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Advancements in research on transcutaneous electrical acupoint stimulation for alleviating pelvic pain in women

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ABSTRACT

Background Pelvic pain is a common complaint of discomfort in women, with an increasing incidence and seriously affecting patients' quality of life. Its etiology involves multiple systems and disciplines, and therefore treatment modalities are diverse. Transcutaneous electrical acupoint stimulation (TEAS) therapy is a classic analgesic means, and electrical stimulation of local acupoints can achieve obvious analgesic effects. This review aims to discuss the application of TEAS for the treatment of various types of pelvic pain, the selection of optimal parameters and the renewal of equipment.

Method

Result TEAS for treatment of pelvic pain in women has been reported mainly for endometriosis, pelvic inflammatory disease (PID), intrauterine adhesion (IUA), pelvic stasis syndrome, interstitial cystitis, primary dysmenorrhoea and other diseases. And for parameter selection, the most used of frequency is dilatational wave, the most used stimulation intensity is 10–20 mA, and the acupoint selection should be based on the specific conditions of the patient.

Conclusions The analgesic mechanism of TEAS has not been fully elucidated, but the efficacy of the treatment is remarkable and there are no significant adverse effects. The selection of the parameters for TEAS and the combination of acupoints for different pains are still the main directions of future research.

INTRODUCTION

For reproductive-age, perimenopausal and even postmenopausal women, female pelvic pain is the most common complaint of discomfort, which has varied clinical manifestations and with aetiology that may involve multiple systems. Approximately 60% of patients do not receive effective treatment, which significantly impairs health and quality of life. Treating female pelvic pain is one of the greatest challenges that gynaecologists face as there is currently no standard treatment available.[1] In clinical setting, the practice is a combination of treatments based on drugs and physiotherapy, with surgical intervention performed in severe cases. In recent years, electrical stimulation has been increasingly used in clinical practice[2] and has also been applied as an adjunctive treatment for pelvic floor disorders. More and more scholars are focusing on the application of electrical stimulation for treatment of pelvic pain due to its obvious analgesic effect.

Transcutaneous electrical acupoint stimulation (TEAS) combines transcutaneous electrical nerve stimulation therapy with traditional acupuncture point theory, delivering specific low-frequency pulsed current to the body through electrode pads on the surface of the corresponding acupoints to treat diseases.[3]

The analgesic mechanism of TEAS has not been fully elucidated; however, these days, it is speculated that it may be related to the following factors: First, local electrical stimulation promotes muscle contraction, accelerates blood circulation in the stimulated area, reduces stagnation of the pelvic organs and inhibits the abnormal proliferation of the endometrial to improve or even eliminate the disease. Second, low-frequency electrical stimulation of the pain site can counteract the action of prostaglandins and inhibit their secretion by inhibiting the cyclo-oxygenase pathway, raising the pain threshold and thereby relieving pain. Third, the same spinal nerve segment innervated by the skin afferent impulses can be transmitted through the coarse fibres or fine fibres to reach the spinal cord, and the signal transmitted through either fibre will inhibit the signal transmission of the other fibre when it reaches the spinal cord. TEAS can enhance the transmission of signals from the coarse fibres (transmitting tactile signals) and inhibit the transmission of

signals from the fine fibres (transmitting nociceptive signals), thus providing analgesia. TEAS also reduces inflammatory exudation and oedema, enhances the activity of the mononuclear phagocyte system, and promotes the absorption and dissipation of inflammatory mass to relieve pelvic inflammation and its adhesion to surrounding tissues.

In recent years, TEAS has been widely used in clinical practice. This paper summarises the reports on TEAS for female pain as follows.

PRACTICAL APPLICATION OF TEAS

Since the 1950s, when acupuncture analgesia was first used in clinical practice, this treatment has been available for almost every type of surgery. However, in the 1980s, the shortcomings of acupuncture analgesia were gradually exposed. First, the analgesic effect was weak, which could only reduce the dosage of anaesthetics, but could not completely replace anaesthetics, which also faced the shortcomings of incomplete analgesia, insufficient muscle relaxation and difficulty in relieving the muscular traction reaction. Second, it was a time-consuming and troublesome operation because the number of needles inserted could be up to 10–100, which required continuous operation by the acupuncturist and consumed manpower, affecting surgeon operation and turnover rate. Third, treatments are not effective in some patients due to individual differences . These problems need to be solved.

In 2007, China listed acupuncture and numbing analgesia as a national key research project[3 4] and carried out clinical research on the effectiveness of acupuncture and numbing analgesia, as well as its related mechanisms, in nine large hospitals across the country, confirming the effect of electroacupuncture stimulation. Professor Han and Ho,[4] in collaboration with Professor Liu's team at Beijing University of Aeronautics and Astronautics, is involved in the development of the TEAS instrument. This instrument places electrode sheets on the skin surface of acupoints to apply electrical stimulation, which can simplify the steps of acupuncture and solve all the inconveniences of acupuncture and analgesia, and is therefore conducive to the further promotion of the application.

In the early days of the invention, TEAS therapeutic devices were large desktop devices that needed to be placed in hospitals, which took up a great deal of human, financial and material resources. In recent years, researchers have developed many small desktop instruments and even wristband-type devices that can be worn anywhere and used at home. When the treatment is attached to the electrode sheet on the surface of the corresponding acupoints, choosing a different frequency, intensity, duration and so on can achieve the analgesic effect. After years of clinical trials, several models have been developed and some of the widely popular are listed in table 1.

APPLICATION OF TEAS IN THE MANAGEMENT OF PELVIC PAIN

Currently, there are no standardised definitions, pathogenesis, diagnosis and differential diagnoses for female pelvic pain. Patients often experience additional discomforts such as lumbosacral pain, dyspareunia and infertility.[3] Female pelvic pain can be categorised into cyclic and non-cyclic based on the absence of a relationship with the menstrual period. This categorisation is used to describe the clinical application of TEAS in the treatment of pelvic pain.[5] Conditions associated with pelvic pain that can be treated using TEAS are shown in figure 1.

Role of TEAS in the management of non-cyclic pelvic pain

TEAS treatment of pelvic inflammatory disease

Pelvic inflammatory disease (PID) is the most common cause of chronic pelvic pain (CPP), accounting for up to 55.6%,[5] and is also characterised by prolonged and recurrent pain. Currently, there is no standardised treatment protocol for the management of CPP caused by PID supported by evidence-based medicine, and most of them are managed with analgesics including ibuprofen.[6] However, PID is a chronic disease that requires long-term medication. Prolonged use of ibuprofen can increase the

Table 1 Comparison of different models of transcutaneous electrical acupoint stimulation equipment

Model	Output channel	Treated areas	Waveform	Treatment mode	Current range (mA)	Frequency range (Hz)
HANS-100A Pain Therapeutic Apparatus (two-lead)	2	4	9	Percutaneous stimulation	0–40	2–100
HANS-100B Pain Therapeutic Apparatus (medical type)	6	Multiple	15	Percutaneous/acupuncture stimulation	0–50/0–9.9	2–100
HANS-200A Pain Therapeutic Apparatus	2	4	15	Percutaneous stimulation	0–40	2–100
HANS-200B Pain Therapeutic Apparatus (six-lead)	6	Multiple	15	Percutaneous/acupuncture stimulation	0–50/0–9.9	2–100
HANS-100F Pain Therapeutic Apparatus (12-lead)	12	Multiple	Full programmable waveform (arbitrary waveform editing according to treatment needs)	Percutaneous/acupuncture stimulation	0–50/0–9.9	2–100

Output channel: sites that can be treated at the same time; waveform: users can choose different waveforms according to the needs of treatment.

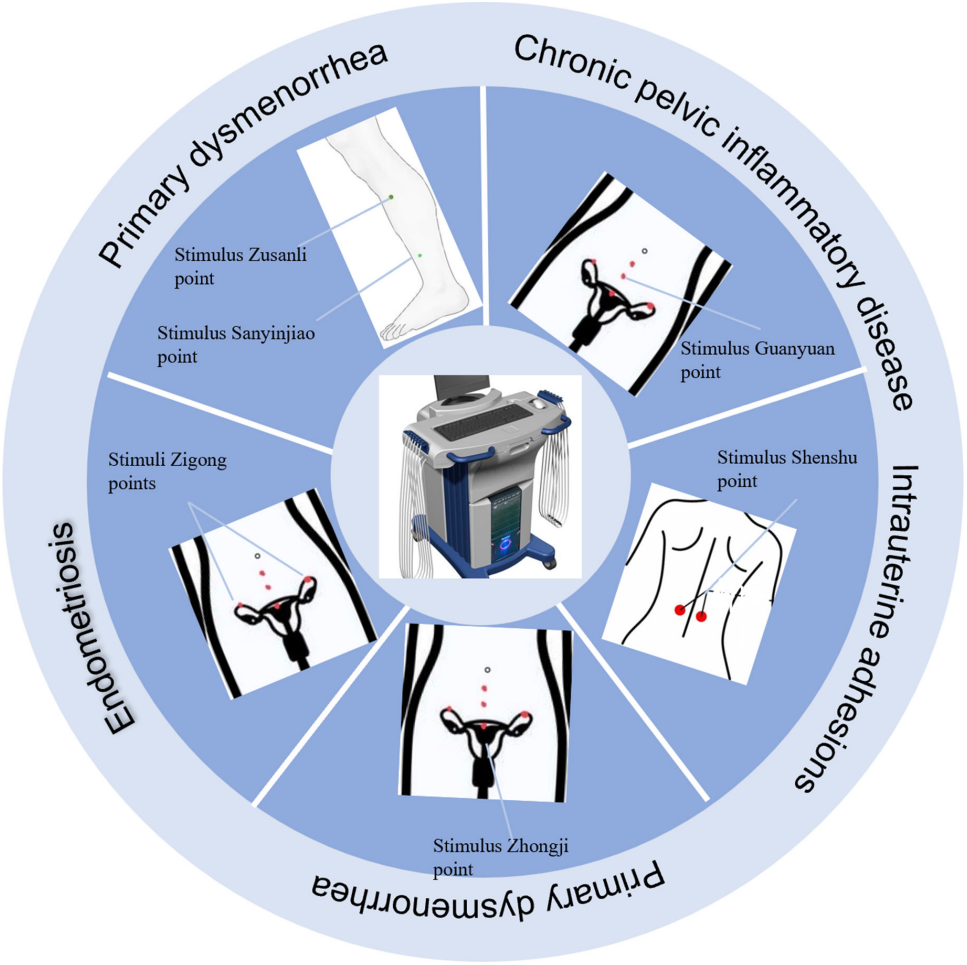

Figure 1 Conditions associated with pelvic pain that can be treated using transcutaneous electrical acupoint stimulation.

risk of adverse reactions, which may reduce medication compliance and lead to decreased therapeutic effect. However, researchers now find that TEAS can potentially enhance the effectiveness of drug treatments for PID.[7–9]

Zhao[10] used a 2/100 Hz dilatational wave to stimulate the uterine points, Zhongji, Zusanli and Sanyinjiao, combined with wild chrysanthemum suppositories to treat patients with chronic pain. It was found that the total effective rate was 93.60% in the combined treatment group and 69.20% in the wild chrysanthemum suppository-only treatment group, with a highly significant difference between the two ($p<0.05$). This suggests that TEAS with drug therapy can promote drug absorption and improve the therapeutic effect of PID. Previous studies have revealed that the pathophysiological mechanism of pain is an inflammatory response and pain sensitisation,[11] which complement each other in the development of pain. Inflammatory factors such as interleukin 6 (IL-6), C reactive protein (CRP), tumour necrosis factor α (TNF-α) and interleukin 1β(IL-1β can play an induced factor role, while the large secretion of analgesic substances, including substance P (SP) and dynorphin (DYN), can further promote the secretion of inflammatory factors and aggravate tissue damage.[11] Li *et al*[12] used acupoint electrical stimulation combined with ibuprofen extended-release capsules to treat patients with PID and found that the levels of IL-6, CRP, TNF-α, IL-1β 5-hydroxytryptamine (5-HT), SP and DYN in their bodies were significantly decreased, suggesting that the analgesic effect of the treatment may be related to the reduction in the levels of inflammatory factors and pain-causing substances.

TEAS-assisted treatment of intrauterine adhesion

Intrauterine adhesion (IUA) is a phenomenon in which the uterine cavity is partially or completely occluded due to endometrial damage and secretion of large amounts of profibroblastic cytokines, such as Transforming Growth Factor-β (TGF-β and Insulin-like Growth Factor 1 (IGF-1), which contribute to the formation of neovasculature and thus to the partial or total occlusion of the uterine cavity, which is also called Asherman's syndrome.[13] Hysteroscopy is the gold standard for diagnosis and treatment of IUA as it can detect the presence of adhesive bands and then separate or remove them; however, the risk of postoperative readhesion is relatively high, about 3.1%–23.5%, especially in patients with moderate or severe uterine adhesions, and the recurrence rate can reach 20%–62.5%.[14] Therefore, prevention of recurrence is key to a successful treatment. In recent years, TEAS

has emerged as a means of preventing readhesion after hysteroscopy. Chen *et al*[15] randomly grouped 98 patients with IUA, giving the control group oestrogen and progesterone treatment and treating the experimental group with low-frequency acupoint electrostimulation based on this treatment. It was found that the total effective rate in the experimental group (83.7%) was significantly higher than that in the control group (69.4%) and the difference was statistically significant (p<0.05). Additionally, the adhesion scores and blood flow parameters showed a noticeable decrease. The trial of Hu *et al*[16] confirmed that TEAS can increase the endometrial thickness, decrease the resistive index, improve the blood circulation of the endometrium and myometrium, and improve the endometrial receptivity. Compared with the role of oestrogen and progesterone in promoting endometrial proliferation and replacing the site of uterine adhesions, combined TEAS treatment is beneficial to increasing endometrial thickness and improving ovarian blood supply, thus increasing menstrual flow, further improving its clinical efficacy.

TEAS for pelvic stasis syndrome

Pelvic stasis syndrome is one of the causes of CPP[17] and is characterised by persistent pain that affects the lower abdomen and lower back, accompanied by excessive fatigue and neurological symptoms, and can also lead to increased menstrual flow and leucorrhoea.[18 19] Currently, there are many treatment methods for pelvic stasis syndrome; however, they have limited efficacy and are expensive. Liang *et al*[20] randomly grouped 80 patients diagnosed with pelvic stasis syndrome, with the control group only treated with avoidance of prolonged standing and resting in the lateral prone position and the experimental group added with TEAS. At the end of the treatment, it was found that the pelvic haemodynamics of the patients in the test group improved better, including increased pelvic venous blood flow velocity, decreased inner diameter of blood vessels, decreased Visual Analogue Scale (VAS) score and elevated quality of life-related indexes, with a statistically significant difference (p<0.05). At present, there are few clinical studies on the treatment of pelvic stasis syndrome with electrical stimulation and studies with large samples are needed in the future to prove its efficacy.

TEAS for interstitial cystitis/painful bladder syndrome

Interstitial cystitis is a chronic non-bacterial bladder inflammation with frequency, urgency, nocturia and/or pelvic pain as the main clinical manifestations, with very intense painful symptoms related to bladder filling which are relieved by urination.[21] Its pathogenesis is unclear and lacks specific pathophysiological changes, and so there is no complete cure for interstitial cystitis. Common treatments include behavioural therapy, lifestyle changes, medications, intravesical instillation and surgery, with pain management throughout the treatment process. Li[22] treated 50 patients with TEAS combined with pelvic floor muscle biofeedback and found that the patients' VAS scores were reduced after treatment and the difference was statistically significant (p<0.05). Meanwhile, there were no significant adverse events and complications during the treatment process. This suggests that local electrical stimulation combined with pelvic floor muscle biofeedback in the treatment of patients with interstitial cystitis has precise efficacy, high safety, no obvious side effects and is worthy of clinical promotion.

TEAS in the management of cyclic pelvic pain

TEAS for endometriosis-related pain

The dominant pathogenetic theory of endometriosis is Sampson's menstrual reflux theory, which states that during menstruation the endometrial glandular epithelium and stroma cells retrograde through the fallopian tubes to develop through the processes of adhesion, proliferation and angiogenesis.[23] The pain associated with endometriosis is complex and related to local inflammatory reactions and even immune factors, as well as to the density and number of nerve fibres.[24]

Qu[25] randomly assigned 84 patients with endometriosis-related pain to a study group and a control group; the control group was given medications (progesterone orally+goserelin acetate subcutaneously), while the study group was given electrical stimulation therapeutic instrument to stimulate acupoints on both sides of the Sanyinjiao (Zhongji and Guanyuan points). The results suggested that the pain-related scores were significantly lower and the quality of life scores were higher in the study group, although the incidence rate of adverse events was higher than that of the control group, and this difference was not statistically significant (p>0.05), indicating that the analgesic effect of TEAS is reliable. Lv[26] has also confirmed that electrical stimulation of Guanyuan, Sanyinjiao and Zhongji points can reduce dysmenorrhoea symptoms, accelerate the recovery of menstruation and improve emotional responses in patients with endometriosis. Some studies have reported an indisputable effectiveness and safety of local acupoint electrical stimulation for treatment of endometriosis-related pain,[10] and there is no risk of acupuncture leading to needle fainting or local haemorrhage. Also, the prospect of clinical application is broad.

TEAS for dysmenorrhoea

Dysmenorrhoea refers to pain and swelling in the lower abdomen before, during and after menstruation, which may be accompanied by lumbosacral pain and even nausea, vomiting, cold sweat and pallor, seriously affecting women's quality of life. More than 90% of women with dysmenorrhoea do not have organic lesions and have primary dysmenorrhoea.[27] It has been reported in the literature that TEAS can alleviate the state of viscous and stagnant blood rheology in the uterine arteries, increase the level of prostaglandin E2 (PGE2) and decrease the

Table 2 Summary of the literature on TEAS for the treatment of pelvic pain in women

Disease	Subjects (n)	Evaluation index	Acupuncture point	Parameter	Treatment	TEAS±related therapy	Control subject
Endometriosis[25]	84	NRS score, ESSS score, SF-36 quality of life score, adverse event rates.	Zhongji and Guanyuan.	2–100 Hz, 50–200 μs, ≤20 mA	30–60 min each time, three times each week, 2 weeks as a course, a total of six courses of treatment.	TEAS+Gestriol+goserelin acetate.	Gestriol+goserelin acetate.
Chronic pelvic inflammatory disease[10]	156	Effective rate.	Zigong, Zhongji, Zusanli and Sanyinjiao.	2/100 Hz,10–30 mA	30 min each time, once each day, 8 weeks as a course.	TEAS+wild chrysanthemum bolt, anal plug.	Wild chrysanthemum bolt, anal plug.
Chronic pelvic inflammatory disease[46]	195	Symptoms, signs, gynaecological examination, Doppler parameters, blood routine, liver and kidney functions.	Zigong, Zhongji, Zusanli and Sanyinjiao.	2/100 Hz,10–30 mA	30 min each time, once a day; one menstrual period is a course of treatment.	TEAS+Kangfu anti-inflammatory suppository, anal plug.	Kangfu anti-inflammatory suppository, anal plug.
Chronic pelvic inflammatory disease[47]	108	Symptom score, B ultrasound examination, effective rate.	Zigong, Zhongji, Zusanli and Sanyinjiao.	2/100 Hz,10–30 mA	30 min each time, once a day, 8 weeks for a course of treatment.	TEAS+pelvic floor muscle exercise.	Fule chongji.
Intrauterine adhesions[15]	98	TCM syndrome score, hysteroscopic score, Doppler parameters.	Guanyuan, Guilai, Shenshu and Zigong.	40 Hz, 250 μs	30 min each time, once a day, 15 days as a cycle, a total of 3 months of treatment.	TEAS.	Estradiol valerate+progesterone.
Intrauterine adhesions[16]	80	Effective rate, menstrual status, Doppler parameters, pregnancy rate.	Tianshu, Guanyuan, Zhongji, Zigong and Sanyinjiao.	2 Hz,10–20 mA	30 min each time, once a day, lasts three menstrual cycles.	TEAS+estradiol valerate+progesterone.	Estradiol valerate+progesterone.
Pelvic congestion syndrome[48]	30	Effective rate, substance P, endorphin, Doppler parameters.	Ashi.	80–120 Hz, 80–120 μs	30 min each time, once every 3 days, 10 times for one course of treatment.	TEAS+pelvic floor rehabilitation treatment.	None.
Primary dysmenorrhoea[49]	72	VAS score, dysmenorrhoea symptom score.	Both sides of Sanyinjiao.	2/100 Hz,15–20 mA	25–30 min each time, once a day, starting 2 days before menstruation, five times per cycle, treatment of two menstrual cycles.	TEAS.	Chlorphen codeine tablets.
Primary dysmenorrhoea[29]	124	VAS score, PGF2α, PGE2α.	Sanyin, Zusanli, Xuehai and Hegu.	2/100 Hz	30 min each time, once a day; 1–2 days before menstrual cramps start, each cycle treatment five times, a total of three menstrual cycles.	TEAS.	Ibuprofen sustained-release capsules.
Primary dysmenorrhoea[30]	60	VAS score, adverse reactions, PGE2, cortisol.	Qihai, Hegu, Sanyinjiao, Xuehai and Zusanli.	2/100 Hz	30 min each time, once a day, 5 days in a row, a total of three menstrual cycles.	TEAS.	Motherwort granules.

ESSS, Endometriosis Symptom Severity Scale; NRS, Numerical Rating Scale; PGE2α, prostaglandin E2α; PGF2α, prostaglandin F2α; SF-36 quality of life score, the medical outcomes study –short (MOS) Item Short Form Health Survey; TCM, traditional Chinese medicine; TEAS, transcutaneous electrical acupoint stimulation; VAS, Visual Analogue Scale.

level of prostaglandin F2α (PGF2α) in the patient's body, and therefore it can alleviate the symptoms of pain; its therapeutic efficacy is also significantly superior to that of drug treatment.[28] Sun[29] randomly divided 124 patients with primary dysmenorrhoea into a drug treatment group and a TEAS treatment group. After three menstrual cycles of treatment, the TEAS group showed significant improvement in VAS score and PGF2α to PGE2 ratio compared with the medication group and the difference was statistically significant ($p<0.05$). Xu *et al*[30] showed that TEAS combined with motherwort granules in the treatment of dysmenorrhoea significantly improved pelvic haemodynamic indexes, reduced the expression level of inflammatory factors and enhanced the efficacy of the disease, making it a reliable therapeutic means.

TEAS treatment of premenstrual syndrome

Premenstrual syndrome manifests itself as recurrent uncomfortable symptoms involving somatic, emotional and behavioural aspects during the luteal phase, which usually occurs 2 weeks before menstruation and with symptoms worsening during menstruation. Its incidence has been found to be 41.9% in a domestic survey,[31] affecting women's life and work. Wang *et al*[32] selected a total of 60 patients from Ningxia People's Hospital and the Second Affiliated Hospital of Qingdao Medical College and randomly selected 30 to be given electrical stimulation of bilateral Yongquan acupoints, while the other 30 patients were given oral administration of the Xiaoyao pill. After 3 months of treatment, the pain symptom scores and urinary catecholamine levels of the patients in the electrical stimulation group were reduced and the results were better than those of the drug group. This suggests that electrical stimulation of acupoints reduces the sympathetic excitability of patients and significantly reduces the clinical symptoms of premenstrual syndrome.

PARAMETER SELECTION

Frequency selection for TEAS

The frequency of impulses that can be felt by nerve tissue ranges from 1 to 100 times per second, known as 1–100 Hz. If it exceeds 100 Hz and reaches hundreds or thousands of Hertz, the nerves will be unable to respond on a one-to-one basis. This is because, after each nerve excitation, there is a 'refractory period' during which the nerve is unable to respond to rapid subsequent stimuli. The frequency of electrical stimulation commonly used in clinical practice is divided into low-frequency (2–10 Hz) and high-frequency (50–100 Hz),[33] and different frequencies can work through different mechanisms, which have frequency-specific. Academician Han's[34] team found that low-frequency (2 Hz) electrical stimulation can activate monoamines such as 5-HT and norepinephrine, as well as cause the release of enkephalins and endorphins from the brain and spinal cord, while high-frequency (100 Hz) electrical stimulation can promote the release of DYN in the spinal cord.[35] The dilatational wave stimulation at 2/100 Hz can release three opioid peptides at the same time, which can exert synergistic analgesic effects.[34] Moreover, the continuous action of single-frequency electrical stimulation makes it easy to produce tolerance,[36] so the analgesic effect is greatly weakened. 2/100 Hz dilatational wave stimulation not only releases the three opioid peptides but also slows down the emergence of the phenomenon of analgesic tolerance under continuous TEAS treatment.[37] Therefore, dilatational wave treatment has become the most commonly used frequency in TEAS treatment.

Intensity selection for TEAS

Low-intensity electrical stimulation mainly exerts analgesic effects through the spinal cord segments, while high-intensity electrical stimulation mainly acts on the negative feedback mechanism of the nucleus tract solitarius, and then produces extensive and long-lasting analgesic effects through the descending inhibitory system.[38] Therefore, low-intensity electrical stimulation only produces analgesic effects on acupoints near the stimulation site, while high-intensity electrical stimulation can exert analgesic effects on acupoints both in the immediate vicinity and far away from the stimulation site.[39] It has been shown that an appropriate intensity of stimulation can improve pain threshold; however, greater intensity does not mean better outcome.[40] A stimulation intensity that is too high will produce pain that is unacceptable to the patient. Patients in the acute pain phase have reduced sensory and pain thresholds, so low-intensity electrical stimulation intensity can produce good analgesia. The current literature suggests that 10–20 mA is the most commonly used stimulation intensity[29] that can achieve a good analgesic effect without causing unbearable pain.

Acupoint selection for TEAS

Most of the syndrome types of gynaecological diseases that cause CPP are blood stasis. For example, endometriosis syndrome differentiation is mostly based on kidney yang deficiency, with blood stasis, qi stagnation and phlegm turbidity being the standard, and chronic PID syndrome differentiation is kidney deficiency blood stasis syndrome. However, unlike the principles of acupuncture and physiotherapy, which are based on the principles of meridian selection, dialectical selection and symptomatic selection, the selection of acupuncture points for TEAS is based on the theory of the same spinal cord segment (ie, the selected acupuncture points are within the innervation of the corresponding spinal cord segments of the pain area); for example, stimulation of the pain point and its adjacent parts can produce a clear analgesic effect.[41] It is important to mention that, in clinical practice, acupoints are typically selected in pairs or groups rather than individually. Stimulating multiple acupoints has a synergistic effect and yields better results compared with stimulating a single acupoint.[42] Therefore, the clinical selection of acupoints should be based on the specific conditions of the patient, but the optimal selection of acupoints still

needs further experimental confirmation. Table 2 lists the commonly used stimulation points for various diseases in the relevant literature.

In the above literature, the acupoints with the highest frequency of application in TEAS treatment are Sanyinjiao points (seven times in total), followed by Zusanli, Zigong and Zhongji points (five times each). It is recorded in the *Golden Needle Wang Le-ting* that Sanyinjiao nourishes yin, strengthens the spleen and helps yang, and it is an important point for treating blood.[43] Therefore, the treatment of gynaecological diseases in traditional Chinese medicine almost always involves the Sanyinjiao point. The Zigong point is an empirical point for treating female reproductive system diseases, especially uterine diseases. The Zhongji point[44] is the intersection point of the Ren and foot three-yin meridian, which can be used to clear heat and dampness, benefit the kidney, regulate menstruation and nourish the uterus.[45] The Zigong and Zhongji points can act directly on the pelvic tissues, accelerate blood circulation in the pelvis, promote the absorption of inflammation and reduce pain in patients.

SUMMARY AND OUTLOOK

While we affirm the clinical efficacy of TEAS, we still need to recognise its shortcomings. First, in current clinical studies, the assessment of analgesic effect is mostly based on VAS scores and dysmenorrhoea symptom scores, etc, but this assessment is easily affected by subjective and objective factors, such as the pain threshold, psychological state and sociocultural background, which has led to a certain degree of limitation in the currently reported studies. Therefore, future studies should standardise the indicators for evaluation and use more objective indicators, such as pain-causing substances, changes in the level of inflammatory factors, etc, to assess the analgesic effect. Second, acupuncture and the moxibustion chakra theory have been the main means of treating pain in traditional Chinese medicine culture since ancient times, and therefore it is more likely to be accepted by Chinese women with a Chinese cultural background and it cannot be ruled out that the analgesic effect may be derived from psychological cues. The prevalence of the analgesic effect of TEAS needs to be confirmed by international multicentre clinical trials. Third, there is no uniform standard for the therapeutic parameters of TEAS, which makes comparability between different clinical trials difficult. Therefore, the selection of the parameters for TEAS and the combination of acupoints for different pains are still the main directions of future research. Multicentre clinical trials with large sample sizes are also needed to further confirm the efficacy of TEAS. However, with the continuous development and improvement of TEAS technology, its replacement with traditional electroacupuncture will become a trend and it will be widely used in the management of pain symptoms of female gynaecological diseases.

In summary, it can be seen that TEAS for treatment of pelvic pain in women has been reported mainly for endometriosis, PID, IUA, pelvic stasis syndrome, interstitial cystitis, primary dysmenorrhoea and other diseases. The efficacy of the treatment is remarkable and there are no significant adverse effects.

Contributors All authors made a significant contribution to the work reported, whether in the conception, study design, execution, acquisition of data, analysis and interpretation, or all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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