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Novel treatment (new drug/intervention; established drug/procedure in new situation)

Vibration therapy of the plantar fascia improves spasticity of the lower limbs of a patient with fetal-type Minamata disease in the chronic stage

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Summary

The authors present a novel treatment for spasticity using a hand-held vibration massager. A fetal-type Minamata disease patient showing spasticity of lower limbs had direct application of vibratory stimuli to the right plantar fascia and to the left hamstring. After the treatment for 1 year, the Modified Ashworth Scale (MAS) of the lower limbs was improved from three (right > left) to two (right < left). After then, direct application of the same method with the left plantar fascia improved the MAS of the left lower limb to two (right = left). The increased deep tendon reflexes had diminished and markedly positive Babinski's sign had also decreased to slightly positive on both sides. This method is so simple that patients can treat themselves at home. The authors think that direct application of vibratory stimuli to the plantar fascia is valuable to patients with neurologic disorders, particularly those who cannot receive more invasive treatments.

BACKGROUND

The management of spasticity is one of the most important issues of medical treatment for patients with neurologic disorders. Although new approaches, botulinum-toxin injections and intrathecal baclofen, have been developed and demonstrated to be effective, they are invasive for patients. We have many patients who cannot receive invasive antispastic treatment. It is desirable to develop non-invasive and simpler antispastic treatments for such patients.

CASE PRESENTATION

The patient is a 54-year-old man who was diagnosed at 7 years of age as a fetal-type Minamata disease caused by methylmercury intoxication in utero. He showed cerebral palsy-like neurological signs, including systemic dystonia, motor dysfunction, spasticity, dysarthria, dysphagia and mental disturbances. His pretreatment evaluation of clinical signs was as follows: The Modified Ashworth Scale (MAS) of the upper limbs was two (right = left) and of the lower limbs was three (right > left). Range of motion (ROM) was reduced as follows: extension of the knee joint, −10° (right) and −20° (left); dorsiflexion of the ankle joint, −10° (right) and 0° (left); eversion of the ankle joint, −10° (right) and 0° (left). He had severe bilateral equinovarus. His deep tendon reflexes were generally increased. Babinski's sign was markedly positive on both sides. He complained of severe pain of the right sole, and this pain was too intense for a therapist to touch his sole. His activity of daily life (ADL) assessed by the functional independence measure (FIM) was 61/126. His ambulation was by wheelchair. His sequence actions of getting up from a recumbent position required 50–60 s. He could stand by using a handrail, but was unstable because of insufficient contact of the right sole with the ground due to pain. An assistant belt was required to help with his transfer. He received oral antispastic drugs, but his spasticity continued.

INVESTIGATIONS

He showed no obvious brain atrophy on brain MRI and his magnetic resonance angiography was normal.

TREATMENT

Because the pain of the right sole appeared to be caused by increased tension of the plantar fascia, we employed direct application of vibratory stimuli to the plantar fascia by using a hand-held vibration massager. In addition, another hand-held vibration massager was placed directly on the left hamstring to decrease the tonus of the hamstring. The devices were used at a frequency of 50 Hz for 15 min twice a week.

As there was significant improvement in the MAS of the right lower limb 1 year later, we tried the same method with the left lower limb, direct application of vibratory stimuli to the left plantar fascia (figure 1).

OUTCOME AND FOLLOW-UP

Soon after the first vibration therapy, the plantar pain was reduced and the sole was able to be touched albeit for a short duration. The pain relief of the right sole allowed the therapist to treat him with repetitive facilitation exercises. Continued vibration therapy decreased his plantar pain to 8/10 on the Visual Analog Scale (VAS) after 2 months, and to 5/10 after 6 months, and longer durations of pain relief were observed. After 1 year, his symptoms and signs had improved. The MAS of the lower limbs improved to two (right < left). This change in muscle tonus was notable because the MAS of the right lower limb with the plantar pain was worse than that of the left before vibration therapy. The ROM of extension of the left knee joint had improved to −10°. The increased deep tendon reflexes of the knee and ankle had diminished. Babinski's sign had decreased to slightly positive on both sides. The severe

Figure 1 Direct application of vibratory stimuli to both plantar fascia by using hand-held vibration massagers.

pain of the right sole decreased to 3/10 on the VAS immediately after vibration therapy. His ADL had improved to 63/126 on the FIM. His sequence actions of getting up from a recumbent position improved to 30–40 s. His standing with support and transferring actions became independent under observation. This notable change in muscle tonus of the right lower limb prompted us to try the same method with the left lower limb.

Nine months after direct application of vibratory stimuli to both plantar fascia, the MAS of the left lower limb improved to two (right = left). Additionally, his ADL was improved to 66/126 on the FIM due to improved standing and transferring actions, and his sequence actions of getting up from a recumbent position improved to 25–30 s. His standing with support and transferring actions became independent almost without observation.

DISCUSSION

The management of spasticity includes oral antispastic drugs, intramuscular botulinum-toxin injections, intrathecal baclofen and vibration therapy. A systematic review reported that evidence of the efficacy of oral antispasptic drugs is weak, and efficacy for quality of life is marginal in patients with non-progressive neurologic diseases.[1] Botulinum-toxin injections and intrathecal baclofen have been demonstrated to be effective, but invasive, for patients. Vibratory stimulation applied to the antagonist of a spastic muscle has been shown to decrease spasticity of a hemiplegic limb in previous studies.[2] In addition, a recent study has shown that the application of vibratory stimulation directly to the spastic muscles decreases the spasticity in stroke patients in the subacute stages.[3] Here we demonstrated that direct application of vibratory stimulation to the plantar fascia is more effective than direct application to the spastic muscles in the chronic neurological case. To the best of our knowledge, this is the first case report on the therapeutic effects of direct application of vibratory stimulation to the plantar fascia on spasticity of the lower limbs of patients with neurologic disorders in the chronic stage. Although the reason why the direct application of vibratory stimulation to the plantar fascia reduced the tonus of the lower muscles remains to be elucidated, it is suspected that the antispastic effect induced by the vibration is generated by both peripheral[4] and supraspinal[5] mechanisms.

The device we used was a hand-held vibration massager which is inexpensive and non-invasive. This method is so simple that patients can apply it at home. We think that this method is valuable to patients with neurologic disorders, even in the chronic stage, particularly those who cannot receive more invasive treatments.

Learning points

- Direct application of vibratory stimuli to the plantar fascia at low-frequency is an effective treatment for spasticity of the lower limbs.
- This method is so simple that patients can treat themselves at home with an inexpensive and non-invasive device.
- Direct application of vibratory stimuli to the plantar fascia is valuable to patients with neurologic disorders, particularly those who cannot receive more invasive antispasptic treatments.

Competing interests None.

Patient consent Obtained.

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