

# ORIGINAL RESEARCH

## CAVITATION SOUNDS DURING CERVICOTHORACIC SPINAL MANIPULATION

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### ABSTRACT

**Background:** No study has previously investigated the side, duration or number of audible cavitation sounds during high-velocity low-amplitude (HVLA) thrust manipulation to the cervicothoracic spine.

**Purpose:** The primary purpose was to determine which side of the spine cavitates during cervicothoracic junction (CTJ) HVLA thrust manipulation. Secondary aims were to calculate the average number of cavitations, the duration of cervicothoracic thrust manipulation, and the duration of a single cavitation.

**Study Design:** Quasi-experimental study

**Methods:** Thirty-two patients with upper trapezius myalgia received two cervicothoracic HVLA thrust manipulations targeting the right and left T1-2 articulation, respectively. Two high sampling rate accelerometers were secured bilaterally 25 mm lateral to midline of the T1-2 interspace. For each manipulation, two audio signals were extracted using Short-Time Fourier Transformation (STFT) and singularly processed via spectrogram calculation in order to evaluate the frequency content and number of instantaneous energy bursts of both signals over time for each side of the CTJ.

**Result:** Unilateral cavitation sounds were detected in 53 (91.4%) of 58 cervicothoracic HVLA thrust manipulations and bilateral cavitation sounds were detected in just five (8.6%) of the 58 thrust manipulations; that is, cavitation was significantly ( $p < 0.001$ ) more likely to occur unilaterally than bilaterally. In addition, cavitation was significantly ( $p < 0.0001$ ) more likely to occur on the side contralateral to the clinician's short-lever applicator. The mean number of audible cavitations per manipulation was 4.35 (95% CI 2.88, 5.76). The mean duration of a single manipulation was 60.77 ms (95% CI 28.25, 97.42) and the mean duration of a single audible cavitation was 4.13 ms (95% CI 0.82, 7.46). In addition to single-peak and multi-peak energy bursts, spectrogram analysis also demonstrated high frequency sounds, low frequency sounds, and sounds of multiple frequencies for all 58 manipulations.

**Discussion:** Cavitation was significantly more likely to occur unilaterally, and on the side contralateral to the short-lever applicator contact, during cervicothoracic HVLA thrust manipulation. Clinicians should expect multiple cavitation sounds when performing HVLA thrust manipulation to the CTJ. Due to the presence of multi-peak energy bursts and sounds of multiple frequencies, the cavitation hypothesis (i.e. intra-articular gas bubble collapse) alone appears unable to explain all of the audible sounds during HVLA thrust manipulation, and the possibility remains that several phenomena may be occurring simultaneously.

**Level of Evidence:** 2b

**Key words:** Cavitation, cervicothoracic spine, spinal manipulation, thrust

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### Acknowledgements

None of the authors received any funding for this study. The authors wish to thank all the participants of the study.

### Declaration of Interests

The authors report no declarations of interest.

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