noise: Unwanted sound
  - Increasing problem during dental procedures
  - One of the 10 leading causes of work-related diseases or injuries (3).
- The Occupational Safety and Health Administration (OSHA) sets guidelines for noise exposure.
  - Permits exposures of 90 dBA for 8 hours
  - Uses a 5 dBA time intensity tradeoff.

- **Noise above threshold levels is known to cause auditory damage, disturb sleep, disrupt concentration, impair learning, and interfere with communication** (4).
- Noise generated from the dental equipment (highspeed handpieces and isolation/evacuation) produces high frequency sounds. (5)

PURPOSE:

Compare the noise generated by different instruments used in pediatric dentistry:

1) Type of handpiece (high-speed air driven (AD) and an electric) (EI),
2) Type of isolation system (rubber dam with a high-volume evacuation (RD + HVE) and Dryshield system) (DS).

METHODS:

- Sound Data Collection
  - Background Noise: Sound Level Meter (SLM) (Larson Davis Model 831C)
  - Individual Sound Exposure: Noise dosimeter (Larson Davis Spartan 730)
- Noise Production: Data collected while **preparing human molars** (mounted in a pediatric typodont) **for stainless-steel crowns using a high-speed handpiece and isolation/evacuation for 5 minutes.**
- Statistics: The effects of the type of handpiece (air, electric) and isolation (rubber dam with high-volume evacuation, Dryshield) on noise level were analyzed using two-way ANOVA.

INSTRUMENTATION/RESULTS:

Figure 1A: Air driven handpiece
Figure 1B: Electric handpiece

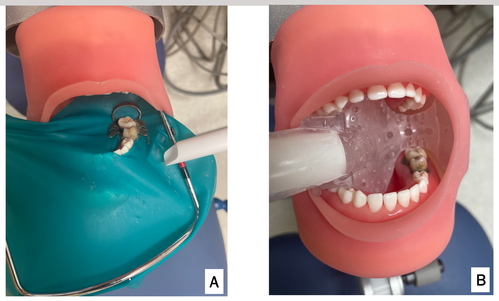

Figure 2A: Molar teeth mounted in typodont with RD/HVE
Figure 2B: Molar teeth mounted in typodont with DS

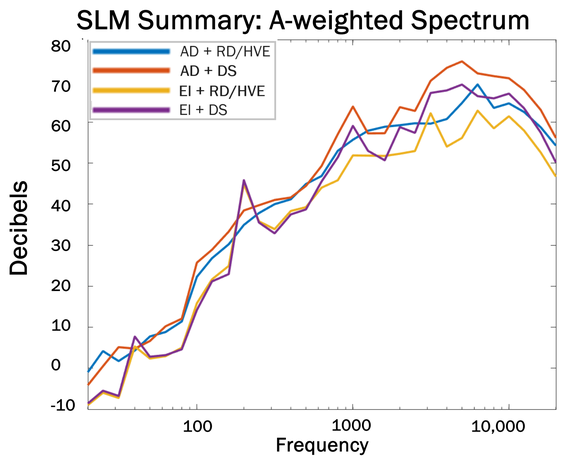

Figure 3: AD + DS and EL + DS generally louder for high frequency content when compared with AD + RV/HVE and EL + RD/HVE

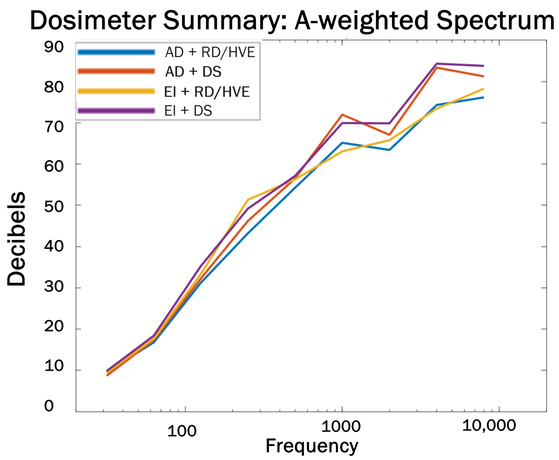

Figure 4: In general, AD + DS and EL + DS both have more high frequency energy than AD + DS and EL + DS.

- There were no differences in peak sound levels between any of the groups ($P > 0.05$).

RESULTS:

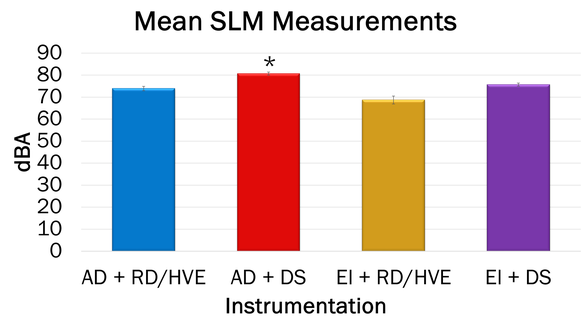

***Figure 5: SLM** data showed the air driven handpiece with Dryshield was statistically the loudest,* generating an equivalent continuous sound pressure level of 80.7 dB LAeq ($p<0.001$).

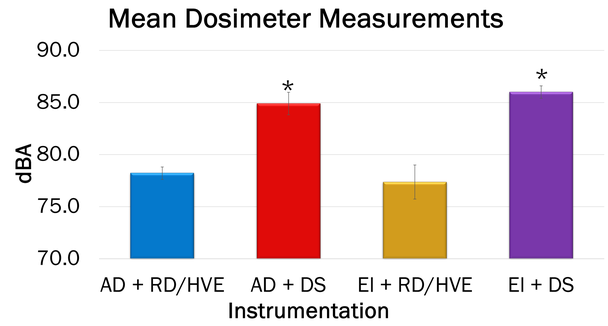

Figure 6: Dosimeter data showed that both the handpieces with Dryshield were statistically the loudest, 84.9 dB LAeq and 86 dB LAeq respectively, (both $p<0.001$).

LAeq is reported in units of A-weighted decibels.

CONCLUSION:

- None of the pediatric dental instrument combinations studied reached the LA_{eq} = 90 dBA limitation for 8 hours set by OSHA.

- Although the noise levels were not above regulatory recommendations to prevent long term hearing loss, practitioners should still consider hearing protection based on individual exposure.

REFERENCES

IUPUI
INDIANA UNIVERSITY
School of Dentistry