Overview

Title of Dataset

Rat-tail models for studying hand-arm vibration syndrome: a comparison between living and cadaver rat tails

Introduction

Over-exposure of the hand-arm system to intense vibration and force over time may cause degeneration of the vascular, neurological, and musculoskeletal systems in the fingers. A novel animal model using rat tails has been developed to understand the health effects on human fingers exposed to vibration and force when operating powered hand tools or workpieces. The biodynamic responses, such as vibration stress, strain, and power absorption density, of the rat tails can be used to help evaluate the health effects related to vibration and force and to establish a dose-effect relationship. While the biodynamic responses of cadaver rat tails have been investigated, the objective of the current study was to determine whether the biodynamic responses of living rat tails are different from those of cadaver rat tails, and whether the biodynamic responses of both living and cadaver tails change with exposure duration. To make direct comparisons, the responses of both cadaver and living rat tails were examined on four different testing stations. The transfer function of each tail under a given contact force (2 N) was measured at each frequency in the one-third octave bands from 20 to 1000 Hz, and used to calculate the mechanical system parameters of the tails. The transfer function was also measured at different exposure durations to determine the time dependency of the response. The biodynamic responses of both cadaver and living rat tails, and the modeling results and time dependency are presented in a manuscript of this study (Warren et al., 2024), the original datasets measured in each trial of the tests are documented in this data description.

Methods Collection

Two series of tests were conducted in this study to investigate the biodynamic response of rat tails and their time dependence, which includes tests with the tails of cadaver rats, and tests with the tails of living rats.

- **Tests with the tails of cadaver rats.** Twelve tails dissected from rat cadavers were used to conduct two series of exposure tests using four testing stations. Four tails were tested each day. The first series was the vibration exposure of sinusoidal excitation from 40 to 1000Hz in the one-third octave bands, with a magnitude of 1.0 g (9.8 m/s^2) rms value. The second series was a 4-hour exposure test at two frequencies (63 and 200 Hz) at the same magnitude of 1.0 g rms.
- **Tests with the tails of living rats.** Six living rats were used in these tests on the same four testing stations. These tests lasted for four days so that each tail could be exposed at each of the four testing stations to examine the effect of testing stations on the biodynamic responses. The vibration exposure was still sinusoidal excitation, but from 20 to 1000Hz in the one-third octave bands, and the input vibration magnitude was 0.5 g rms. The exposure duration was one hour each day.

References

Warren CM, Xu XS, Jackson M, McKinney W, Wu JZ, Welcome DE, Waugh S, Chapman P, Sinsel EW, Service S, Krajnak K, and Dong RG (2024). Rat Tail Models for Studying the Hand-Arm Vibration Syndrome: A Comparison between Living and Cadaver Rat Tails. Vibration, 7(3): 722-737.

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- The work was conducted in Physical Effects Research Branch, Health Effects Laboratory Division, National Institute for Occupational Safety and Health (NIOSH), by the following researchers:
    - Christopher M.Warren (cpw4@cdc.gov)
    - Xueyan S. Xu (fze2@cdc.gov)
    - Mark Jackson (moj8@cdc.gov)
    - Walter G. McKinney (wdm9@cdc.gov)

- John Z. Wu (ozw8@cdc.gov)
- Daniel E. Welcome (zzw8@cdc.gov)
- Stacey Waugh (ztz6@cdc.gov)
- Phillip Chapman (ttf4@cdc.gov)
- Erik W Sinsel (eur2@cdc.gov)
- Samantha Service (ppf3@cdc.gov)
- Kristine Krajnak (ksk1@cdc.gov)
- Ren G. Dong (rkd6@cdc.gov)

Contact Point for Further Information

Physical Effects Research Branch, Health Effects Laboratory Division, National Institute for Occupational Safety and Health (NIOSH), Morgantown, West Virginia 26505, USA.