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Pełna oferta:



Additional Effect of Electrical Stimulation for Women with Stress Urinary Incontinence: Literature Review

Dodatkowy efekt stymulacji elektrycznej u kobiet z wysiłkowym nietrzymaniem moczu: przegląd literatury

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Abstract

Aims. This narrative review aims to investigate the effect of adding electrical stimulation (ES) to pelvic floor muscles training (PFMT) in the management of stress urinary incontinence (SUI) in women. Also, this review aims to provide a framework for future research in order to formulate more comprehensive, lifestyle-centered guidelines for treating women with SUI. **Methods.** A literature search was conducted in PubMed, PEDro, Cochrane library, and Google Scholar databases using the keywords "Physical therapy modalities", "Pelvic floor muscle training", "Exercise", "Electrical stimulation", "Interferential", "Pelvic floor disorders", "Stress urinary incontinence" and "Women". Reviewed literature was descriptively analyzed and summarized. **Results.** ES is effective in the treatment of the SUI comparing to control or placebo treatment, while there is a little evidence that support the use of ES as an additional treatment for women with SUI as studies showed high diversity of ES parameters used. **Conclusion.** Adding ES to PFMT may be helpful for women who find difficulty to voluntarily contract their pelvic floor muscles. More well-designed studies are needed to strength the evidence of using ES for treatment of women with SUI.

Key words:

electrical stimulation, pelvic floor exercises, stress urinary incontinence, women

Streszczenie

Cele. Ten przegląd literatury ma na celu zbadanie wpływu wprowadzenia stymulacji elektrycznej (ES) do treningu mięśni dna miednicy (PFMT) w leczeniu wysiłkowego nietrzymania moczu (WNM) u kobiet. Przegląd ten ma również na celu stworzenie ram dla przyszłych badań w celu sformułowania bardziej kompleksowych, skoncentrowanych na stylu życia wytycznych dotyczących leczenia kobiet z WNM. **Metody.** Przeszukano literaturę w bazach danych PubMed, PEDro, Cochrane library i Google Scholar przy użyciu słów kluczowych „Modalności fizjoterapeutyczne”, „Trening mięśni dna miednicy”, „Ćwiczenia”, „Stymulacja elektryczna”, „Interferencje”, „Zaburzenia dna miednicy”, „Wysiłkowe nietrzymanie moczu” i „Kobiety”. Przeszukana literatura została przeanalizowana i podsumowana opisowo. **Wyniki.** ES jest skuteczny w leczeniu WNM w porównaniu z wynikami osiągniętymi w grupie kontrolnej lub placebo, natomiast istnieje niewiele dowodów na poparcie stosowania ES jako dodatkowej metody leczenia kobiet z WNM, ponieważ badania wykazały dużą różnorodność stosowanych parametrów ES. **Wniosek.** Wprowadzenie ES do PFMT może być pomocne dla kobiet, które mają trudności z dobrowolnym skurczem mięśni dna miednicy. Potrzebnych jest więcej lepiej zaprojektowanych badań, aby wzmocnić dowody na stosowanie ES w leczeniu kobiet z WNM.

Słowa kluczowe:

elektrostymulacja, ćwiczenia dna miednicy, wysiłkowe nietrzymanie moczu, kobiety

Introduction

Urinary incontinence (UI) is defined according to International Continence Society (ICS) as involuntary loss of urine, causing a serious social and health problems. The incidence of UI was predicted that it affects nearly 300 million women and 120 million men worldwide. However, this number may be underestimated due to the intimate nature of the disease [1].

The main types of UI are urge urinary incontinence, mixed urinary incontinence, and stress urinary incontinence (SUI) which is the most common type of UI. SUI is defined as involuntary leakage of urine upon increase in the intra-abdominal pressure as effort, exertion, sneezing or coughing [2]. The pathophysiology of the SUI can be summarized as the PFM's work to support the bladder neck in the intraabdominal cavity and maintain urinary continence. Weakness of these muscles shifts the bladder to the extra-abdominal cavity and thus a change in the urethra-vesicle angle occurs. As a result of intra-abdominal pressure changes, the bladder neck opens rather than closes when intra-abdominal pressure increases causing UI [3].

Treatments for UI include physical therapy, lifestyle changes, behavioral therapy, pharmacotherapy, and surgical treatments but, physical therapy is considered the first line of treatment [4]. Physical therapy includes PFMT with or without biofeedback, ES, and the use of vaginal cones [5]. The PFMT is an exercise protocol of PFM's voluntary contraction which was described in 1948 by Arnold Kegel as a method of UI treatment [6]. Exercise protocol should outline the frequency, intensity, duration and the progression of the program. PFMT is performed at least; several days weekly, for 8 weeks. Maintenance period of PFMT is recommended after the initial training to ensure the long term effect [7]. PFMT can increase muscle strength, endurance and coordination [8]. There is a strong evidence that PFMT is effective in prevention and treatment of UI in women (level of evidence: I) [9]; however, many women may find it difficult to adhere to PFMT for long time [8].

Most studies measure the effect of PFMT included women who can perform voluntary PFM's contraction in their inclusion criteria [10]; however, research shows that nearly 30%–40% of women are unable to voluntarily contract the PFM's by only following the instruction [11]. So it is necessary to use other techniques to augment the PFMT effect and teach patient how to voluntarily contract PFM's [12]; ES is one of these techniques. ES is considered a second-line treatment when PFMT alone is not sufficiently effective [13]. One of the most common therapeutic options for patients with SUI is ES. In 1963, ES reported for the first time by Cadwell as a treatment of UI [14]. Since that time ES has been used in the clinical practice in treating UI, although, till now there is no evidence about the most effective ES parameters and protocols for treatment of SUI [15]. Therefore; this study reviewed the available literature studied the effect of ES in treating women with SUI to find out if adding ES to PFMT will improve the patients' outcomes.

Methods

This narrative review was based on a literature search in Pubmed, PEDro, Cochrane library and Google Scholar databases with the keywords "Physical therapy modalities", "Pelvic floor muscle training", "Exercise", "Electrical stimulation", "Interferential", "Pelvic floor disorders", "Stress urinary incontinence" and "Women". The search extended till October 2020. No language or time limits were applied. Randomized controlled trials (RCTs), non-RCTs and review articles concerned with the use of any type of ES with PFMT for women with SUI were included. Studies on children or men with SUI were excluded.

Results

Results of this review are based on reviewing the available literature about the effect of adding ES to PFMT in treating of women with SUI; emphasis was on the additional effect of ES when used with PFMT. A summary of the eight reviewed studies is provided in (Table 1).

Types of ES

The main types of ES include the transvaginal, sacral, tibial nerves and suprapubic stimulation. The transvaginal ES causes contractions of the pelvic floor, increasing the number of muscle fibers with rapid contraction. The sacral-nerve stimulation consists of implantation of a wire electrode in one of the sacral foramina, usually S3, which is then connected to a stimulator device. The tibial nerve ES that is a peripheral non-implantable method that can be applied percutaneously with a needle or transcutaneous that connected with electrocardiograph- electrode. This type causes neuromodulation to the PFM's through stimulation of the posterior tibial nerve that has projections to the sacral nerve plexus, so the stimulus reaches the S2, 4 junction of the sacral nerve plexus via the invasive route of the posterior tibial nerve creating a feedback loop that modulates bladder innervations. The suprapubic ES aims for a direct stimulation of S3 nerve roots causing effect similarly to the sacral ES, but less invasive [16].

How ES may work to restore continence in women with SUI

To understand how the ES stimulation works so, firstly understand the role of PFM's in maintain continence. Understanding the structure and the function of the PFM also helps in selection the best treatment to SUI [3]. The pelvic floor consists of passive [ligaments, fascia] and active [muscles] components that support the pelvic organs as the bladder, reproductive organs, and the rectum [17]. The proper cooperation between the soft tissue components and the appropriate action determines the proper PFM's function. As the PFM's function in addition to keep pelvic organs on place, they also affect the function of this organs as maintain faecal and urine continence, labour, voids, and defecation. The PFM's support the pelvic organs by coordinated contraction and relaxation and provides active support through a constant state of

muscular contraction and passive support from the surrounding connective tissue and fascia. With an increase in intra-abdominal pressure, the PFMs reflexively contract with upward movement and closure of the vagina, urethral and anal sphincters. This action is important for maintaining continence [18].

The aim of ES for SUI is to improve PFMs function so that it can be used when needed [when the intra-abdominal pressure increase] to close the urethra and increase the muscle bulk, which may help reduce urine loss by closing the urethral walls. Direct ES on the pelvic floor stimulate motor-efferent fibers of the pudendal nerve, which cause contraction of the PFMs and support the intrinsic part of the urethral sphincter-closing mechanism [19].

The effect of ES in restoring continence can be summarized according to Stewart et al. [13] as the following:

- Strengthening the PFMs and improve their ability to close the urethra.
- Strengthening the structural support of the urethra and the neck of the bladder by increasing the muscle bulk.
- Coordinate the resting and active closure of the proximal urethra.
- Inhibiting reflex bladder contractions.
- Improving blood supply of the urethral and bladder neck tissues.

Application of ES

The ES can be applied in the form of transcutaneous or percutaneous stimulation. Transcutaneous ES is applied via suprapubic, vulval surface electrodes, vaginal or rectal electrodes [20]. The vaginal electrodes are used more than the surface electrodes although the surface electrodes can be used as alternative to the vaginal electrode; it is cheap, non-invasive and need less sterilization with broadly similar effect [21, 22]. Percutaneous ES uses needle electrodes that penetrate the skin in conjunction with a surface electrode placed close to the needle electrode to act as a reference electrode as in posterior tibial nerve stimulation. This type is used for women with overactive bladder symptoms, not SUI [20].

ES parameters

It seems that no standard protocol of ES for the treatment of women with SUI, as there are a great variation in the parameters used in the studies to assess the effect of ES in treating SUI [13].

Type of current: different types of ES current were used in the studies: faradic, interferential, neuromuscular stimulation or alternating pulse currents [23].

Frequency: the most common used frequency was 50 Hz although some studies used lower or higher frequencies and others used a variant frequency from 1–100 Hz [16].

Pulse duration and shape: a range of variation with no common pattern was used (studies used 100 or 200 or 250 or 300 or 700 μ s) [21, 24–27].

Duty cycle: was mainly 1:1 or 1:2 on: off. [13].

Intensity:

intensities up to 100 mA or according the patients' tolerance [16].

Duration of the session:

it was mainly from 15 to 30 mins [23]. In some studies the session duration was 1 hour [27, 28], one study used ES up to 6-8 hours every night (29), with no standard time.

Repetition of treatment:

the session was applied for more than 1 time per day, 1 time daily or on alternating days [13].

Total duration of the treatment:

it was commonly from 6 weeks to 6 months [16] it was rarely less than 6 weeks as some studies last for 10 days only [24] and others last for 4 or 5 weeks [30, 31].

Supervision:

ES used supervised by the physiotherapist or used at home [23].

The effect of the ES in treating SUI

The use of ES was suggested to provide some benefit in UI but contradictory results were found regarding SUI and mixed UI due to the variations in stimulation parameters [16]; the current evidence is not clear. Results of this review show that ES is probably more effective than no active or sham treatment and it can be considered as a first-line alternative to PFMT in women who are unable to contract their PFMs voluntarily.

The effect of adding ES to PFMT

The studies that compared the effect of adding ES to PFMT versus PFMT alone [24-26, 28, 32-35] show great contradiction regarding the type of electrodes as most used intravaginal electrodes, while others used surface electrodes, the stimulation parameters that were characterized by wide diversity in terms of current, current intensity, pulse shape and duration, frequency, duty cycle, and duration of treatment and its supervision, the outcomes measures, baseline characteristics of the included patients and the results, as shown in (Table 1). So, a conclusive result regarding the effect of adding ES to PFMT in treating SUI cannot be conducted based on the available literature.

Summary

It was recommended that PFMT prevent and treat SUI (level of evidence: I). However, for many women, isolated voluntary contraction of PFMs is a major concern. Patients with SUI are often unable to perform isolated voluntary PFMs contraction; that makes exercises therapy alone ineffective [9]. So, combined physiotherapy as PFMT with ES can be beneficial for those patients, however, the evidence of adding ES to PFMT is still limited.

The present literature, about the use of ES as an additional treatment for women with UI, does not provide standard

Table 1. The characteristics of the studies compare the effect of adding ES to PFMT

Author / year	Study design	Patients	Age mean (SD)	Comparison	Outcomes	ES parameters	Conclusion
O'Sullivan et al., 2009 [11]	RCT	75 females diagnosed with SUI	G1 = 52.17 G2 = 49.96 G3 = 44.82	ES with PFMT Vs PFMT VERSUS Control group	<ul style="list-style-type: none"> - King's Health Questionnaire (KHQ) - Functional strength of the PFM - Presence and the intensity of urinary symptoms 	<ul style="list-style-type: none"> - Intravaginal electrode, Frequency = 60 Hz, Pulse width = 1ms, 6 s on: 12 s off, Intensity = 10-30 mA, 20 min session every day for 10 days. 	Both physical therapy treatments groups were effective in improve the pelvic floor muscular functioning & quality of life.
Bidmead, 2002 (31)	4 arms RCT	107 women urodynamically diagnosed with SUI	Not reported	ES with PFMT Vs Sham ES with PFMT Vs PFMT Vs Control group	<ul style="list-style-type: none"> - Pad test - Quality of life scores - Compliance to the treatment 	Unclear	<ul style="list-style-type: none"> - Clinic based ES, under supervision, may enhance results of physiotherapy - Home stimulators is of little benefit & merely increases the cost & complexity of treatment
Eyjolfsdottir, 2009 (24)	RCT	24 females diagnosed with SUI	Range = 27-73 G1 = 56 G2 = 46	ES+ PFMT Vs PFMT	<ul style="list-style-type: none"> - Subjective report of cure or improvement of SUI - Quantity & frequency of urinary incontinence episodes - PFM strength 	<ul style="list-style-type: none"> - Frequency = 50 Hz - Pulse width = 200 μs, Twice a day for 9 weeks. 	<ul style="list-style-type: none"> - PFMT is an effective treatment for SUI - ES gave no additional effect for this patient group.
Firra, 2013 (32)	Randomized block design study	64 women, 38 with SUI & 26 with UII	55.1 G1 = 63.6 G2 = 52.7 G3 = 48.2	Exercise alone Vs Exercise with ES Vs Control Group	<ul style="list-style-type: none"> - Quality of life measured by the York Incontinence Perception Scale (YIPS). - PFM strength measured by perineometer. - Number of leaks recorded by 3-day bladder diary. 	<ul style="list-style-type: none"> - Vaginal electrode - Frequency = 12.5 Hz cycled - 5 s on: 10 s off - Treatment time 30 min 	<ul style="list-style-type: none"> - The addition of ES appears most useful for muscle reeducation in women with weak PFMs.
Jeyaseelan, 2002 (27)	RCT	19 females diagnosed with SUI	Not reported	ES Vs PFMT Vs PFMT plus ES	<ul style="list-style-type: none"> - PFM strength (using the modified Oxford Grading Scale) - 24-hour pad test - 3-day voiding diary to measure severity of incontinence - Incontinence Impact Questionnaire Urogenital Distress Inventory 	<ul style="list-style-type: none"> - Vaginal electrode, - One hour a day every day (except when menstruating) 	<ul style="list-style-type: none"> - It is difficult to ascertain whether the combined treatment approach is better than ES or PFMT alone. - From the patient perspective, the combined approach is more effective.

Author / year	Study design	Patients	Age mean (SD)	Comparison	Outcomes	ES parameters	Conclusion
Jha, 2017 (33)	Single center two arm parallel group RCT	114 women with SUI & sexual dysfunction	18 years or older	PFMT plus ES Vs PFMT	<ul style="list-style-type: none"> - Prolapse & Incontinence Sexual function Questionnaire (PISQ-31) - Adverse events - Cost-effectiveness. 	<ul style="list-style-type: none"> - Vaginal electrode - The other electrical stimulation parameters was not reported 	<ul style="list-style-type: none"> - Comparing PFMT to ES, did not add specific beneficial over PFMT.
Patil, 2010 (34)	RCT	110 women with genuine SUI	30–70 year G1 = 43.60 G2 = 45.17	IFT+ PFMT Vs PFMT	<ul style="list-style-type: none"> - Frequency volume chart - VAS - Incontinence Impact Questionnaire (IIQ-7) - 1-hour pad test 	<ul style="list-style-type: none"> - Interferential Current - 4 surface electrodes (2 over the obturator foramen & 2 medial to ischial tuberosity) - Frequency = 0-100 Hz, - Maximum intensity. - 1st treatment session 15 min; duration of subsequent treatment sessions were increased to 30 minutes. 	<ul style="list-style-type: none"> - Findings indicate a potential benefit to including IFT with PFMT when treating genuine stress incontinence.
Schmidt, 2009 (25)	RCT	32 females diagnosed with SUI	G1 = 49.18 G2 = 54.7 G3 = 52.09	ES + PFMT Vs PFMT+ biofeedback Vs PFMT	<ul style="list-style-type: none"> - Quality of life - Urodynamic parameters - Subjective assessment of improvement - Compliance to the treatment 	<ul style="list-style-type: none"> - Vaginal electrode, - Frequency = 50 Hz - Pulse duration = 300 μs 	<ul style="list-style-type: none"> - All 3 techniques were effective for home treatment of UI

RCT: Randomized controlled trial, IFT: Interferential therapy, VAS: visual analogue scale, Hz: hertz, μ s: microsecond, mA: milliampere

ES protocol to be used. So, more well-designed studies are needed to investigate the best ES parameters for treating women SUI with consideration of the initial strength of PFM, best parameters, time to cure, cost effect and adverse events.

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