Acupuncture and Laser Acupuncture as Treatments for Emotional Distress in Infertile Women in Japan

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ABSTRACT

Objectives: Needle and laser acupuncture are often used to improve the success rate of assisted reproductive technology (ART). This study examined whether needle or laser acupuncture ameliorated the emotional distress experienced by infertile women undergoing *in vitro* fertilization and embryo transfer (IVF-ET) or intracytoplasmic sperm injection (ICSI).

Materials and Methods: Fifty-one infertile women who were undergoing IVF-ET or ICSI received needle acupuncture (needle-acupuncture group; n = 32) or laser acupuncture treatment (laser-acupuncture group; n = 19). The emotional distress experienced by the infertile women was evaluated using 2 questionnaires—the Profile of Mood States (POMS) and the State–Trait Anxiety Inventory (STAI)—both before and after 3 months of treatment.

Results: In the needle-acupuncture group, the POMS detected significant post-treatment reductions in tension/anxiety ($P < 0.001$), depression/dejection ($P < 0.001$), anger/hostility ($P < 0.001$), confusion ($P < 0.05$), and total mood disturbance (TMD; $p < 0.001$). However, the POMS scores for vigor/activity and fatigue were not altered significantly after the treatment. In the STAI, both State and Trait scores had significantly decreased after the acupuncture ($P < 0.001$ and $P < 0.05$, respectively). In the laser-acupuncture group, the POMS detected significantly lower tension/anxiety ($P < 0.05$) and vigor/activity ($P < 0.05$) scores after the treatment. However, the POMS did not detect significant changes in depression/dejection, anger/hostility, fatigue, confusion, or TMD after the treatment. Furthermore, neither the STAI-State nor the STAI-Trait score had significantly decreased after the laser acupuncture treatment.

Conclusions: These results indicate that needle and laser acupuncture ameliorate the emotional distress experienced by women who are undergoing IVF-ET or ICSI.

Keywords: infertility, acupuncture, laser acupuncture, POMS, STAI

INTRODUCTION

NEEDLE AND LASER ACUPUNCTURE are forms of complementary alternative medicine that are effective for treating a variety of conditions, such as chronic pain, wounds, inflammation, and depression.^{1–6} These treatments have also been used to improve the pregnancy rate.^{7–11}

Infertility treatments increase psychologic stress, and several reports have indicated that acupuncture treatment alleviates emotional distress in infertile women.^{12–18} However, it is unclear if laser acupuncture ameliorates this distress.

Many investigators have reported the benefits of needle acupuncture for improving pregnancy rates. Conversely, a

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2013 review concluded that acupuncture does not improve the clinical pregnancy rate, ongoing pregnancy rate, live birth rate, or miscarriage rate, regardless of whether needle acupuncture is delivered before or after embryo transfer (ET), or before oocyte collection.¹⁹ With respect to laser acupuncture, several researchers have reported its effect on the pregnancy rate^{9,10,20}; however the treatment's efficacy has not yet been ascertained reliably.

This article is concerned with whether needle or laser acupuncture is able to ameliorate the emotional distress suffered by infertile women. The article presents the first study to address this question specifically.

MATERIALS AND METHODS

Patients

Fifty-one infertile women of reproductive age (31–48) who had undergone repeated *in vitro* fertilization and ET (IVF-ET), or intracytoplasmic sperm injection (ICSI), at the Tamura Hideko Ladies' Clinic, in Kyoto City, Kyoto, Japan, between April 2010 and December 2011 were also treated using needle acupuncture ($n=32$; needle-acupuncture group) or laser acupuncture ($n=19$; laser-acupuncture group). Informed consent was obtained from all individual participants included in the study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Also, ethical approval for this investigation was granted by the ethics committee of Meiji University of Integrative Medicine, Nantan-Shi, Kyoto, Japan.

Acupuncture and Laser Acupuncture Protocol

Thirty-two women received needle acupuncture treatment during IVF-ET or ICSI (the needle-acupuncture group). The acupuncture was administered for 10 minutes, twice per week, for 3 months (~ 24 sessions). Needles were placed in the following recognized Traditional Chinese Medicine acupuncture locations: DU 20 (*Baihui*); LI 4 (*Hegu*); PC 6 (*Neiguan*); ST 29 (*Guilai*); ST 36 (*Zusanli*); SP 6 (*Sanyinjiao*); SP 8 (*Diji*); SP 10 (*Xuehai*); LV 3 (*Taichong*); and UB 33 (*Zhongliao*). Use of these points were based on Paulus et al.'s study.²¹ Paulus et al. showed that acupuncture increased pregnancy rates. Stainless steel-needles (0.16 mm in diameter and 30 mm in length) were inserted into all of the abovementioned acupuncture points (insertion depth was 10 mm), except for UB 33, into which a needle measuring 0.30 mm in diameter and 60 mm in length was inserted horizontally for a distance of 50 mm. The needles were rotated to evoke the De Qi sensation.

Laser acupuncture was performed on 19 women during IVF-ET or ICSI (laser acupuncture group). The Medilaser soft pulse 10 (MODEL MLD-1006; Mochida Siemens

Medical System Co. Ltd., Japan) was used for this treatment; the wavelength was set at 830 nm and the output at 10 watts. Laser acupuncture was performed on each patient's acupoints for a total of ~20 minutes until the patient's skin felt warm. These acupoints were similar to those used for the needle-acupuncture group. The treatment was performed twice per week, for 3 months (~ 24 sessions).

Needle acupuncture and laser acupuncture were not used simultaneously, and were applied on the points in a series. There was no rule in the order of the points used.

As an additional treatment, in both groups, laser acupuncture was administered to locations near the bilateral stellate ganglia for ~5 minutes before and after treatment.

Assessment Methods

The participants completed 2 validated questionnaires: (1) emotional disturbance was measured using the Japanese version of the Profile of Mood States (POMS)²² and (2) anxiety was measured using the Japanese version of the State-Trait Anxiety Inventory (STAI).²³

The POMS produces scores for depression/dejection, anger/hostility, vigor, fatigue, tension/anxiety, confusion, and total mood disturbance (TMD). The TMD score was calculated according to the method described by Shacham.²⁴

The STAI is comprised of 2 separate scales: (1) the State scale, which measures the degree of anxiety at a particular time, and (2) the Trait scale, which assesses the tendency of an individual to respond to stressful circumstances with raised anxiety. These 2 scores were evaluated before and after the treatments.

Statistics

An unpaired Student's *t*-test was used to compare the patients' clinical characteristics, pretreatment POMS scores, and pretreatment STAI scores between the 2 groups. To compare the POMS and STAI scores obtained before and after treatment, the paired Student's *t*-test was used. Chi-square analysis was used to compare the frequencies of the various causes of infertility and pregnancy outcomes. *P*-values <0.05 were considered statistically significant.

RESULTS

The clinical characteristics of the 2 groups are shown in Table 1. No significant differences were found between the 2 groups in terms of either clinical characteristics or infertility diagnoses. However, before treatment, the POMS score for vigor/activity, as well as the STAI-State score, showed significant differences between the 2 groups (Table 2).

In the needle-acupuncture group, after 3 months of treatment, the POMS detected significant reductions in tension/anxiety ($P<0.001$), depression/dejection ($P<0.001$), anger/hostility ($P<0.001$), confusion ($P<0.05$), and TMD

TABLE 1. PATIENTS' CHARACTERISTICS

Characteristics	Needle acupuncture (n=32)	Laser acupuncture (n=19)	P-value
Age (yr)	39.1 ± 3.6	39.6 ± 4.3	NS
Duration of infertility (mo)	33.2 ± 19.2	23.1 ± 20.4	NS
Previous IVF cycle (n)	1.1 ± 2.2 (min 0; max 8)	0.2 ± 0.6 (min 0; max 2)	NS
Previous ICSI cycle (n)	6.7 ± 5.8 (min 0; max 22)	5.9 ± 4.8 (min 0; max 14)	NS
Reasons for infertility (n of pts)			
Male factor	4	3	NS
Ovarian dysfunction	11	8	NS
Tubal factor	2	4	NS
Endometriosis	6	5	NS
Unknown	12	3	NS

Data are presented as mean ± standard deviation or as *n*.
yr, years; NS, nonsignificant; mo, months; IVF, *in vitro* fertilization;
min, minimum; max, maximum; ICSI, intracytoplasmic sperm injection;
pts, patients.

($P < 0.05$). However, the POMS scores for vigor/activity and fatigue had not changed significantly. In the laser-acupuncture group, the POMS detected significant reductions in tension/anxiety ($P < 0.05$) and vigor/activity ($P < 0.05$) after 3 months of treatment. However, the POMS scores for depression/dejection, anger/hostility, fatigue, confusion, and TMD were not affected significantly (Table 2).

Table 2 also shows the changes in the STAI scores recorded after treatment. In the needle-acupuncture group, the STAI-State and STAI-Trait scores had significantly decreased after treatment ($P < 0.001$ and $P < 0.05$, respectively). In the laser-

acupuncture group, neither the STAI-State nor the STAI-Trait scores had changed significantly after treatment.

Table 3 shows the pregnancy outcomes. The clinical pregnancy rates in the needle- and laser-acupuncture groups were 9.4% (3/32) and 10.5% (2/19), respectively. The miscarriage rates in the needle- and laser-acupuncture groups were 0% (0/3) and 50.0% (1/2), respectively. There was no significant difference between clinical pregnancy and miscarriage rates in both groups.

No side-effects were observed in either treatment group.

DISCUSSION

Using the POMS and STAI, this study examined whether needle- or laser-acupuncture treatments could reduce the emotional distress suffered by infertile women, as well as if these treatments could improve the pregnancy rates effectively in women undergoing IVF-ET or ICSI. The results suggested that needle and laser acupuncture were safe and effective treatments for the emotional distress experienced by infertile women, and that needle acupuncture was more effective than laser acupuncture.

Emotional Distress in Infertile Women

In the present study, the pretreatment depression/dejection scores in the needle-acupuncture group were higher than those in healthy women, indicating that the infertile women in the needle-acupuncture group were suffering from high levels of depression/dejection. However, the STAI-State and STAI-Trait scores of healthy women range from 31 to 41 and from 34 to 44, respectively, whereas the mean STAI-State scores of women undergoing infertility treatment have been reported to range from 33 to 50.²⁵ In the current study,

TABLE 2. COMPARISON OF POMS AND STAI SCORES BEFORE TREATMENT WITH THOSE AFTER TREATMENT

Scores	Needle acupuncture (n=32)			Laser acupuncture (n=19)		
	Before	After	P-value	Before	After	P-value
POMS						
Tension/anxiety	10.1 ± 4.9	7.1 ± 4.5	<0.001	9.2 ± 4.3	6.5 ± 5.6	<0.05
Depression/dejection	11.6 ± 7.6	7.5 ± 6.2	<0.001	8.7 ± 7.5	6.3 ± 8.9	NS
Anger/hostility	10.0 ± 6.7	6.5 ± 5.5	<0.001	7.3 ± 4.7	5.3 ± 4.1	NS
Vigor/activity	12.5 ± 5.2	11.5 ± 4.4	NS	15.8 ± 3.6*	13.7 ± 6.0	<0.05
Fatigue	7.8 ± 5.0	6.2 ± 4.7	NS	5.8 ± 3.9	5.7 ± 4.5	NS
Confusion	7.8 ± 4.2	6.5 ± 3.3	<0.05	7.2 ± 3.7	5.8 ± 4.3	NS
Total mood disturbances	134.9 ± 26.2	122.4 ± 21.9	<0.001	122.5 ± 21.4	116.1 ± 25.5	NS
STAI						
STAI-State	43.1 ± 8.7	38.9 ± 8.4	<0.001	37.9 ± 7.9*	36.4 ± 9.2	NS
STAI-Trait	43.0 ± 9.3	40.9 ± 9.1	<0.05	38.5 ± 6.9	39.2 ± 7.9	NS

Data are presented as mean ± standard deviation.

* $P < 0.05$ in needle acupuncture vs. laser acupuncture (before treatment).

POMS, Profile of Mood States; NS, nonsignificant; STAI, State-Trait Anxiety Inventory.

TABLE 3. PREGNANCY OUTCOMES

<i>Pregnancy outcomes</i>	<i>Needle acupuncture (n = 32)</i>	<i>Laser acupuncture (n = 19)</i>	<i>P-value</i>
Clinical pregnancy (%)	3 (9.4)	2 (10.5)	NS
Miscarriage (%)	0 (0)	1 (50.0)	NS

Data are presented as *n* of patients (percentage).

NS, nonsignificant.

the infertile women in the needle-acupuncture group experienced more-severe depression before treatment than those in the laser-acupuncture group.

IVF-ET and ICSI involve a number of stressful aspects: daily injections; blood sampling; ultrasounds; laparoscopic surgery; and the possibility of failure at any of the various stages. The stress experienced by infertile women changes over time. In the early stages of infertility, most of the stress these women experience derives from a physical inferiority complex, while, later on, they tend to become stressed about what others outside of their families will say.²⁶ Turner et al.²⁷ also found that infertile women had persistently elevated stress and anxiety levels during IVF-ET; in infertile Japanese women, high levels of emotional distress have been detected using the hospital anxiety and depression scale, as well as the POMS, suggesting that infertile women need psychologic support.²⁸

The influence of stress on reproductive failure has been discussed in many previous studies.²⁹ The latest meta-analysis suggested that emotional distress caused by fertility problems or other life events co-occurring with fertility treatment does not reduce the likelihood of pregnancy.³⁰ Furthermore, it has been suggested that, although psychosocial interventions have been found to reduce the stress, they are unlikely to influence pregnancy rates.³¹ However, some studies show an association,^{32–35} and stress reduction through relaxation training or behavioral treatment has been found to improve conception rates,³⁶ suggesting that it is necessary to investigate stress-reduction modalities throughout the IVF cycle. Thus, evidence is mixed regarding whether stress is negatively correlated with success in fertility treatment. In any case, emotional distress widely influences infertile women's quality of life and social activity. It might also cause social and legal problems; thus, increased attention has been paid to emotional distress, not only in connection with infertility treatment but also from social and legal points of view.

Needle-Acupuncture Treatment in Infertile Women

Although some articles have suggested that acupuncture increases the pregnancy rate of infertile women,^{37–40} the latest systematic reviews have concluded that performing acupuncture before and after IVF-ET, or before oocyte collection, does not influence the clinical pregnancy rate, ongoing pregnancy rate, live birth rate, or miscarriage rate.¹⁹

In brief, the effects of acupuncture on infertility in women are disputed. One previous study investigating the effects of acupuncture on the emotional distress experienced by infertile women, as well as the association between pregnancy rates and emotional distress, suggested that acupuncture has beneficial effects on levels of the serum stress hormones cortisol and prolactin, and that the treatment improves reproductive outcomes in patients undergoing IVF-ET.¹² Balk et al.¹⁶ also found that the efficacy of acupuncture was associated with reduced stress levels—both before and after IVF-ET, and that acupuncture might improve pregnancy rates.

However, although Isoyama et al.¹⁸ found that acupuncture ameliorated anxiety symptoms significantly in women undergoing IVF-ET treatment, the researchers detected no significant differences in clinical pregnancy rates between the verum acupuncture and sham acupuncture groups in that study. Furthermore, Domar et al.¹⁵ presented evidence that acupuncture was not associated with increased pregnancy rates in patients undergoing IVF-ET, but that the subjects who received acupuncture were more relaxed and optimistic. Moreover, in randomized controlled trials (RCTs) investigating emotional distress during acupuncture treatment, it has been suggested that acupuncture reduces infertility-related stress.^{13,14}

The results of the current study indicated that needle acupuncture might be an effective treatment for emotional distress and depression in infertile women, as well as for depression during pregnancy and premenstrual dysphoric disorder, as has been reported previously.^{5,40} Several researchers have detected changes in the concentrations of adrenocorticotrophic hormone, leu- and met-enkephalin, β -endorphin, dynorphin, serotonin, and biogenic amines, among others, during acupuncture treatment.⁴¹ Such changes might have beneficial effects on the nervous system, such as reductions in anxiety and emotional distress.^{41,42}

Laser-Acupuncture Treatment in Infertile Women

Although the effects of laser acupuncture on pregnancy rates and emotional distress have not been elucidated fully, some reports have suggested that laser acupuncture improves pregnancy rates.^{9,10,20} Regarding the effects of laser acupuncture on depression, an RCT by Quah-Smith et al., reported that the therapy was effective for treating mild-to-moderate depression.⁶ A later study that Quah-Smith conducted with other researchers suggested that laser acupuncture ameliorated the symptoms of depression significantly.⁴³ Moreover, Quah-Smith with yet another group investigated the changes in the default mode network (DMN) that occurred during laser acupuncture in subjects with and without depression. The results suggested that the antidepressant effects of laser acupuncture involve modulation of the posterior DMN.⁴⁴ The present study was the first

to observe the effects of laser acupuncture on the emotional distress experienced by infertile women. It was found that the POMS scores for tension/anxiety were decreased significantly after laser acupuncture, suggesting that laser acupuncture is effective against the emotional distress suffered by infertile women.

Differences Between Needle and Laser Acupuncture in Infertile Women

Needle- and laser-acupuncture treatment had different effects on emotional distress. There are a couple of possible explanations for these differences. First, it is possible that selection bias affected the results, because the baseline POMS score for vigor/activity, and the STAI-State scores, were higher in the needle-acupuncture group than in the laser-acupuncture group. Secondly, needle and laser acupuncture activate markedly different brain regions. Specifically, needle acupuncture increases hemodynamic signals in the anterior insula and decreases them in the limbic and paralimbic structures; namely, the amygdala and anterior hippocampus, as well as the cortices of the subgenual and retrosplenial cingulate, the ventromedial prefrontal cortex, and the frontal and temporal poles.⁴⁵ Yet, laser acupuncture activates the inferior parietal lobule, the primary somatosensory cortex, the precuneus of the parietal lobe, and the medial and superior frontal gyri of the frontal lobe.⁴⁶ It was also shown that needle acupuncture activates the parietal cortical region, which is associated with the primary motor cortex, while laser acupuncture activates the precuneus, which is associated with mood in the posterior DMN.⁴⁷

However, the clinical pregnancy rates in the needle- and laser-acupuncture groups were 9.4% (3/32) and 10.5% (2/19), respectively. Although similar acupuncture points were used to those used by Paulus et al,²¹ the pregnancy rates in the current study were lower. This might have been because the participants in the current study had been infertile for quite long periods of time and had received many previous ICSI cycles before undergoing the present treatment (i.e., the current subjects had more intractable infertility than those in Paulus' study). Furthermore, Westergaard et al.³⁹ found that the clinical and ongoing pregnancy rates of patients younger than 38 were higher than those seen in women ages ≥ 38 . In addition, there were differences in the timing and frequency of treatment between the current study and the abovementioned studies—the continuous treatment method used in the current study is widely used in Japan. Therefore, it is necessary to examine infertile patients of different ages and at different stages of infertility in detail.

Also in the current study, although both needle-acupuncture and laser-acupuncture were performed with uniform stimulation, adjusting individual stimulation amounts could produce different results. In the future, it is also important to consider the optimal dose and timing of treatments tailored to individual conditions.

Study Limitations

The sample size was too small to enable analysis of the differences in emotional distress between the subjects that became pregnant and those that did not. Accordingly, these results cannot be used to determine definitively the relationship between pregnancy outcomes and emotional distress.

Further limitations of the study design included the lack of a control group. In this study, placebo- or sham-acupuncture procedures were not performed. Usually, during placebo or sham acupuncture, the needle is placed at a different point from the target position or is placed only at the skin's surface. Also, acupuncture such as Streitberger's placebo needle may be used. Yet, laser acupuncture is easy to recognize due to the feeling of warmth it creates at the acupuncture point. Thus, it seems difficult to create a placebo. However, in the future, to confirm the optimal dosage and timing of laser-acupuncture treatment for infertility in women, an RCT is required.

CONCLUSIONS

The results of the current study suggested that needle and laser acupuncture were safe and effective treatments for the emotional distress experienced by infertile women, and that needle acupuncture was more effective than laser acupuncture.

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