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# JUST SITTING IN A CHAIR IS ENOUGH TO TRIGGER THOUSANDS OF PELVIC FLOOR MUSCLE CONTRACTIONS?

## What They Don't Tell Us

This independent literature review examines whether magnetic stimulation is capable of induce supramaximal muscle contractions. The focus of this analysis is solely on **muscle contraction,** and no other effects of magnetic stimulation.

**LAIRA RAMOS**
**2025**

Contend

## Abstract

**Introduction:** Some companies commercialize medical devices that use magnetic stimulation (MS) for aesthetic purposes and neuromuscular rehabilitation. These companies claim that the therapy can induce supramaximal muscle contractions, and that such contractions are the primary mechanism behind the treatment's effectiveness. This literature review aims to evaluate whether magnetic stimulation is capable of inducing supramaximal muscle contractions.

**Methods:** To conduct the literature review, 17 studies were selected (Study Level I). All articles concerning muscle contraction cited within these 17 primary studies were also thoroughly reviewed (Study Level II). Additionally, all articles cited within these Level II studies that addressed muscle contraction were rigorously examined as well (Study Level III).

**Results:** The objective of this review was to identify studies that directly measured muscle contraction during magnetic stimulation, specifically assessing the intensity of these contractions and determining whether they exceed the force generated by a maximal voluntary contraction (MVC). Among the 147 articles reviewed across all levels, only 5 studies included direct measurements of muscle contraction during magnetic stimulation. None of these studies demonstrated that magnetic stimulation is capable of producing a contraction stronger than a maximal voluntary contraction.

**Discussion:** What most surprised the author during this review was the high number of articles that cited references to support claims, particularly those related to supramaximal muscle contraction, where the cited references did not, in fact, contain the information attributed to them. Upon reviewing these sources, it became evident that many citations were inaccurate or misleading, undermining the scientific validity of the claims being made. The lack of scientific rigor observed in several articles, particularly in high-impact journals, is striking. This raises serious concerns about the standards currently being applied in the publication and peer-review process and calls into question how scientific knowledge is being produced and disseminated in this field.

**Conclusion:** Based on the available evidence, there is currently no scientific support for the claim that magnetic stimulation can induce supramaximal muscle contractions. The findings highlight the need for more rigorous research and greater transparency in scientific reporting, particularly in the context of device-based therapies.

**Conflict of Interest Statement:** The author declares no conflict of interest related to this study.

## Introduction

Pelvic floor dysfunctions represent a growing challenge for both women and healthcare systems worldwide. At least 25% of adult women will experience some form of pelvic floor complaint during their lifetime. These disorders include urinary incontinence, pelvic organ prolapse, fecal incontinence, chronic pelvic pain, sexual dysfunctions and functional constipation, all of which impose significant direct and indirect costs on healthcare systems and society, and have a substantial economic impact.

The total annual cost of pelvic floor disorders is estimated at €90 to 110 billion in the European Union, $130 to 165 billion in the United States and $220 to 290 billion globally. Individual expenses range from €1,000 to over $30,000 per patient, depending on severity, type of treatment and regional access to care.

Pelvic organ prolapse tends to generate higher costs due to the need for surgery and hospitalization. Chronic pelvic pain is one of the leading sources of indirect costs, caused by absenteeism, repeated prescriptions and frequent consultations. Sexual dysfunctions and functional constipation are widely underreported. Overall, it is estimated that fewer than 30% of women with pelvic floor disorders receive adequate treatment.

Beyond public health concern, pelvic floor disorders have serious physical implications, with significant impact on quality of life, emotional wellbeing and professional performance. These conditions also affect family life, causing emotional stress, changes in routines and a greater need for support from partners and caregivers.

Conservative therapies, particularly pelvic floor muscle rehabilitation, are recommended as first-line treatment. In recent years, magnetic stimulation has emerged as a popular noninvasive technology, promoted for its comfort, ease of use and potential to improve adherence, especially for female urinary incontinence.

Devices using electromagnetic fields are marketed as capable of inducing involuntary supramaximal muscle contractions without any effort from the patient, who only needs to sit on the chair fully clothed. These contractions are described as being stronger than those achieved through maximal voluntary contraction (MVC), and some claims suggest that thousands can be generated in a single session. This mechanism is presented as the primary explanation for the therapeutic effects of these technologies.

However, such claims require scientific scrutiny. In neuromuscular physiology, supramaximal contraction may occur when an external stimulus is applied together with a voluntary contraction, recruiting additional motor units. This is documented for electrical stimulation. However, the use of the term involuntary supramaximal muscle contractions in magnetic stimulation remains physiologically unproven, with no scientific evidence.

This review examines the scientific basis of this concept by identifying studies that objectively measured pelvic floor muscle contraction during magnetic stimulation, with a specific focus on contraction force intensity.

## Methods

To conduct this literature review, 17 studies were selected (**Study Level I**). All articles related to muscle contraction induced by magnetic stimulation cited within these 17 primary studies were thoroughly reviewed (**Study Level II**). Additionally, all articles cited within the Level II studies that addressed muscle contraction induced by magnetic stimulation were also rigorously examined (**Study Level III**).

The author performed the initial search using the PubMed database, focusing on publications from the past five years. The following search strategy was applied: **(urinary incontinence[Title]) AND (((magnetic[Title]) OR (electromagnetic[Title]) OR (HIFEM[Title])) AND (clinicaltrial[Filter] OR meta-analysis[Filter] OR randomized controlled trial[Filter] OR review[Filter] OR systematic review[Filter]) AND (female[Filter]))**. The filters applied included: Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Review, Systematic Review, and Female. The most recent search was conducted on May 5, 2025. **Studies Level I** (1–9)

Earlier publications, **Studies Level I** (10–17), were also reviewed to gather additional data on magnetic stimulation and its effects on muscle contraction, with the aim of understanding the physiological mechanisms involved and the historical evolution of this therapeutic approach.

A complementary search on PubMed was conducted on May 10, 2025, using the following strategy: **((((muscle contraction) AND (supramaximal)) AND (magnetic)) AND (stimulation)) NOT(resonance)**. This search yielded 53 articles. The author reviewed all abstracts and found no evidence supporting the occurrence of supramaximal muscle contractions induced by MS.

Each article was classified according to the following criteria:

- Muscle contraction is assessed during magnetic stimulation; however, **there is no measurement of supramaximal muscle contractions**.
- **Maximal urethral closing pressure** (MUCP) is measured during magnetic stimulation. MUCP is recorded at rest, without any pelvic floor muscle contraction. There is no measurement of supramaximal muscle contractions.
- Muscle contraction is not assessed during magnetic stimulation. It is evaluated **before and after** treatment. There is no measurement of supramaximal muscle contractions.
- There is **no assessment of muscle contraction.** Neither during magnetic stimulation, either before or after treatment.
- This article discusses **brain magnetic stimulation.** There is no mention of supramaximal muscle contractions.
- This is a **systematic review | meta-analysis**; however, there is **no information about muscle strength** during magnetic stimulation.
- This article **is not about magnetic stimulation**.
- This is a **conference presentation**, abstract is not available.
- This article presents a **mathematical model** of magnetic stimulation. It is theoretical and does not include any assessment of muscle contraction.
- It is a **book**, and the author didn't cite what chapter is in the reference. It was not possible to find any information about MS in the book content.

## Results

The objective of this review was to identify studies that directly measured pelvic floor muscle contraction during magnetic stimulation, specifically assessing the intensity of these contractions and determining whether they exceed the force generated by a maximal voluntary contraction (MVC).

All first nine **Studies Level I** (1–9) focused on the use of magnetic stimulation in pelvic floor muscles. **Although none of these studies assessed pelvic floor muscle contraction during magnetic stimulation**, they consistently affirm that this therapy induces such contractions, presenting this unverified mechanism as the basis for treatment success. Studies (1,2,4,6) go further by supporting the term <u>supramaximal muscle contraction</u>, even though there is no scientific evidence to support this claim.

Analyzing Shah et al (1), published in European Journal of Obstetrics and Gynecology in 2025, the authors cited: *"…Furthermore, as HITSTM works by creating a rapidly changing electromagnetic field which <u>stimulates thousands of supramaximal</u> contractions during one therapy, it might be more beneficial than just performing the exercises alone (18)…"* Reference (18), presents no assessment of muscle contraction, neither during magnetic stimulation, nor before or after the treatment. However, the study also states: "*Elicited contraction torque increases with intensity, as more motor units are recruited. It would plateau if all units could be recruited, resulting in <u>supramaximal contraction</u>*…"

Going deeper into Leonard et al (2), published in Neurourology and Urodynamics in 2025, the authors cited: "*…As the concepts of magnetic stimulation by Faraday's law, the utilization of high-frequency time-varying magnetic field would induce electrical activity that depolarizes the nerves and causes <u>contraction of the PFMs</u>* (19,20)..." Reference (19), does not evaluate muscle contraction at any time. Reference (20), evaluated muscle contraction only before and after treatment, not during magnetic stimulation.

Leonard et al (2) also cited: "... *HIFEM offers noninvasive stimulation and <u>strengthening of PFMs</u> without requiring active collaboration from treated subjects* (21,22)*...*" Reference (21), published in Journal of Clinical Medicine in 2021, is a systematic review and clinical prospective non-randomized study. They conclude: "…*Additional advantages include no side effects, no need to undress, and <u>automatic contractions</u>.*" None of the studies included in the systematic review measured pelvic floor muscle contraction during magnetic stimulation. In the clinical study there is no assessment of muscle contraction, neither during magnetic stimulation, either before or after treatment. Reference (22), is not about MS.

Leonard et al (2) *cited directly the concept of <u>supramaximal contraction</u>: "… HIFEM addresses this limitation by inducing <u>supramaximal contractions</u> through selective stimulation of neuromuscular tissue via alternating electromagnetic fields* (23). *Recent studies suggest that these <u>induced contractions</u> enhance PFM integrity, activity, and endurance, thus benefiting cases of UI* (24,25)*...*" References (23,25) do not evaluate muscle contraction at any time, and (23) is an aesthetic study about arm thickening. In the case of (24) muscle contraction is assessed only before and after treatment, by electromyography.

Mohamed et at (3), published in Journal of Bodywork & Movement Therapies in 2024. They state: *"The magnetic stimulation (MS) applied in the pelvic region induces eddy currents, which subsequently permeate into the surrounding tissues. This leads to axon depolarization, which* *initiates an impulse that travels towards the motor endplate, releasing acetylcholine and causing muscle fiber contraction."* However, none of the studies they cited analyzed pelvic floor muscle contraction during magnetic stimulation.

Tosun et al (4), published in Therapeutics and Clinical Risk Management in 2024, claim that magnetic stimulation can produce supramaximal muscle contraction, even though the study does not evaluate pelvic floor muscle contraction at any time. The authors state: "*…Subsequently, the high frequency of action potentials results in specific and supramaximal muscle contractions.*" They also affirm: "*The advantage of HIFEM technology over this type of traditional approach is a rapidly changing electromagnetic field mechanism that initiates thousands of supramaximal contractions during a single therapy*..."

Antić et al (5), published in International Urogynecology Journal in 2023 is a systematic review that analyzed five studies. None of them assessed pelvic floor muscle contraction at any time. Even so, the authors state: "*…Simultaneously, the efferent nerve branches are also stimulated to facilitate strengthening of the pelvic floor muscles and increase the tonus of the urethral sphincters…*"

Another interesting point in Antić et al. (5) is that they cite three authors to recommend optimal stimulation parameters of MS, even though there is no evidence of muscle contraction during magnetic stimulation: *"To date, the optimal frequency and pulse duration have not yet been established, although a higher dose of 50 Hz has been reported to be the dose required to achieve good pelvic floor contraction for the treatment of SUI, and a lower dose of 10–20 Hz is required for UUI* (21,26,27)." Reference (21), as mentioned above, is a systematic review and none of the studies included in the systematic review measured pelvic floor muscle contraction during magnetic stimulation.

Reference (26), Lim et al, published in Neurourology and Urodynamics in 2014, is a systematic review that analyzed eight studies. Among them, only three assessed pelvic floor muscle contraction, and this was done before and after treatment, not during magnetic stimulation. The authors cited: "*There was substantial divergence in relation to the frequencies and durations of stimulation, ranging from 5 Hz to 50 Hz, and 20 min to daily usage*." They also report: "*To date, the optimum frequency and pulse duration has not yet been established, although a higher dose of 50 Hz has been reported as the dose required to achieve a good pelvic floor contraction for treatment of SUI* (28–31)." Reviewing all four references (28–31) none of them include any assessment of muscle contraction. There is no evaluation during magnetic stimulation, nor before or after treatment.

Reference (27), Braga et al, published in Journal of Clinical Medicine in 2022. The authors cited: *"FMS is a technique based on Faraday's law of magnetic induction, approved by the United States Food and Drug Administration (FDA) in 1998, for stimulating the central and peripheral nervous system (19,32). It generates electrical activity, which induces controlled depolarization of the nerves, resulting in pelvic muscle contraction and sacral S2-S4 roots neuromodulation (19)…".* Reference (19), as mentioned before, does not evaluate muscle contraction at any time. Reference (32) discusses brain magnetic stimulation.

Reference (6), Guerette et al, published in Journal of Women's Health Care in 2023. Even with no evaluation to prove it, the authors state: "*Further, the HIFEM is supraphysiologic, engaging the muscles more intensely and more rapidly than is otherwise possible*" and they cited: "*These* *contractions are of higher tension and frequency than can be achieved with voluntary contractions or biofeedback during PFMT and are, therefore, defined as supramaximal. Moreover, since the magnetic field penetrates living tissues without attenuation, the induced contractions achieve greater depth and intensity (24,33)*." In both referenced studies (24,33), muscle contraction was assessed only before and after treatment, using EMG and ultrasound respectively.

Reference (7), Mikuš et al, published in Medicina in 2022. The authors cited: "…One such method of treating SUI is extracorporeal magnetic innervation (EMI) of the PFM (34,35). This method is based on indirect contraction of the PFM by an external magnetic field…"

Reference (34), Gilling et al, published in BJU International in 2009, is a randomized trial in which pelvic floor muscle contraction was assessed only before and after treatment. There is no assessment during magnetic stimulation, and no mention of muscle contraction during MS in the entire article.

Reference (35), Lim et al, published in Int Urogynecol J in 2017, is a randomized trial in which pelvic floor muscle contraction was assessed only before and after treatment. There is no assessment during magnetic stimulation. Even so, the authors cited: "…*which penetrates deep into pelvic floor muscles, leading to pelvic floor nerve stimulation and contraction (19).*" Reference (19) does not evaluate muscle contraction at any time.

Lim et al (35), also cited: *"Results from our recent randomized controlled trial showed that repetitive contractions stimulated by PMS significantly improved SUI symptoms and increased pelvic floor muscle strength (36)." Reference (36)* is a randomized trial in which pelvic floor muscle contraction was assessed only before and after treatment.

Reference (8), Weber-Rajek et al, published in BioMed Research International in 2020. The authors cited: "…*Once the sodium-potassium pump is activated and the motor neuron depolarization begins, nerve impulses reach the neuromuscular junction which consequently initiates muscle contraction* (19,37,38)…" All three references (19,37,38) include no assessment of muscle contraction, neither during magnetic stimulation, nor before or after treatment.

Reference (9), Hou et al, published in Journal of Advanced Nursing in 2020, is a systematic review and meta-analysis. However, there is no information about muscle strength during magnetic stimulation. The authors cited: "*Min et al. 2017 (39) suggested that magnetic stimulation improves incontinence by not only contracting pelvic floor muscles but also simultaneously inhibiting the antagonistic reflex mechanism for emptying the bladder.*" Reference (39), however, is not about magnetic stimulation; it addresses electrical stimulation.

References (10–17), were also reviewed to gather additional data on magnetic stimulation and its effects on muscle contraction. References (10,11) are related to the aesthetic field. References (12) addresses the treatment of urinary incontinence but was published more than five years ago. References (13–16) are older studies focused on understanding the magnetic stimulation technique. Reference (17) presents a mathematical model.

Reference (10), Sant'Ana et al, published in Journal of Cosmetic Dermatology in 2023, is a retrospective, non-randomized and non-controlled study about magnetic stimulation applied to the abdominal muscles for aesthetic purposes. Even though the title refers to

"*Electromagnetic field for supramaximal muscle stimulation*…" there is no assessment of muscle contraction, neither during magnetic stimulation, nor before or after treatment.

It is interesting to observe how frequently Reference (10), cited other authors to support the theory of supramaximal contraction. For example, the authors cited: "*It is known that electromagnetic pulses are delivered at a highfrequency rate, inhibiting muscle relaxation, which results in a phenomenon known as supramaximal or tetanic contractions, not reproducible by voluntary muscle contraction* (40)*". They continue: "…The authors*(41) *hypothesize that induced supramaximal contractions may lead to an increase in metabolic activity…" and further affirm: "…treatment with electromagnetic contraction can induce programmed cell death, since in supramaximal contractions, lipid breakdown can lead to FFA extrusion into the intracellular and extracellular space…* (42,43)*". Additionally, they state: "…because in the same way that it occurs during intense physical exercise, the muscular contraction induced by the magnetic field can increase the extracellular uptake of FFA and lower its concentration in the blood plasma* (44,45)*".* References (40–42) do not evaluate muscle contraction at any time. References (43–45) are not studies about magnetic stimulation.

Reference (11), Duncan et al, published in Aesthetic Surgery Journal in 2020, analyzed striated porcine muscle tissue through biopsy. There is no assessment of muscle contraction, neither during magnetic stimulation, nor before or after treatment. However, the authors state: "…In addition, the frequency of delivered pulses does not allow the muscle to relax between 2 consecutive stimuli, which results in supramaximal tension within the muscle and thus supramaximal muscle contraction." There is no evidence to support this claim in any of the references cited in the article.

Reference (12), Wallis et al, published in Clinical Medicine & Research in 2012, is a randomized clinical trial that evaluated the use of magnetic pants to treat urinary incontinence. There is no assessment of muscle contraction, neither during magnetic stimulation, nor before or after treatment. The authors cited: "In ExMI, a pulsed magnetic field is generated which induces an electrical depolarization of the nerves within the pelvic floor, consequently causing the pelvic floor muscles to contract (37)." Reference (37) also presents no assessment of muscle contraction, neither during magnetic stimulation, nor before or after treatment.

References (13–16) only observed that magnetic stimulation can promote muscle contraction, with no evaluation of the intensity. Reference (17) presents a mathematical model.

Among the 147 articles reviewed across all levels, only 5 (46–50) studies included direct measurements of muscle contraction during magnetic stimulation. None of these studies demonstrated that magnetic stimulation is capable of producing supramaximal muscle contraction, a contraction stronger than a maximal voluntary contraction. Of these 5 studies, only 2 (46,47) used instruments capable of objectively measuring muscle force, and both evaluated the quadriceps femoris. One study focused on respiratory muscles (48). The remaining 2 studies (49,50) used surface electromyography (EMG) to measure electrical activity in the biceps and finger muscles. While EMG detects electrical activity, it does not quantify muscle tension or force. This highlights the importance of using appropriate instruments when conducting scientific research.

## Discussion

Beyond the physiological mechanisms, the central concern of this review is the complete lack of scientific evidence supporting the claim that magnetic stimulation (MS) can induce supramaximal muscle contractions. Despite being frequently cited in scientific articles and widely promoted in commercial advertising, no study has objectively demonstrated that magnetic stimulation generates a contraction stronger than that produced during a maximal voluntary contraction (MVC). More critically, no study has even demonstrated that MS produces any measurable contraction of the pelvic floor muscles.

Among the 147 articles analyzed, only five directly measured muscle activity during magnetic stimulation. None of them focused on the pelvic floor muscles. In fact, the few studies that measured force used accessible, superficial muscles such as the quadriceps, where the magnetic field was applied directly over the muscle belly. These findings cannot be extrapolated to deep internal muscles like those of the pelvic floor, which are not in direct contact with the electromagnetic source during chair-based stimulation.

When a patient is seated on a magnetic stimulation chair, the electromagnetic field passes primarily through the gluteal region. The pelvic floor muscles lie deeper. Assuming that these muscles are effectively and intensely stimulated under these conditions, without any direct measurement to support such a claim, undermines the scientific method.

This leads to another significant issue: the complete absence of objective, standardized assessment of pelvic floor muscles. Most articles report only maximal voluntary contraction, disregarding essential physiological variables such as nerve latency, muscle latency, contraction time and relaxation time.

These factors are fundamental to understanding muscle function and to determining whether magnetic stimulation can promote neuromuscular changes in pelvic floor muscles. It is possible that this neuronal improvement is actually responsible for the positive clinical outcomes reported.

Even more concerning is the observation that many studies reference articles as sources to support the idea of supramaximal contractions, yet these citations do not contain any such evidence. What emerges is a troubling pattern: a cascade of repetition where “he said that they said,” but no one ever truly demonstrated it. This undermines the credibility of scientific publishing and raises a critical question: how is science being done, and can we trust what is being published? When major journals accept papers that reproduce untested claims without scrutiny, science becomes vulnerable to commercial influence.

In conclusion, there is no scientific evidence that magnetic stimulation induces supramaximal contractions. More importantly, no study has ever demonstrated that MS is capable of producing measurable contractions in the pelvic floor muscles. The concept appears to be grounded in repetition and marketing rather than objective science. This finding reinforces the need for rigorous methodologies, critical evaluation of literature and transparency in research, particularly when commercial interests are involved.

## All Studies

1. **The effect of high-intensity TESLA stimulation (HITS) therapy on pelvic floor electromyography (EMG) and potential clinical implications for use** (1) **STUDY 1-2025**
   1.1. A comparative study on the effects of high-intensity focused electromagnetic technology and electrostimulation for the treatment of pelvic floor muscles and urinary incontinence in parous women: analysis of posttreatment data. (33)
   1.2. State of the art review: intravaginal probes for recording electromyography from the pelvic floor muscles.(51)
   1.3. Introduction to High Intensity Tesla Stimulation (HITS) with StarFormerTM and Review of Electro-Magnetic Field Device clinical applications.(18)
      1.3.1. Repetitive peripheral magnetic stimulation to reduce pain or improve sensorimotor impairments: A literature review on parameters of application and afferents recruitment. (52)
      1.3.2. Recruitment Patterns in Human Skeletal Muscle During Electrical Stimulation (53)
      1.3.3. Transcutaneous magnetic stimulation of the quadriceps via the femoral nerve.(46)
      1.3.4. Cortical motor output decreases after neuromuscular fatigue induced by electrical stimulation of the plantar flexor muscles. (54)
      1.3.5. Update on extracorporeal magnetic innervation (EXMI) therapy for stress urinary incontinence (37)
      1.3.6. Electromyographic Evaluation of the Pelvic Muscles Activity After High-Intensity Focused Electromagnetic Procedure and Electrical Stimulation in Women With Pelvic Floor Dysfunction. (24)
      1.3.7. Comparative study of effects of extracorporeal magnetic innervation versus electrical stimulation for urinary incontinence after radical prostatectomy (55)
   1.4. Pelvic floor muscle training for female stress urinary incontinence: a randomised control trial comparing home and outpatient training. (56)
2. **Noninvasive High-Intensity Focused Electromagnetic Therapy in Women With Urinary Incontinence: A Systematic Review and Meta-Analysis** (2) **STUDY 2-2025**
   2.1. A Comparative Study on the Effects of High-Intensity Focused Electromagnetic Technology and Electrostimulation for the Treatment of Pelvic Floor Muscles and Urinary Incontinence in Parous Women: Analysis of Posttreatment Data (33)
   2.2. Assessment of the Short-Term Effects After High-Inductive Electromagnetic Stimulation of Pelvic Floor Muscles: A Randomized, Sham-Controlled Study (57)
   2.3. Electromyographic Evaluation of the Pelvic Muscles Activity After High-Intensity Focused Electromagnetic Procedure and Electrical Stimulation in Women With Pelvic Floor Dysfunction (24)
   2.4. Impact of Pulsed Electromagnetic Field on Mixed Incontinence in Parous Women a Prospective Randomized Study (58)
      2.4.1. An Effective Meta-analysis of Magnetic Stimulation Therapy for Urinary Incontinence (59)
      2.4.2. Systematic Review: Randomized, Controlled Trials of Nonsurgical Treatments for Urinary Incontinence in Women (60)
   2.5. Effects of Magnetic Stimulation on Urodynamic Stress Incontinence Refractory to Pelvic Floor Muscle Training in a Randomized Sham Controlled Study (61)

- 2.6. Magnetic Stimulation for Stress Urinary Incontinence: Study Protocol for a Randomized Controlled Trial (62)
- 2.7. Multicenter, Randomized, Sham-Controlled Study on the Efficacy of Magnetic Stimulation for Women With Urgency Urinary Incontinence. (63)
- 2.8. Extracorporeal Magnetic Innervation Therapy for Stress Urinary Incontinence (19)
- 2.9. Effects of Magnetic Stimulation in the Treatment of Pelvic Floor Dysfunction (20)
- 2.10. Effectiveness of Magnetic Stimulation in the Treatment of Urinary Incontinence: A Systematic Review and Results of Our Study (21)
- 2.11. Electrical Stimulation With Non-Implanted Devices for Stress Urinary Incontinence in Women (22)
- 2.12. Lifting and Toning of Arms and Calves Using High-Intensity Focused Electromagnetic Field (HIFEM) Procedure Documented by Ultrasound Assessment (23)
- 2.13. Extracorporeal Magnetic Innervation Therapy: Assessment of Clinical Efficacy in Relation to Urodynamic Parameters (25)
- 2.14. HIFEM Procedure for Treatment of Urinary Incontinence Accompanied With Female Sexual Dysfunction: 1-Year Follow-Up Data (64)
- 2.15. Efficacy of 3 Tesla Functional Magnetic Stimulation for the Treatment of Female Urinary Incontinence (27)
  - 2.15.1. Extracorporeal magnetic innervation therapy for stress urinary incontinence. (19)
  - 2.15.2. Magnetic stimulation of the human brain and peripheral nervous system: An introduction and the results of an initial clinical evaluation. (32)

3. **Effect of electromagnetic stimulation combined with visceral manipulation on stress urinary incontinence in postmenopausal women: A randomized controlled trial.** (3) **STUDY 3 2024**
   - 3.1. EAU Guidelines on Assessment and Nonsurgical Management of Urinary Incontinence (65)
   - 3.2. Arabic (Tunisian) translation and validation of the Urogenital Distress Inventory short form (UDI-6) and Incontinence Impact Questionnaire short form (IIQ-7) (66)
   - 3.3. Effectiveness of pelvic floor muscle training on quality of life in women with urinary incontinence: a systematic review and meta-analysis. (67)
   - 3.4. Pelvic floor muscle activation and strength components influencing female urinary continence and stress incontinence: a systematic review. (68)
   - 3.5. Hydrostatic pressure sensation in cells: integration into the tensegrity model. (69)
   - 3.6. Extracorporeal magnetic innervation treatment for urinary incontinence. (30)
   - 3.7. Urinary incontinence in women: modern methods of physiotherapy as a support for surgical treatment or independent therapy (70)
     - 3.7.1. A randomized-controlled trial pilot study examining the effect of extracorporeal magnetic innervation in the treatment of stress urinary incontinence in women. (38)
     - 3.7.2. Magnetic stimulation for female patients with stress urinary incontinence a meta-analysis of studies with short-term follow-up. (71)
     - 3.7.3. Comparison of alpha-blocker, extracorporeal magnetic stimulation alone and in combination in the management of female bladder outlet obstruction (72)
     - 3.7.4. Extracorporeal magnetic stimulation for treatment of stress and urge incontinence in women–results of 1-year follow-up (73)

6.2. A comparative study on the effects of highintensity focused electromagnetic technology and electrostimulation for the treatment of pelvic floor muscles and urinary incontinence in parous women: (33)
   6.2.1. HIFEM technology the non-invasive treatment of urinary incontinence. (83)
   6.2.2. HIFEM technology a new perspective in treatment of stress urinary incontinence.(84)
   6.2.3. Effects of magnetic stimulation in the treatment of pelvic floor dysfunction. (20)
   6.2.4. Clinical Decisions in Therapeutic Exercise: Planning and Implementation (85)
   6.2.5. Pelvic Organ Dysfunction in Neurological Disease: Clinical Management and Rehabilitation. (86)
6.3. Safety and efficacy of a non-invasive high-intensity focused electromagnetic field (HIFEM) device for treatment of urinary incontinence and enhancement of quality of life (76)
6.4. The use of HIFEM technology in the treatment of pelvic floor muscles as a cause of female sexual dysfunction: a multi-center pilot study (87)
   6.4.1. HIFEM technology a new perspective in treatment of stress urinary incontinence. (84)
   6.4.2. HIFEM technology the non-invasive treatment of urinary incontinence. (83)
   6.4.3. The status of pelvic floor muscle training for women. (88)

7. **Efficacy Comparison between Kegel Exercises and Extracorporeal Magnetic Innervation in Treatment of Female Stress Urinary Incontinence: A Randomized Clinical Trial** (7) **STUDY 7- 2022**
   7.1. Patients' Perception and Satisfaction with Pulsed Magnetic Stimulation for Treatment of Female Stress Urinary Incontinence. (35)
      7.1.1. Neuronal stimulation by pulsed magnetic fields in animals and man. (19)
      7.1.2. Randomized controlled trial of pulsed magnetic stimulation for stress urinary incontinence: 1-year results. (36)
   7.2. A Double-Blind Randomized Controlled Trial of Electromagnetic Stimulation of the Pelvic Floor vs. Sham Therapy in the Treatment of Women with Stress Urinary Incontinence (34)
8. **Assessment of the Effectiveness of Pelvic Floor Muscle Training (PFMT) and Extracorporeal Magnetic Innervation (ExMI) in Treatment of Stress Urinary Incontinence in Women: A Randomized Controlled Trial** (8) **STUDY 8 – 2020**
   8.1. Extracorporeal magnetic innervation therapy for stress urinary incontinence (19)
   8.2. Update on extracorporeal magnetic innervation (EXMI) therapy for stress urinary incontinence (37)
   8.3. A randomized-controlled trial pilot study examining the effect of extracorporeal magnetic innervation in the treatment of stress urinary incontinence in women (38)
      8.3.1. Extracorporeal magnetic innervation therapy for stress urinary incontinence (19)
      8.3.2. Update on extracorporeal magnetic innervation (EXMI) therapy for stress urinary incontinence. (37)
9. **Effects of extracorporeal magnetic stimulation on urinary incontinence: A systematic review and meta-analysis** (9) **STUDY 9 - 2020**
   9.1. Pulsed magnetic stimulation for stress urinary incontinence: 1-year follow up results.(36)
   9.2. The effectiveness of magnetic stimulation for patients with pelvic floor dysfunction: a systematic review and meta-analysis. (74)

- 9.2.1. Pulsed magnetic stimulation for stress urinary incontinence: 1-year follow up results.(36)
- 9.3. Long-term sacral magnetic stimulation for refractory stress urinary incontinence (89)
- 9.4. Efficacy of electromagnetic therapy for urinary incontinence: a systematic review. (26)
  - 9.4.1. A critical review on magnetic stimulation: what is its role in the management of pelvic floor disorders? (28)
  - 9.4.2. A double-blind randomized controlled trial of electromagnetic stimulation of the pelvic floor vs sham therapy in the treatment of women with stress urinary incontinence (34)
  - 9.4.3. Conservative treatment of female urinary incontinence with functional magnetic stimulation (90).
  - 9.4.4. Functional magnetic stimulation for mixed urinary incontinence. (91)
- 9.5. Systematic review: randomized, controlled trials of nonsurgical treatments for urinary incontinence in women. (60)
- 9.6. An effective meta-analysis of magnetic stimulation therapy for urinary incontinence (59)
  - 9.6.1. A double-blind randomized controlled trial of electromagnetic stimulation of the pelvic floor vs sham therapy in the treatment of women with stress urinary incontinence (34)
  - 9.6.2. Pulsed magnetic stimulation for stress urinary incontinence: 1-year follow up results.(36)
- 9.7. Magnetic stimulation for female patients with stress urinary incontinence, a meta-analysis of studies with short -term follow-up (71)
  - 9.7.1. Detrusor inhibition induced from mechanical stimulation of the anal region and from electrical stimulation of pudendal nerve afferents (92)
  - 9.7.2. Therapeutic effect and mechanism of electrical stimulation in female stress urinary incontinence. (39)
  - 9.7.3. The mechanisms of the action of electrical stimulation of muscles (93)
- 9.8. Therapeutic effect and mechanism of electrical stimulation in female stress urinary incontinence (39)

**10. Electromagnetic field for supramaximal muscle stimulation: A retrospective study of safety, efficacy, and patient satisfaction in Brazil** (10) – **STUDY 10 - 2023**

- 10.1. Simultaneous Changes in Abdominal Adipose and Muscle Tissues Following Treatments by High-Intensity Focused Electromagnetic (HIFEM) Technology-Based Device: Computed Tomography Evaluation (40)
  - 10.1.1. Improvement in Isometric strength of the quadriceps femoris muscle after training with electrical stimulation (94)
  - 10.1.2. Muscular strength development by electrical stimulation in healthy individuals (95)
  - 10.1.3. High intensity focused electromagnetic therapy evaluated by magnetic resonance imaging (96)
  - 10.1.4. Safety and efficacy of a novel high-intensity focused electromagnetic technology device for noninvasive abdominal body shaping (97)
  - 10.1.5. Ultrasound Assessment of Subcutaneous Abdominal Fat Thickness After Treatments With a High-Intensity Focused Electromagnetic Field Device: A Multicenter Study (98)

10.1.6. An Induction of fat apoptosis by a non-thermal device: safety and mechanism of action of non-invasive HIFEM technology evaluated in a histological porcine model. (41)

10.1.7. An introduction to the basic principles of magnetic nerve stimulation. (99)

10.2. Induction of Fat Apoptosis by a Non-Thermal Device: Mechanism of Action of Non-Invasive High-Intensity Electromagnetic Technology in a Porcine Model (41)

10.2.1. Magnetic stimulation of the quadriceps femoris muscle: comparison of pain with electrical stimulation (47)

10.2.2. Extracorporeal magnetic innervation therapy for stress urinary incontinence (19)

10.2.3. Functional magnetic stimulation of expiratory muscles: a noninvasive and new method for restoring cough (48)

10.2.4. Peripheral electrical and magnetic stimulation to augment resistance training (100)

10.2.5. Strengthening of quadriceps by neuromuscular magnetic stimulation in healthy subjects (101)

10.2.6. Muscle training with repetitive magnetic stimulation of the quadriceps in severe COPD patients (102)

10.2.7. Effects of induced electric fields on finite neuronal structures: a simulation study (103)

10.2.8. Prediction of neural excitation during magnetic stimulation using passive cable models (104)

10.2.9. Obesity-induced endoplasmic reticulum stress causes chronic inflammation in adipose tissue. (105)

10.2.10. Free fatty acid induces endoplasmic reticulum stress and apoptosis of b-cells (106)

10.3. Mechanism of nonthermal induction of apoptosis by highintensity focused electromagnetic procedure: Biochemical investigation in a porcine model (42)

*10.3.1. Induction of fat apoptosis by a non-ther mal device: mechanism of action of non-invasive high-intensity electromagnetic technology in a porcine model.*(41)

10.4. ER stress and lipid metabolism in adipocytes. (43)

10.5. Clinical study demonstrates that electromagnetic muscle stimulation does not cause injury to fat cells (107)

10.5.1. Ultrasound Assessment of Subcutaneous Abdominal Fat Thickness After Treatments With a High-Intensity Focused Electromagnetic Field Device: A Multicenter Study (98)

*10.5.2. High intensity focused electro-magnetic technology (HIFEM) for non-invasive buttock lifting and toning of gluteal muscles: A multi-center efficacy and safety study.* (108)

*10.5.3. High intensity focused electromagnetic therapy evaluated by magnetic resonance imaging: Safety and efficacy study of a dual tissue effect based noninvasive abdominal body shaping* (96)

*10.5.4. Safety and efficacy of a novel highintensity focused electromagnetic technology device for noninvasive abdominal body shaping* (97)

10.5.5. *Long-term follow-up on patients with HIFEM-induced abdominal tissue changes: MRI and CT assisted quantification of muscle growth and fat reduction.* (109)

10.5.6. *Noninvasive induction of muscle fiber hypertrophy and hyperplasia: Effects of high-intensity focused electromagnetic field evaluated in an in-vivo porcine model: A pilot study* (11)

10.6. Fate of fatty acids at rest and during exercise: regulatory mechanisms (44)

10.7. Skeletal muscle energy metabolism during exercise. Nat Metab (45)

**11. Noninvasive induction of muscle fiber hypertrophy and hyperplasia: Effects of high-intensity focused electromagnetic field evaluated in an in-vivo porcine model: A pilot study** (11) **STUDY 11- 2020**

11.1. A model of the stimulation of a nerve fiber by electromagnetic induction (17)

11.2. Neural adaptations to resistive exercise: mechanisms and recommendations for training practices (110)

11.3. Are humans able to voluntarily elicit maximum muscle force? (111)

11.4. Spinal and supraspinal factors in human muscle fatigue. (112)

11.5. Adaptations in muscular activation of the knee extensor muscles with strength training in young and older adults. (113)

11.6. High intensity focused electromagnetic therapy evaluated by magnetic resonance imaging: safety and efficacy study of a dual tissue effect based non-invasive abdominal body shaping (96)

11.7. Safety and efficacy of a novel highintensity focused electromagnetic technology device for noninvasive abdominal body shaping (97)

11.8. High intensity focused electro-magnetic technology (HIFEM) for non-invasive buttock lifting and toning of gluteal muscles: a multicenter efficacy and safety study (108)

11.9. Novel non-invasive technology based on simultaneous induction of changes in adipose and muscle tissues: safety and efficacy of a high intensity focused electro-magnetic (HIFEM) field device used for abdominal body shaping (114)

11.10. Ultrasound assessment of subcutaneous abdominal fat thickness after treatments with a high-intensity focused electromagnetic field device: a multicenter study. (98)

11.11. Induction of fat apoptosis by a nonthermal device: mechanism of action of non-invasive highintensity electromagnetic technology in a porcine model (41)

11.12. Safety and efficacy of a non-invasive high-intensity focused electromagnetic field (HIFEM) device for treatment of urinary incontinence and enhancement of quality of life (76)

11.12.1. Magnetic stimulation for stress urinary incontinence: study protocol for a randomized controlled trial.(62)

11.12.2. Effects of magnetic stimulation in the treatment of pelvic floor dysfunction (20)

11.12.3. High intensity focused electromagnetic therapy evaluated by magnetic resonance imaging: Safety and efficacy study of a dual tissue effect based non-invasive abdominal body shaping: MRI evaluation of electromagnetic therapy (96)

11.12.4. HIFEM technology—A new perspective in treatment of stress urinary incontinence. (84)

11.12.5. The non-invasive treatment of urinary incontinence. (83)

11.13. Muscle soreness, swelling, stiffness and strength loss after intense eccentric exercise. (115)

11.14. Effects of training and creatine supplement on muscle strength and body mass (116)

11.15. Magnetic stimulation of the quadriceps femoris muscle: comparison of pain with electrical stimulation. (47)

11.16. Burns in functional electric stimulation: two case reports (117)

11.17. Skin burn risks using transcutaneous direct current. In: Proceedings of 17th International Conference of the Engineering in Medicine and Biology Society (118)

11.18. Comparison of therapeutic magnetic stimulation with electric stimulation of spinal column vertebrae (119)

**12. Pelvic static magnetic stimulation to control urinary incontinence in older women: a randomized controlled trial** (12) **STUDY 12 - 2012**

12.1. Update on extracorporeal magnetic innervation (EXMI) therapy for stress urinary incontinence. (37)

12.1.1. Extracorporeal magnetic innervation therapy for stress urinary incontinence. (19)

12.1.2. Effect of functional continuous magnetic stimulation on urethral closure in healthy volunteers.(120)

12.2. Extracorporeal magnetic innervation therapy for stress urinary incontinence. (19)

12.2.1. The electric field induced during magnetic stimulation (121)

12.2.2. Noninvasive magnetic stimulation of human motor cortex. (122)

12.2.3. Magnetic stimulation of the human brain and peripheral nervous system (32)

12.3. Symptom change in women with overactive bladder after extracorporeal magnetic stimulation: a prospective trial (123)

12.3.1. A critical review on magnetic stimulation: what is its role in the management of pelvic floor disorders (28)

12.3.2. Magnetic stimulation of the sacral roots for the treatment of stress incontinence: an investigational study and placebo controlled trial (124)

12.3.3. Effect of functional continuous magnetic stimulation for urinary incontinence (125)

12.3.4. Update on extracorporeal magnetic innervation (EXMI) therapy for stress urinary incontinence. (37)

12.4. A double-blind randomized controlled trial of electromagnetic stimulation of the pelvic floor vs sham therapy in the treatment of women with stress urinary incontinence. (34)

12.4.1. Systematic review. Randomized controlled trials of non-surgical treatments for urinary incontinence in women. (60)

12.4.2. Evaluation of neuromuscular electrical stimulation in the treatment of genuine stress incontinence (126)

12.4.3. Efficacy of functional electrical stimulation in treating genuine stress incontinence: a randomised clinical trial (127) only abstract

12.4.4. Update on extracorporeal magnetic innervation (EXMI) therapy for stress urinary incontinence. (37)

- 12.4.5. Extracorporeal innervation treatment for urinary incontinence. (30)
- 12.4.6. A randomized, double-blinded, sham-controlled trial of postpartum extracorporeal magnetic innervation to restore pelvic muscle strength in primiparous patients (128)
- 12.4.7. Effect of continuous magnetic stimulation for urinary incontinence. (125)
- 12.4.8. Effects of magnetic stimulation in the treatment of pelvic floor dysfunction. (20)
- 12.4.9. Effectiveness of functional magnetic versus electrical stimulation in women with urinary incontinence (129)
- 12.4.10. Urodynamic and clinical evaluation of 91 female patients with urinary incontinence treated with perineal magnetic stimulation: 1-year follow up. (130)

12.5. Effect of functional continuous magnetic stimulation for urinary incontinence. (125)

- 12.5.1. Induction of urethral closure and inhibition of bladder contraction by continuous magnetic stimulation. (131)

12.6. Magnetic stimulation of the sacral roots for the treatment of stress incontinence: an investigational study and placebo controlled trial (124)

- 12.6.1. A new technique for assessing the efferent innervation of the human striated urethral sphincter. (132)
- 12.6.2. Responses to multi-pulse magnetic stimulation of spinal nerve roots mapped over the sacrum in man (133) (not found)
- 12.6.3. Extracorporeal magnetic innervation therapy for stress urinary incontinence (19)
- 12.6.4. Effect of functional continuous magnetic stimulation on urethral closure in healthy volunteers (120)

12.7. Extracorporeal magnetic innervation for the treatment of stress urinary incontinence: results of two-year follow-up. (31)

- 12.7.1. Magnetic stimulation of the human brain and peripheral nervous system: an introduction and the results of an initial clinical evaluation. (32)
- 12.7.2. Extracorporeal magnetic innervation therapy for stress urinary incontinence. (19)
- 12.7.3. Update on extracorporeal magnetic innervation therapy for stress urinary incontinence. (37)
- 12.7.4. Extracorporeal magnetic stimulation for the treatment of stress and urge incontinence in women (73)
- 12.7.5. Extracorporeal magnetic innervation treatment for urinary incontinence (30)
- 12.7.6. Functional extracorporeal magnetic stimulation as a treatment for female urinary incontinence (134)
- 12.7.7. A comparison of magnetic and electrical stimulation of spinal nerves (49)
- 12.7.8. A comparison of magnetic and electrical stimulation of peripheral nerves. (50)
- 12.7.9. Randomized, double-blind study of electrical stimulation for urinary incontinence due to detrusor overactivity (135)
- 12.7.10. Effect of functional continuous magnetic stimulation on urethral closure in healthy volunteers.(120)
- 12.7.11. Urethral and bladder responses to anal electrical stimulation (136)

12.8. A prospective randomised doubleblind controlled trial evaluating the effect of trans-sacral magnetic stimulation in women with overactive bladder (137)

12.9. Long-term effects of extracorporeal magnetic innervations in the treatment of women with urinary incontinence: results of 3-year followup (29)
   12.9.1. Update on extracorporeal magnetic innervation (ExMI) therapy for stress urinary incontinence. (37)
   12.9.2. Effect of electrical stimulation on stress and urge urinary incontinence. Clinical outcome and practical recommendations based on randomized controlled trials (138)
   12.9.3. Advantages and pitfalls of functional electrical stimulation. (139)

12.10. Extracorporeal magnetic stimulation of the pelvic floor: impact on anorectal function and physiology. A pilot study (140)
   12.10.1. Effect of functional continuous magnetic stimulation for urinary incontinence (125)
   12.10.2. Magnetic stimulation of the sacral roots for the treatment of stress incontinence: an investigational study and placebo controlled trial (124)
   12.10.3. A method to determine pudendal nerve motor latency and central motor conduction time to the external sphincter (141)
   12.10.4. Effects of magnetic sacral nerve stimulation on anorectal pressure and volume. (142)
   12.10.5. Neuromodulation of detrusor hyper-reflexia by functional magnetic stimulation of the sacral roots (143)

**13. Modulation of sensorimotor performances and cognition abilities induced by RPMS: clinical and experimental investigations** (13) **STUDY 13 - 2003**

14. **Magnetic Stimulation of the Nervous System** (14) **STUDY 14 - 1999**

14.1. Magnetic stimulation excites skeletal muscle via motor nerve axons in the cat. Muscle Nerve. (144) (only abstract)

14.2. Determining the site of stimulation during magnetic stimulation of a peripheral nerve (145)

14.3. Topographic mapping of the human motor cortex with magnetic stimulation: factors affecting accuracy and reproducibility. (146)

**15. Magnetically induced muscle contraction is caused by motor nerve stimulation and not by direct muscle activation** (15) **STUDY 15 - 1994**

**16. Magnetic stimulation of muscle evokes cerebral potentials** (16) **STUDY 16- 1991**

**17. A model of the stimulation of a nerve fiber by electromagnetic induction** (17) **STUDY 17 - 1990**

17.1. Relevance of stimulus duration for activation of motor and sensory fibers: Implications for the study of H-reflexes and magnetic stimulation (147) <u>(OBS.: the article cited is from 1988, this is from 1992)</u>

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