Pilot Study of Fixed-Site High-Frequency Transcutaneous Electrical Nerve Stimulation in Fibromyalgia

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PURPOSE

Fibromyalgia is a condition of unknown etiology that is characterized by chronic widespread pain, poor sleep quality, fatigue, and neurological complaints. The disorder affects an estimated 10 million people in the U.S. and 3-6% of the world population. Common treatments include anticonvulsants, antidepressants and benzodiazepines. However, most patients do not obtain adequate pain relief and may suffer from dose limiting side effects. There is a need for non-pharmacological treatments with limited adverse effects.

Transcutaneous electrical nerve stimulation (TENS) is a non-invasive treatment for chronic pain that has no major side effects. Conventional TENS is delivered through surface electrodes to generate a strong, nonpainful sensation. The resulting stimulation of large diameter, deep tissue afferents produces widespread pain relief by decreasing central excitability and increasing central inhibition. TENS has not been extensively evaluated in fibromyalgia, however several studies have suggested benefit.

In traditional practice, TENS electrodes are applied to the painful area. This is not practical in fibromyalgia due to the widespread distribution of pain. Fixed-site high-frequency TENS (FS-TENS) is a form of TENS in which the device stimulates a predetermined area rather than to overlap the pain. The objective of this pilot study was to evaluate FS-TENS efficacy in diagnosed fibromyalgia.

METHODS

This was a prospective, open-label, single-site, interventional study of FS-TENS in fibromyalgia. Consecutive patients presenting to a multispecialty pain clinic were considered. The inclusion criteria were age ≥ 18 and a diagnosis of fibromyalgia according to the 2010 American College of Rheumatology criteria. Exclusion criteria were a physical or psychological impediment to use of FS-TENS. Enrolled subjects provided informed consent and filled out a baseline Fibromyalgia Impact Questionnaire (FIQR). Subjects were given a FS-TENS device (Quell®, NeuroMetrix, Waltham, MA). The subjects were directed to self-administer therapy as much as possible for 30 days, including during sleep. Subjects returned to the study site for a 30-day follow-up at which time they filled out a follow-up FIQR and indicated patient global impression of change (PGIC) on a 7-point scale (0 – "no change" to 7 – "a great deal better").

METHODS (continued)

The primary outcome measure was the baseline to 30-day change in the FIQR. Statistical significance was assessed by the non-parametric Wilcoxon Signed-Rank test, with a one-sided hypothesis that FS-TENS improves FIQR over 30 days. FIQR responders were defined as ≥14% improvement. A PGIC responder was defined as ≥4 on the 7-point scale. Post-hoc analyses included evaluation of FIQR domains, the FIQR pain level (over past 7 days) item, the FS-TENS dose-response relationship and interactions between FS-TENS and concurrent prescription opioids.

Table 1

Subject ID	Age	M/F	Height (cm)	Weight (kg)	BMI (m/kg²)	Sx (yrs)	Dx (yrs)	Initial FIQR	F/U FIQR	FIQR Change	FIQR % Change	Therapy Sessions	FIQR Responder[b]	PGIC[c]
107	67	F	160	75.9	29.6	10	4	73.2	65.0	-8.2	-11.2%	171	No	3
104	53	F	165	113.6	41.7	15	15	61.8	74.7	12.8	20.8%	23	No	4
105	33	F	165	69.1	25.3	20	16	93.7	87.0	-6.7	-7.1%	182	No	4
103	53	F	163	75.0	28.4			85.2	56.3	-28.8	-33.9%	222	Yes	5
106	55	F	168	60.0	21.3	9	1	28.7	19.3	-9.3	-32.6%	326	Yes	6.5
101*	60	F	170	75.9	26.2	51	25	70.7	75.0	4.3	6.1%	0	No	1
100	59	F	163	81.8	31.0	5	5	64.0	22.0	-42.0	-65.6%	215	Yes	6
108	68	F	150	57.7	25.7	9	9	70.7	29.3	-41.3	-58.5%	40	Yes	5
102	55	F	175	63.6	20.7	8	8	70.7	75.2	4.5	6.4%	153	No	5
109*	53	F	155	54.1	22.5	1	1	75.0	92.5	17.5	23.3%		No	3
111	65	F	163	72.7	27.5	12	1	58.8	56.3	-2.5	-4.2%		No	1
110	53	F	168	90.0	32.0			75.8	45.7	-30.2	-39.8%		Yes	3
N=12	56.2 (9.2)[&]		164 (6.7)[&]	74.1 (16.2)[&]	27.7 (5.7)[&]	9.5[#]	6.5[#]	70.7[#]	60.7[#]	p=0.068[a]	-9.1%[#]		5 Responder	7 definite or possible responders

a: Wilcoxan Signed-Rank test, one tailed hypothesis
b: Responder defined as FIQR improvement ≥ 14% (Bennett et al. *J Rheumatol*, 2009.)
c: Global Impression; no noticeable improvement (1-3), possible improvement (4), definite improvement (5-7)
*: Reported that device aggravated symptoms; &: mean (std); #: median

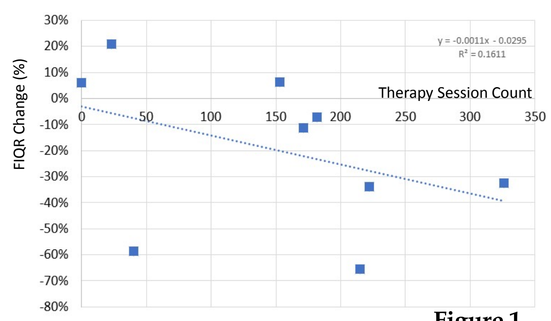

Figure 1

RESULTS

A total of 12 subjects were enrolled and completed the study (see Table 1 for results). Subject age was 56±9 years (range 33-68), 100% were female and BMI was 27.7±5.7 kg/m². The median time since symptoms was 9.5 years and the median time since diagnosis was 6.5 years. Fibromyalgia severity was mild (1), moderate (0) and severe (11) according to the baseline FIQR.

The FIQR improved for 8 out of 12 subjects, with 5 (42%) classified as FIQR responders. The baseline FIQR was 69.0±15.9 and the 30-day FIQR was 58.2±24.7. The baseline to 30-day change approached statistical significance (p=0.068). A total of 7 (58%) subjects reported possible or definite improvement on PGIC. Fibromyalgia severity at 30-days was mild (3), moderate (3) and severe (6). Two subjects reported that FS-TENS aggravated their fibromyalgia symptoms. There were no serious adverse events.

Pain level decreased from 7.2±2.0 at baseline to 5.9±2.5 at 30-days which was a statistically significant change (p=0.007). 25% of subjects were responders at the 30% pain reduction level (moderate clinical improvement) and 50% of subjects were responders at the 15% pain reduction level (minimal clinically significant improvement). The relative change in FIQR was correlated (r=0.40, p<0.05) to the amount of FS-TENS therapy suggesting a dose-response association (Figure 1). Subjects not taking prescription opioids showed a trend towards greater improvement in FIQR, however the sample size was too small for statistical testing.

CONCLUSIONS

In this study, FS-TENS use for 30-days decreased the severity of fibromyalgia in about half of subjects as assessed by changes in FIQR and PGIC. The efficacy of FS-TENS was dose-dependent. Strengths of this study include use of validated FIQR and PGIC outcome instruments and objective assessment of therapy adherence. Limitations include a small samples size, non-compliance by several subjects, lack of a control group and a short study duration. The results of this study suggest that FS-TENS may be useful as a non-pharmacological treatment option for fibromyalgia and should be further evaluated.

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