

# Application Fields and Innovative Technologies

**Effectiveness of tongue vibration training in middle-aged to elderly patients with obstructive sleep apnoea**  
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**Purpose** Impaired upper-airway neuromuscular control is a central mechanism underlying obstructive sleep apnoea (OSA), particularly among middle-aged and elderly adults. Tongue Vibration Training (TVT), a low-frequency mechanical stimulation technique targeting lingual musculature, has emerged as a potential non-invasive therapy to enhance airway stability [1,2]. OSA is strongly associated with impaired tongue motor control, and many patients have limited tolerance to Continuous Positive Airway Pressure (CPAP). The neural responsiveness of upper-airway musculature may also influence therapeutic outcomes. This study investigated a non-invasive TVT combined with visual feedback as an adjunct therapy. It was also to evaluate the feasibility, neuromuscular effects, and preliminary efficacy of TVT, incorporating electroencephalography (EEG) to explore changes in sleep architecture and cortical arousal patterns. **Methods** In this prospective pilot study, fifty patients with mild-to-moderate OSA confirmed by overnight polysomnography (PSG) were randomized into a control group (n=20) receiving traditional oral therapy and an experimental group (n=30) receiving 24 sessions of TVT (3–7 Hz, 2–5 mm amplitude, 15 minutes/session). Assessments every three weeks included IOPI (Iowa Oral Performance Instrument) Primary outcomes included changes in EEG- derived sleep parameters. EEG recordings were analyzed for spectral power distribution. Secondary outcomes included tongue strength measured via Iowa Oral Performance Instrument (IOPI), tongue and lip pressure, oral motor performance, and sleep quality using the PSQI (Pittsburgh Sleep Quality Index). Statistical analyses were conducted using paired t-tests with significance set at  $p < 0.05$ . **Results and Discussion** After 18 weeks, EEG analysis in the experimental group revealed a mild increase in sigma activity, which may indicate improved cortico-muscular coordination. Significant improvements were also observed in tongue and lip pressure ( $P < 0.0001$ ), tongue movement performance, and PSQI scores, with no adverse events reported. Overall, TVT effectively enhances upper airway muscle strength and sleep quality. As a non-invasive and well-tolerated intervention, it may serve as a valuable adjunct therapy for patients with poor CPAP adherence. TVT also appears feasible for middle-aged and older adults with OSA. Notably, the EEG findings provide novel insights into its potential neuromodulatory effects, demonstrating improvements not only in sleep stability but also in cortical arousal dynamics.

## References

1. Effects of Tongue Resistance and Strengthening Exercises on Tongue Strength and Oropharyngeal Swallowing in Frail Older Adults With Mild Cognitive Impairment: A Double-Blind Randomised Controlled Trial. Kao SH, Chu H, Banda KJ, Sung CM, Chen R, Chang LF, Chiang KJ, Pien LC, Chou KR *J Oral Rehabil.* 2025 Nov 5. doi: 10.1111/joor.70087
2. The Effect of Tongue Vibration Exercise Combined With Oromotor Training on Tongue Function in Older Adults. Yi-Jen Chen, Chia-Hui Chueh, Tzu-Hui Chiang, Chia-Ling Lee, Ko-Long Lin, Chia-Hsin Chen. *J Oral Rehabil.* 2025 Sep 26. doi: 10.1111/joor.70063

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EEG detection during TVT



Schematic diagram of a patient undergoing TVT