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DAMPING OF MONOCULAR PENDULAR NYSTAGMUS WITH VIBRATION IN A PATIENT WITH MULTIPLE SCLEROSIS

Acquired pendular nystagmus (PN) occurs commonly in multiple sclerosis (MS) and results in a highly disabling oscillopsia that impairs vision. It usually consists of pseudo-sinusoidal oscillations at a single frequency (3–5 Hz) that often briefly stop for a few hundred milliseconds after saccades and blinks. The oscillations are thought to arise from instability in the gaze-holding networks (“neural integrator”) in the brainstem and cerebellum.^{1,2} Here we describe a patient with monocular PN in whom vibration on the skull from a handheld muscle massager strikingly diminished or stopped her nystagmus.

This is a single observational study without controls (Class IV).

Case report. A 32-year-old woman with MS (characterized by prior left optic neuritis, internuclear ophthalmoparesis, and ataxia) presented with monocular horizontal PN and bothersome oscillopsia. She was myopic with corrected visual acuity 20/20 in the right eye and 20/40 in the left but improving to 20/25 in extreme left gaze where the PN damped. With the Hardy-Rand-Rittler pseudoisochromatic plates, color vision was intact in the right eye but she missed 3 plates with her left eye. Saccades by the left eye were slightly slower during adduction, reflecting a subtle left internuclear ophthalmoplegia. A left monocular, small-amplitude, horizontal (about 3°–4° peak-to-peak), 4–5 Hz PN was present (video on the *Neurology*® Web site at Neurology.org). The nystagmus briefly stopped following blinks and saccades and on eccentric gaze but was unaffected by convergence, occlusion of either eye, head shaking, hyperventilation, or changes in body position. Striking, however, was the effect of vibration using a handheld Brookstone Mini Muscle Massager over the vertex, both mastoids, and the chin. The PN was markedly reduced (to less than 50% of the original 3°–4° amplitude) or briefly appeared to stop completely (video) and the patient reported a concomitant reduction in her oscillopsia. This effect occurred every time the vibrator was applied and the PN returned to a larger amplitude immediately when vibration stopped (figure and video). The effect of dorsal neck muscle vibration was inconsistent. Elbow vibration

and placing a soft contact lens in the left eye did not affect the PN. Switching on the vibrator near the ear without skin contact or just placing the vibrator against the skin, without turning it on, did not affect the PN.

Discussion. The novel finding in our patient was the striking effect of skull vibration on the PN, causing it to diminish or cease. Based on this finding, we hypothesize 2 mechanisms—one related to vestibular excitation and the other to activation of proprioceptive or other somatosensory inputs to eye movement, gaze-holding mechanisms. Vibration of the skull excites the peripheral vestibular system,¹ which might influence an unstable gaze-holding neural integrator, leading to suppression of PN, perhaps in the same way saccades are thought to reset the integrator and transiently stop PN. Another disorder in which vestibular input affects nystagmus is spasmus nutans, in which relatively low-frequency head nodding and passive head shaking lead to an indirect suppression of the fine, higher-frequency PN that characterizes this condition.³

Activation of proprioceptive signals from the muscles around the head, the neck (though it is hard to exclude simultaneous excitation of skull), or the eye muscles themselves might be another conduit by which the vestibular nuclei could be activated and influence gaze-holding networks. More direct stimulation of the gaze-holding networks by proprioceptive or other somatosensory inputs would be another possibility. For example, neck muscle vibration induces visual illusory movements (by modifying the perception of head orientation) and provokes changes in eye position.^{4–6} The effects of somatosensory manipulation on nystagmus are well-described in congenital nystagmus (CN). Soft contact lenses,^{7,e1–e3} insertion of acupuncture needles in the neck muscles,^{e4} and unilateral cutaneous stimulation of the neck or ophthalmic division of the trigeminal nerve^{e5} diminish CN. Further, alterations in orbital proprioceptive feedback loops may explain how extraocular muscle surgeries diminish CN,⁷ as well as MS-related PN.^{e6}

This is the first report of MS-related PN that dramatically diminishes with vibration, and it carries potentially important clinical ramifications, especially for patients who do not respond to or cannot tolerate treatment with medications. Successful damping of PN with vibration, for example by wearing a neck

Supplemental data
at Neurology.org

Figure Data from commercially available, battery-operated, handheld vibrator (Brookstone Mini Muscle Massager)

The vibrator has a vibration frequency of 100 Hz and amplitude of approximately 1 mm (measured with a strobe light) and contacts a circular area on the skin measuring 3 cm in diameter. When assessing the effect of vibration on the nystagmus, we placed the vibrator against the right and left mastoid prominence, vertex, chin, and dorsal neck muscles. When testing mastoid vibration, the vibrator was placed directly behind the pinna of the ear. When testing the dorsal neck muscles, the vibrator was applied approximately 2–5 cm below the occipital bone and 2–5 cm lateral to the cervical spine; the vibrator was never in direct contact with the skull but we cannot exclude the possibility of propagation of vibration to the skull. The patient's eye movements were recorded using the ICS Chartr 200 (GN Otometrics, Schaumburg, IL). From the beginning of the recording, a horizontal pendular nystagmus is present in the left eye. When vibration is applied over the left mastoid, the amplitude of the nystagmus damps almost immediately and diminishes even more shortly thereafter (the shaded portion of the tracing indicates when the vibration was applied). When the vibrator is turned off, the nystagmus immediately intensifies. Green arrows point to the nystagmus. Note time (x-axis) and amplitude (y-axis) scales. HL = horizontal left eye movements; HR = horizontal right eye movements; VL = vertical left eye movements; VR = vertical right eye movements.

vibrator close to the skull, may help patients with MS to see better when high acuity vision is required. If these observations are replicated in a larger cohort, one might develop an inconspicuous, easy-to-wear device to deliver such vibrations in patients. As such, vibration (not unlike the geste antagoniste of cervical dystonia) may provide periods of improved visual function that would improve the patients' quality of life.

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Author contributions: Dr. Beh contributed to data collection, data interpretation, manuscript preparation, and manuscript revision. Dr. Tehrani contributed to data collection, data interpretation, and manuscript revision. Dr. Kheradmand contributed to data collection, data interpretation, and manuscript revision. Dr. Zee contributed to data collection, data interpretation, and manuscript revision.

Study funding: No targeted funding reported.

Disclosure: The authors report no disclosures relevant to the manuscript. Go to Neurology.org for full disclosures.

Received September 17, 2013. Accepted in final form December 26, 2013.

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1. Leigh RJ, Zee DS. The Neurology of Eye Movements. Contemporary Neurology Series 70, 4th ed. Oxford: Oxford University Press; 2006.
2. Jasse L, Vighetto A, Vukusic S, Pelisson D, Tilikete C. Unusual monocular pendular nystagmus in multiple sclerosis. J Neuro-Ophthalmol 2011;31:38–41.
3. Gottlob I, Zubcov AA, Wizov SS, Reinecke RD. Head nodding is compensatory in spasmodic nutans. Ophthalmology 1992;99:1024–1031.
4. Biguer B, Donaldson IM, Hein A, Jeannerod M. Neck muscle vibration modifies the representation of visual motion and direction in man. Brain 1988;111:1405–1424.
5. Roll JP, Vedel JP, Ribot E. Alteration of proprioceptive messages induced by tendon vibration in man: a microneurographic study. Exp Brain Res 1989;76: 213–222.
6. Lennerstrand G, Han Y, Velay JL. Properties of eye movements induced by activation of neck muscle proprioceptors. Graefes Arch Clin Exp Ophthalmol 1996;234: 703–709.
7. Dell'Osso LF, Wang ZI. Extraocular proprioception and new treatments for infantile nystagmus syndrome. Prog Brain Res 2008;171:67–75.

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