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# Efficacy of Neuromuscular Electrical Stimulation in managing patients with Ankle Sprain and Chronic Ankle Instability: A Systematic Review

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## ABSTRACT

One of the common injury affecting general population as well as the sportsperson is the Ankle sprains which further results in chronic ankle instability. Various physiotherapeutic interventions have been shown to be effective in managing these patients. NMES, an electrical modality is being used to manage this condition but there is scarcity of literature on its beneficial effects and optimal dosimetry required in managing these patients. To evaluate the efficacy of Neuromuscular Electrical Stimulation in managing patients with ankle sprain and chronic ankle instability.

A systematic search of three databases PubMed, Cochrane Library and Science Direct was conducted to identify the effects of NMES on pain, swelling, balance, physical function, muscle morphology and functional recovery among ankle sprain and chronic ankle instability patients.

Pain and swelling reduction were noted in ankle sprain patients but no significant improvement in physical function and functional recovery was observed. In chronic ankle instability patients motor control, balance and muscle morphology were found to be improved with the use of NMES but with long duration protocols.

Neuromuscular Electrical Stimulation may prove to be beneficial in managing symptoms of patients with ankle sprain and chronic ankle instability such as pain, swelling, balance and physical function, if applied for duration for longer duration or as an additional treatment.

**Keywords:** ankle sprain, chronic ankle instability, neuromuscular electrical stimulation.



## INTRODUCTION

Ankle sprain is one of the most common injuries which affect sportspersons. It accounts for more than 80% of injuries. Not only in sportspersons it is also very common in general population resulting in secondary complications [2] (Gribble PA etal; 2016). Signs and symptoms of ankle sprains include pain, tenderness, swelling, loss of range of motion and function. High rates of reinjury, persistent symptoms, and reduced self-reported ankle function has been associated with lateral ankle sprains leading to consequences such as chronic ankle instability, functional instability, mechanical instability making it a public health concern[2,3] (Gribble PA etal; 2016). Chronic ankle instability (CAI) is characterized by repetitive episodes or feeling of the ankle giving way; symptoms such as pain, weakness, or reduction in ankle range of motion (ROM); diminished self-reported function; and recurrent ankle sprains that persist for more than 1 year after the initial injury[4] (Jay Hertel etal; 2019). It was reported that 40% of first-time lateral ankle sprains were found to develop chronic ankle instability [5] (Doherty C etal; 2016).

Neuromuscular Electrical stimulation (NMES) has been shown to manage muscle inhibition caused by pain and effusion by increasing motor unit recruitment and motor unit firing rate [6] (Barss TS etal; 2018). NMES has been found to be effective in restoring quadriceps muscle strength after knee injuries [7],[8],[9] (Bax L etal; 2005,

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Glaviano NR; 2016, Yoo JH etal; 2010), Stroke induced walking dysfunction [10] (Chen S etal; 2024), dysphagia and patients with vocal fold paresis [11] (Miller etal; 2013).

Various therapeutic interventions are effective in managing patients with ankle sprains which include cryotherapy, functional supports, manual therapy, early ambulation, short term use of NSAIDS and rehabilitation. Although evidence regarding the use of electrotherapy modalities is limited [12] (Ruiz-Sánchez FJ; 2022), Neuromuscular Electrical stimulation has been found to be effective in managing patients with ankle sprains and chronic ankle instability. There is scarcity of literature supporting its efficacy that needs to be evaluated further. The present study reviews the effects of NMES on various symptoms of ankle sprain and chronic ankle instability.

## METHODOLOGY

This systematic review focussed on the role of NMES in ankle sprains and chronic ankle instability and was carried out in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher D etal; 2009). [13]

### Search Strategy and selection of the studies

A search was carried out in databases which included PubMed, Science Direct, and Cochrane database. Search strategy for PubMed database was ("Neuromuscular Electrical Stimulation OR NMES") AND ("Ankle sprain") OR ("Neuromuscular Electrical Stimulation OR NMES") AND ("Chronic Ankle Instability OR CAI").

### Inclusion criteria

Peer-reviewed randomized controlled trials (RCTs), cohort studies and systematic reviews. Studies published between 1986 and January 2025 and articles published in the English language. Studies involving individuals who had ankle sprains or chronic ankle instability, studies evaluating the role of NMES alone or as an adjunct to other therapeutic interventions, studies reporting quantitative outcomes.

### Exclusion Criteria

Case reports, expert opinions, conference abstracts, dissertations, non-peer reviewed articles, studies conducted on animals, studies involving neurological patients or use of NMES in other joint injuries and grey literature, studies focussing on other physiotherapeutic interventions.

The included studies were conducted in accordance with the following PICO statement:

P = Patients with diagnosis of ankle sprain or chronic ankle instability.

I = Interventional use of Neuromuscular Electrical Stimulation.

C = Comparison with control group or therapeutic exercises or standard care.

O = Outcomes like pain, swelling, functional recovery.

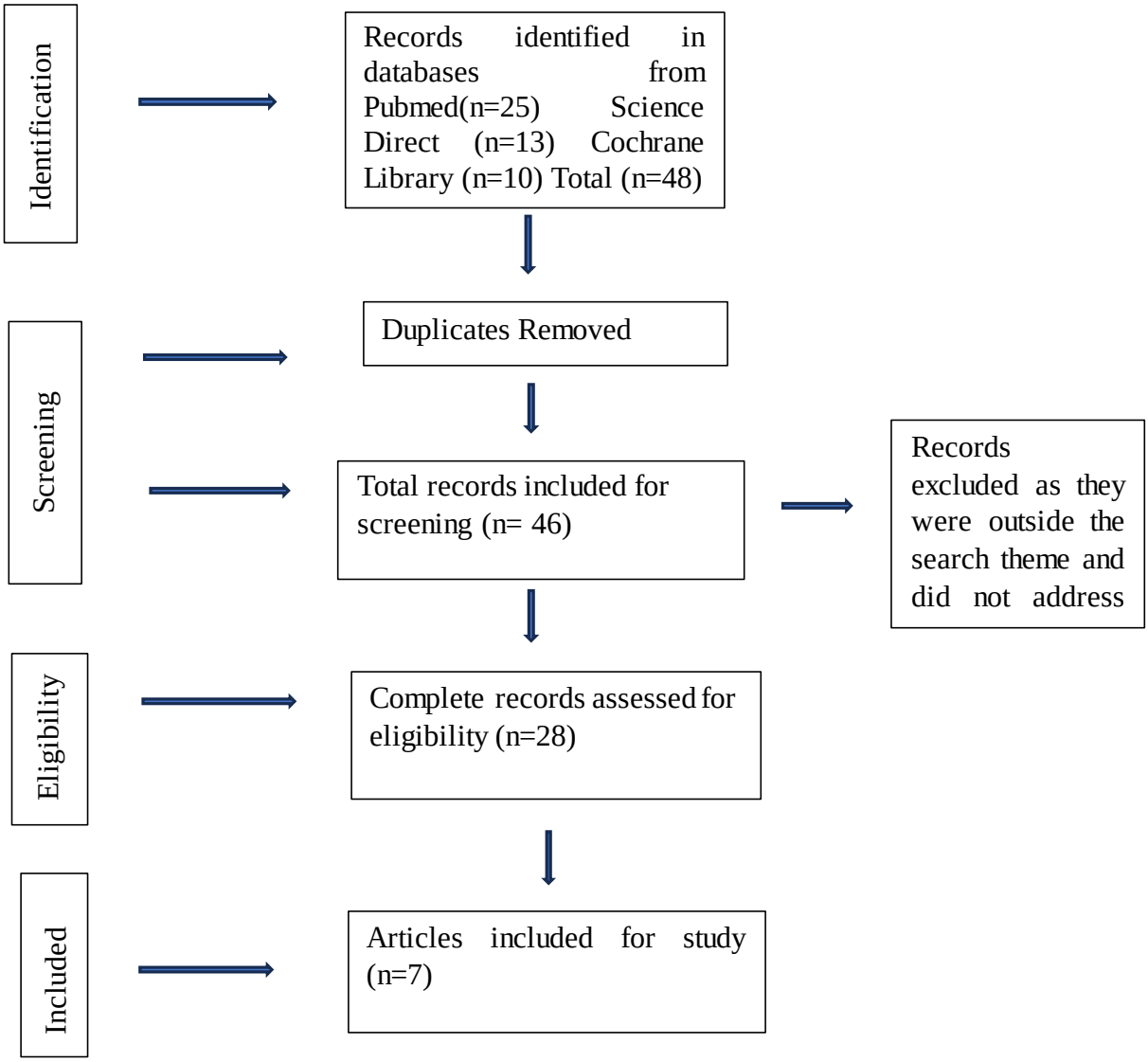


***Figure 1 :*** PRISMA flowchart

## RESULTS

### Selection of Studies

Figure 1 shows the PRISMA flow chart where guidelines followed for the review are specified and the reasons for exclusion of the articles are explained. The initial articles found were 48 in English language. Following which duplicates were removed and those meeting the eligibility criteria were screened further with title screening and finally seven articles were included in this systematic review.

### Data Extraction

Data was extracted using standardized extraction format. Extracted data included: Author(s) and year of publication, study design, study population, intervention used (duration, frequency, intensity, number of sessions, site of application), outcome parameters (pain, swelling, muscle morphology, girth, balance, and functional recovery) and the results obtained.

### Risk of bias and Quality Assessment

RCTs were assessed using PEDRo scale, the Physiotherapy Evidence Database. Included studies demonstrated good methodological quality. Common methodological limitations included lack of therapist and assessor blinding and inadequate allocation concealment. Despite these limitations, most studies employed appropriate outcome measures and provided sufficient data to support their findings.

**Data Synthesis**

Due to substantial heterogeneity in intervention protocol and outcome measures and lack of availability of literature, findings were grouped according to key outcomes.

**Summary of results**

The systematic review analyzed studies evaluating the effectiveness NMES alone or as an adjunct in management of patients with ankle sprain or chronic ankle instability.

**Pain**: On comparison of the effect of standard care with NMES and standard care group pain measured by using VAS scale was found to be improved in both groups but with greater reduction when NMES was provided as an adjunct to standard care treatment[14] (Wainwright TW etal; 2019).

**Swelling**: Different methods were used to assess swelling in ankle sprain patients such as volumetry testing [15] (Mazloum V etal; 2023), fluid displacement method [14] (Wainwright TW etal; 2019) and ankle foot volume [16] (Man, IO etal; 2007). Two of the studies resulted in contradictory results, reporting no significant decrease in swelling with administration of NMES while another study mentioned decrease in oedema.

**Muscle Morphology**: On assessment of muscle morphology using diagnostic ultrasound device in chronic ankle instability patients muscle morphology of ankle plantarflexors in terms of cross-sectional area and thickness was found to be significantly improved[17] (Choi S etal; 2024).

**Balance**: Different studies assessed balance using different tests such as modified Star Excursion Balance Test,SEBT[18] (Gottlieb U etal; 2024) and square hop test[19] (Choi S etal; 2024) and in both the studies statistically significant differences were found with the use of NMES in patients with chronic ankle instability. Whereas another study reported non-significant changes on balance with administration of sub noxious NMES [20] (Needle AR et al; 2023).

**Physical Function**: For physical function assessment using figure of eight test in ankle sprain patients no significant improvement was noted using NMES [14] (Wainwright TW et al; 2019) while on assessment of frontal ankle motor control, significant improvements were found in patients with chronic ankle instability [19] (Zheng H et al; 2024).

**Functional Recovery**: Most of the studies assessed functional recovery using Foot and Ankle Ability Measure (FAAM) in both ankle sprain and chronic ankle instability patients. They reported improvement in patients with chronic ankle instability but not in patients with ankle sprain patients with the use of NMES [14],[18] (Wainwright TW et al; 2019) (Gottlieb U et al; 2024).

***Table 1:*** Summarization of results

| Authors & Year | Study type | Study population | NMES | Outcome Studied | Parameters studied | Result NS (Not significant) Sig (Significant) | PEDro Scoring |
|---|---|---|---|---|---|---|---|
| **Vahid Mazloum et al (2023)** | RCT | Athletes with unilateral lateral ankle | NMES was performed over the tibialis anterior and gastrocnemius | Ankle Swelling | Volumetry(ml)<br>Perimetry (cm)<br>Relative volumetry (cm) | NS<br>NS<br>NS | 6 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | sprains | muscles for 30 min per session | | | | |
| Ivy OW Man et al (2007) | Experimental study | Subjects with acute ankle sprain injury | For NMES group intensity was increased upto tolerance level for 30 minutes | Ankle foot volume<br>Ankle girth<br>Self-assessed ankle function | Volume<br>Girth<br>Adapted Hughston Clinic Subjective Rating Scale for Ankle Disorders | NS<br>Sig<br>NS | 9 |
| Thomas W Wainwright et al (2019) | Pilot randomized controlled study | Patients with oedema following grade I or II ankle sprain | Standard care +NMES NMES device worn for 8hr to 16hrs per day | Oedema<br>Physical Function<br>Functional Recovery<br>Pain | Fluid displacement<br>Figure of eight values<br>Foot and ankle Ability Measure<br>VAS | Sig<br>NS<br>NS<br>Sig | 8 |
| Sujin Choi et al (2024) | Randomized Controlled Trial | Participants with Chronic Ankle Instability (CAI) | NMES 3 sessions /week frequency of 30 Hz and pulse width of 300µs with 10 sec on and 30 sec off cycles applied at Gastrocnemius and Flexor Digitorum Longus | Muscle Morphology of Plantarflexors<br>Balance | Cross Sectional Area<br>Thickness<br>Y Balance Test<br>Square Hop Test | Sig<br>Sig<br>Sig<br>Sig | 6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Huifen Zheng et al (2024) | Randomized Controlled Double blind trial | Individuals with Chronic Ankle Instability | NMES for 6 weeks applied to fibularis longus | Frontal ankle motor control | Frontal ankle inversion angle | Sig | 9 |
| | | | | | Ankle inversion angular velocity | Sig | |
| | | | | | Peak ankle eversion moment | Sig | |
| | | | | | Frontal ankle ROM | NS | |
| | | | | | Frontal dynamic joint stiffness | NS | |
| Uri Gottlieb et al (2024) | Randomized Controlled trial | Individuals with Chronic Ankle Instability | 12 sessions of home-based exercise + Peroneal NMES | Postural Control | Modified SEBT | NS | 9 |
| | | | | | Single Leg drop jump time to stabilization | NS | |
| | | | | Patient reported outcome measures | Identification of Functional Ankle Instability (IdFAI) | Sig | |
| | | | | | Foot and Ankle Ability Measure (FAAM) | Sig | |
| Alan R Needle et al (2023) | Randomized Controlled trial | Individuals with Chronic Ankle Instability | 2 weeks (5 session) sub noxious NMES to ankle pronators | Postural stability | Maximum Jump height on Vertec Jump | NS | 7 |
| | | | | Physical Function | Single side hop test | NS | |
| | | | | Patient reported function | FAAM | NS | |
| | | | | Muscle Strength | Ankle pronator strength using HHD | NS | |
| | | | | Neural Excitability | Reflexive excitability | Sig | |

## DISCUSSION

This review aimed to investigate the effects of NMES in ankle sprain and chronic ankle instability patients on various outcome measures.

NMES has been shown to reduce swelling caused by immobility, as with immobility there is increase in venous pressure and NMES works through its action on musculo-venous pump. In patients with ankle sprain swelling is inflammatory in nature caused by increase in capillary permeability which leads to accumulation of interstitial fluid thus causing swelling. Therefore, in ankle sprain patients NMES may not be an effective treatment strategy for reducing swelling but when administered with conventional treatment protocol, it proved to be effective[21] (Hubbard Turner T; 2019). Pain reduction and improvement in ankle function in post ankle sprain patients is associated with reduction in swelling thus it can be concluded that NMES alone may be effective if provided for long term or in combination with conventional treatment protocol for faster recovery [22] (Denegar CR et al; 2009).

In contrast, physical function was reported to be enhanced in chronic ankle instability patients with use of NMES for a duration of six weeks or longer as NMES produces muscle contraction [23] (Blazevich AJ et al; 2021). NMES has been suggested to enhance muscle strength by engaging larger motor units by primary activation of motor axons which results in muscle adaptation, induction of contractile capabilities and neural adaptations thus enhancing muscle strength, cross sectional area, thickness and improving efficiency of muscles to generate dynamic forces during functional performance) [24],[25] (Jones S et al; 2016) (Vanderthommen, M et al; 2007).

Duration of NMES treatment also has an impact on its effectiveness. If provided for seven days or for further longer duration, it has been proved to be more effective. Sites of application of NMES were different in different studies such as on ankle pronators [20] (Needle AR et al; 2023), tibialis anterior [15] (Mazloum V et al; 2023), peroneal muscles [18] (Gottlieb U et al; 2024), fibularis longus [19] (Zheng H et al; 2024) and ankle plantarflexors[17] (Choi S et al; 2024). The dosimetry of NMES was also different in these studies. For NMES to be effective it should be applied for long duration, higher intensity as tolerable by the patient.

## FUTURE SCOPE

Future studies may assess for the optimal duration, frequency, pulse width, intensity (on and off cycle) duration which prove to be most effective in managing patients with ankle sprain and chronic ankle instability. Site of application of NMES which offers best results can be further investigated. For generalizability of results, studies should be conducted on larger sample size both in athletic population as well as in general population.

## CONCLUSION

NMES can be beneficial in managing symptoms of patients with ankle sprain and chronic ankle instability such as pain, swelling, balance and physical function, if applied for duration of six weeks or longer or if applied along with usual treatment protocol.

## AUTHOR DECLARATIONS

**CRediT Author Statement / Author contributions**

**Anu Bansal:** Conceptualization; Methodology; Formal Analysis; Investigation; Writing – Original Draft; Visualization.

**Pooja Sharma:** Conceptualization, Supervision; Writing – Review & Editing; Resources.

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## REFERENCES


Barss, T. S., Ainsley, E. N., Claveria-Gonzalez, F. C., Luu, M. J., Miller, D. J., Wiest, M. J., & Collins, D. F. (2018). Utilizing physiological principles of motor unit recruitment to reduce fatigability of electrically-evoked contractions: A narrative review. *Archives of Physical Medicine and Rehabilitation, 99*(4), 779–791.

Bax, L., Staes, F., & Verhagen, A. (2005). Does neuromuscular electrical stimulation strengthen the quadriceps femoris? A systematic review of randomised controlled trials. *Sports Medicine, 35*(3), 191–212.

Blazevich, A. J., Collins, D. F., Millet, G. Y., Vaz, M. A., & Maffiuletti, N. A. (2021). Enhancing adaptations to neuromuscular electrical stimulation training interventions. *Exercise and Sport Sciences Reviews, 49*(4), 244–252.

Chen, S., Gao, J., Zhou, Y., Zheng, B., Liu, Y., Cao, M., & Chen, J. (2024). Implications of neuromuscular electrical stimulation on gait ability, balance and kinematic parameters after stroke: A systematic review and meta-analysis. *Journal of NeuroEngineering and Rehabilitation, 21*(1), 164.

Choi, S., & Jun, H.-P. (2024). Effects of rehabilitative exercise and neuromuscular electrical stimulation in patients with chronic ankle instability: A randomized controlled trial. *Medicina, 60*(7), 1187. https://doi.org/10.3390/medicina60071187

Denegar, C. R., Saliba, E., & Saliba, S. (2015). *Therapeutic modalities for musculoskeletal injuries* (4th ed.). Human Kinetics.

Doherty, C., Bleakley, C., Hertel, J., Caulfield, B., Ryan, J., & Delahunt, E. (2016). Recovery from a first-time lateral ankle sprain and the predictors of chronic ankle instability: A prospective cohort analysis. *The American Journal of Sports Medicine, 44*(4), 995–1003.

Fong, D. T. P., Hong, Y., Chan, L. K., Yung, P. S. H., & Chan, K. M. (2007). A systematic review on ankle injury and ankle sprain in sports. *Sports Medicine, 37*(1), 73–94.

Glaviano, N. R., & Saliba, S. (2016). Can the use of neuromuscular electrical stimulation be improved to optimize quadriceps strengthening? *Sports Health, 8*(1), 79–85.

Gottlieb, U., Hayek, R., Hoffman, J. R., & Springer, S. (2024). Exercise combined with electrical stimulation for the treatment of chronic ankle instability: A randomized controlled trial. *Journal of Electromyography and Kinesiology, 74*, 102856. https://doi.org/10.1016/j.jelekin.2023.102856

Gribble, P. A., Bleakley, C. M., Caulfield, B. M., Docherty, C. L., Fourchet, F., Fong, D. T. P., ... & Delahunt, E. (2016). 2016 consensus statement of the International Ankle Consortium: Prevalence, impact and long-term consequences of lateral ankle sprains. *British Journal of Sports Medicine, 50*(24), 1493–1495.

Gribble, P. A., Bleakley, C. M., Caulfield, B. M., Docherty, C. L., Fourchet, F., Fong, D. T. P., ... & Delahunt, E. (2016). Evidence review for the 2016 International Ankle Consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. *British Journal of Sports Medicine, 50*(24), 1496–1505. https://doi.org/10.1136/bjsports-2016-096189

Hertel, J., & Corbett, R. O. (2019). An updated model of chronic ankle instability. *Journal of Athletic Training, 54*(6), 572–588.

Hubbard-Turner, T. (2019). Lack of medical treatment from a medical professional after an ankle sprain. *Journal of Athletic Training, 54*(6), 671–675.

Jones, S., Man, W. D. C., Gao, W., Higginson, I. J., Wilcock, A., & Maddocks, M. (2016). Neuromuscular electrical stimulation for muscle weakness in adults with advanced disease. *Cochrane Database of Systematic Reviews*, (10).

Man, I. O. W., Morrissey, M. C., Barrie, J. L., & Brown, M. (2007). Effect of neuromuscular electrical stimulation on ankle swelling in the early period after ankle sprain. *Physical Therapy, 87*(1), 53–65.

Mazloum, V., Akbari, H., & Gholampour, A. (2023). The comparison of the effects of neuromuscular electrical stimulation and Kinesio Taping on ankle swelling in athletes with lateral ankle sprain. *Journal of Experimental Orthopaedics, 10*(1), 63.

Miller, S., Jungheim, M., Kühn, D., & Ptok, M. (2014). Electrical stimulation in treatment of pharyngolaryngeal dysfunctions. *Folia Phoniatrica et Logopaedica, 65*(3), 154–168.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Antes, G., Atkins, D., ... & Tugwell, P. (2014). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Revista Española de Nutrición Humana y Dietética, 18*(3), 172–181.

Needle, A. R., Tinsley, J. E., Cash, J. J., Koeval, B. K., Barton, J. A., & Howard, J. S. (2023). The effects of neuromuscular electrical stimulation to the ankle pronaFtors on neural excitability and functional status in patients with chronic ankle instability. *Physical Therapy in Sport, 60*, 1–8.

Ruiz-Sánchez, F. J., Ruiz-Muñoz, M., Martín-Martín, J., Coheña-Jimenez, M., Perez-Belloso, A. J., Romero-Galisteo, R. P., & Gónzalez-Sánchez, M. (2022). Management and treatment of ankle sprain according to clinical practice guidelines: A PRISMA systematic review. *Medicine, 101*(42), e31087.

Vanderthommen, M., & Duchateau, J. (2007). Electrical stimulation as a modality to improve performance of the neuromuscular system. *Exercise and Sport Sciences Reviews, 35*(4), 180–185.

Wainwright, T. W., Burgess, L. C., & Middleton, R. G. (2019). Does neuromuscular electrical stimulation improve recovery following acute ankle sprain? A pilot randomised controlled trial. *Clinical Medicine Insights: Arthritis and Musculoskeletal Disorders, 12*, 1179544119849024.

Yoo, J. H., Lim, B. O., Ha, M., Lee, S. W., Oh, S. J., Lee, Y. S., & Kim, J. G. (2010). A meta-analysis of the effect of neuromuscular training on the prevention of the anterior cruciate ligament injury in female athletes. *Knee Surgery, Sports Traumatology, Arthroscopy, 18*(6), 824–830.

Zheng, H., Tian, F., Sun, W., Zheng, L., & Xiao, W. (2024). Neuromuscular electrical stimulation improves frontal ankle motor control in individuals with chronic ankle instability during drop landing. *American Journal of Physical Medicine & Rehabilitation, 103*(10), 890–896.