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Matsuta Y[1], Yokoi S[1], Hashimoto N[2], Aoki Y[1], Akino H[1], Yokoyama O[1]

1. *Department of Urology, Faculty of Medical Sciences, University of Fukui,* ***2.*** *Department of Clinical Laboratory, Faculty of Medical Sciences, University of Fukui*

LOW-FREQUENCY TRANSCUTANEOUS ELECTRICAL STIMULATION OF FOOT AMELIORATES INTRACTABLE OAB SYMPTOMS

Hypothesis / aims of study

Posterior tibial nerve stimulation (PTNS) is a minimally invasive treatment option for intractable overactive bladder (OAB). Although PTNS is safe and efficacious, the inconvenience of frequent hospital visits can be prohibitive for patients. Thus, more convenient treatment, e.g. home-based treatment, would be attractive to many patients. Tai *et al*. reported that transcutaneous electrical stimulation of somatic afferents in the foot could inhibit reflex micturition and increase bladder capacity in anesthetized cats [1, 2]. Based on these reports, Chen *et al*. reported a significant increase in bladder capacity after 90-minute stimulation in healthy human subjects [3]. However, to our knowledge the effect of foot stimulation in OAB patients is still unknown. Thus, we examined whether electrical foot stimulation can improve their symptoms as well as objective findings in patients with intractable OAB.

Study design, materials and methods

The institutional review board of University of Fukui approved the protocol. Patients with OAB symptoms refractory with behavioural and medical therapy were enrolled in this study. After the instruction of treatment device (Pulsecure-PRO KR-7, OG Wellness, Japan), patients continued foot stimulation at their home. Using surface electrodes, 30-minute unilateral foot stimulation was continued once a day, for 12 weeks. Stimulation parameters were 5 Hz pulse frequency, biphasic rectangular waveform pulse and 0.05 milliseconds width. Stimulation intensity was set by each patient to a maximal level without causing discomfort or pain. Cystometric and uroflowmetry parameters were compared before and after the treatment, and the changes in the King's health questionnaire (KHQ) and frequency-volume chart were evaluated every 4 weeks. All values were indicated as mean ± standard error.

Results

Twelve patients aged 67.1 ± 5.7 (range 26-90) years olds were enrolled in the present study. All patients finished 12-week protocol without difficulty. No treatment-related adverse event was reported. The maximum cystometric bladder capacity was significantly increased from 167.4 ± 28.1 ml to 255.6 ± 41.0 ml after the 12-week stimulation (Figure 1D). No statistically significant changes were seen in mean post-void residual volume and urinary flow rate (from 17.1 ± 4.8 to 16.5 ± 5.6 ml and from 14.8 ± 2.7 to 20.8 ± 3.8 ml/s, respectively). Most of the patients reported a reduction of pad usage. Regarding KHQ, incontinence impact and severity measures domains were consistently improved from the time point of 4 weeks (Figure 2). As for frequency-volume chart, foot stimulation did not change average urine volume or micturition frequency during daytime or night.

Interpretation of results

Foot stimulation increased maximum cystometric capacity and improved urinary incontinence, however, it did not decrease micturition frequency. This discrepancy may be explained by relatively small increase in the capacity which causes first or normal desire to void (Figure 1 A and B). The effect of foot stimulation on the bladder sensation might be small but enough for improving urinary incontinence. Previously, the single 90-minute stimulation transiently increased bladder capacity in healthy subjects [3]. In spite of the short duration of stimulation, a significant increase in cystometric bladder capacity was also seen in the present study, suggesting a post-stimulation inhibition on the micturition reflex due to the repetitive stimulation. If we could find an identical way to enhance this post-stimulation effect, it would lead to a better treatment efficacy.

Concluding message

Transcutaneous electrical foot stimulation increased cystometric bladder capacity and improved KHQ scores in intractable OAB patients. Because foot stimulation is non-invasive and can be performed safely at home, it would provide several potential advantages over ordinary PTNS.

Figure 1
Changes in cystometric bladder capacity after 12-week foot stimulation

determined by paired *t*-test

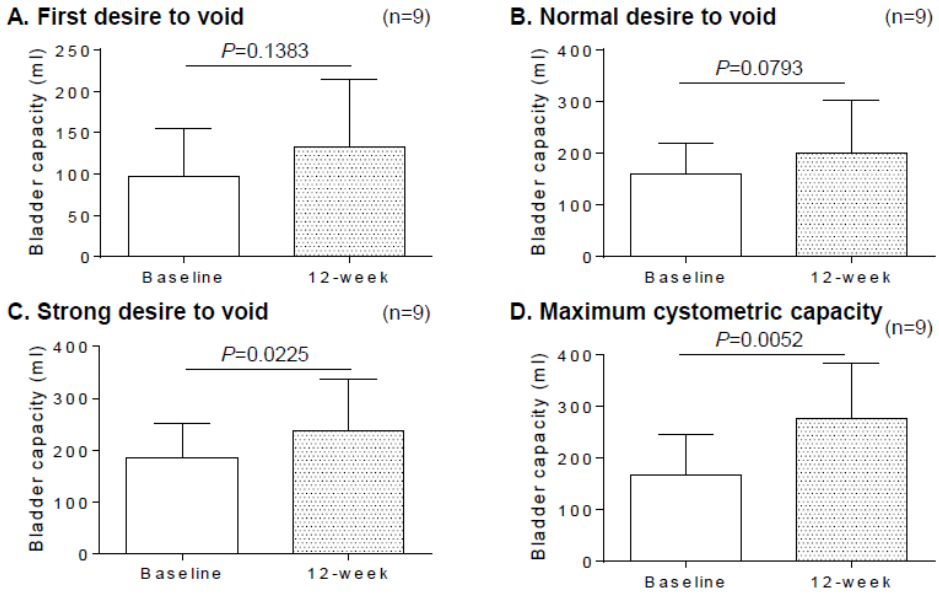
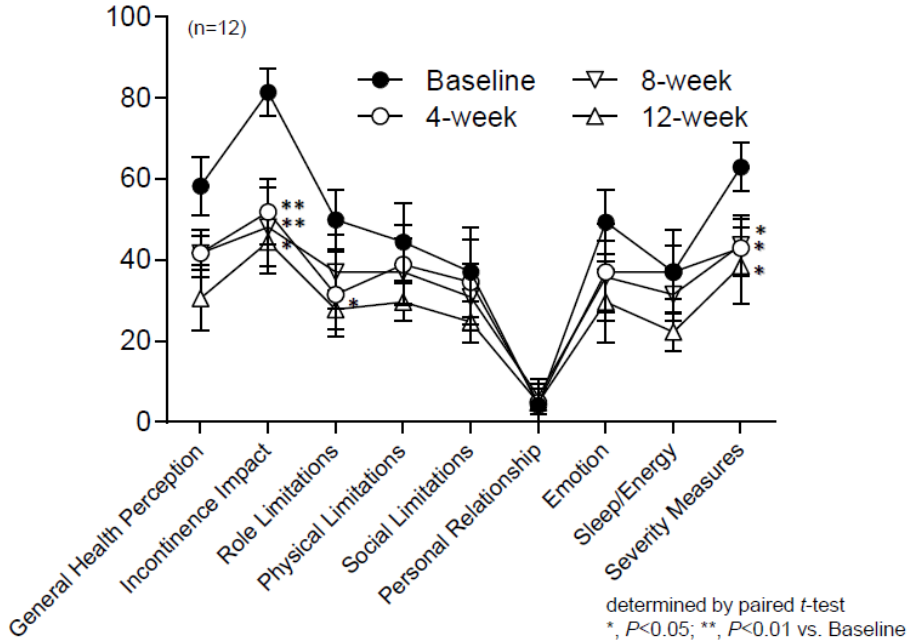


Figure 2
Changes in King's Health Questionnaire before and during foot stimulation



determined by paired *t*-test
*, $P<0.05$; **, $P<0.01$ vs. Baseline

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Disclosures

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