Original Article

# A REVIEW ARTICLE ON INJURY AND MODALITIES USED FOR REHABILISATION OF BRACHIAL PLEXUS

**Rushal Jaiswal[1], Mitushi Deshmukh[2*]**

[1]UG Scholar, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Sawangi (Meghe), Wardha, Maharashtra, India

[2]Assistant Professor, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Sawangi Meghe, Wardha, Maharashtra, India

Email: mitushideshmukh11@gmail.com

**DOI:** 10.47750/pnr.2022.13.S06.385

## Abstract

Transcutaneous electrical nerve stimulation (TENS) is not therapeutic cure that works by activating complex neural network and engaging inhibitory descending processes in the central nervous system to diminish hyperalgesia . Neuromuscular electrical stimulation (NMES) have recommended as supplement for other treatments, such as workout, or as a stand-alone treatment to increase muscle power, decrease knee discomfort, and improve function. NMES may be an alternate treatment for people who are unable or unable to engage in full-body exercise to strengthen upper limb muscles. Patients appear to like NMES programmer, which have resulted with advancement in muscle work, physical exercise strength, and wholesomeness. The widespread utilisation of [TENS] Transcutaneous Electrical Nerve Stimulation to alleviate injury is based on pain suppression by extra somatosensory information. High-frequency [50-100 Hz] and of less-intensity 'traditional' TENS, and less-frequency [2-4 Hz] and more-intensity 'acupuncture-like' TENS, both cause analgesia in animal models.

**Keywords:** Functional electrical stimulation; human pain; Spastic reflexes; Spasticity; NMES; [TENS] transcutaneous electrical nerve stimulation..

## INTRODUCTION

TENS is charge activating therapy that results on providing palliative treatment by activating afferent nerves and triggering the strain gate device and/or the narcotic system. The drawings depict a two-channel TENS device with four lead wires (two for each channel) and electrode pads attached(1).Brachial plexus injuries (BPI) have increased dramatically in the last 50 years as a result of technical improvements in transportation, particularly in the field of motor vehicles, in the twentieth and twenty-first centuries. Microsurgery advancements have given us new options for improving the scientific result for the brachial plexus injuries. Over since 30 years ago, the outcomes of brachial plexus injuries have considerably improved. In addition to non-operative (conservative) management, where we can achieve reasonable mobility with the help of rehabilitation and physiotherapy, we now have new operational options, such as neurosis, nerve healing, use of nerve grafts and nerve transfer, and palliative surgical procedures, such as tendon transfer or arthrodesis, and functioning free muscle transplantation(2). Electrical stimulation can enhance muscle power, extension, edoema reduction, waste reduction, tissue repair, and injury reduction. TENS is a charge stimulation machine that was previously used to treat pain with more frequencies but is now used to treat pain with very low frequencies. TENS is an electrical stimulation machine that used to use more frequencies but now uses ultra-low frequencies to treat pain. TENS is a sort of electrical application which was once used to treat pain with high frequencies but is now used to treat pain with extremely low frequencies. TENS is a type of charged sensation that once applied high frequencies but now uses extremely low frequencies to treat pain. Electrical stimulation (ES), also known as neuromuscular charged sensation (NMES), is particularly delivered at more frequencies (20-50 Hz) to induce muscle bulk, whereas TENS is a different type of charged sensation that used to use high frequencies but now uses very less frequencies to relieve pain (sensation level TENS, 2-10 Hz) . By spreading through little afferent sensory fibres, TENS stops pain impulses. TENS targets sensory nerve fibres only when used at very less frequencies, and in activate the motor nerve fibres resulting in no discernible muscle contraction (3). In terms of preventing ICUAW, combining NMES therapy with standard care is more successful than standard care alone NMES. Despite this, there is no solid evidence that NMES is useful in preserving muscle mass in ICU patients. Because patients were not stratified by major diagnosis or disease severity, we discovered that the impacts of NMES

were likely underestimated. More study is required to assess the long time result of NMES treatment in the ICU on physical activities and wholesomeness in ICU survivors, as well as to describe the feasibility, keeps & budget friendly of NMES in various very ill patient subpopulations (4).EMS is used in medicine for rehabilitation, such as physical therapy to avoid muscle atrophy caused by inactivity or neuromuscular imbalance caused by brachial plexus injury. This isn't to be confused with TENS, which employs an electric current to relieve pain. TENS uses a sub-threshold current, which means no muscle contraction occurs. EMS is used to address muscle weakness in persons with progressive conditions like cancer or chronic obstructive pulmonary disease who are not able or un willing to engage in full body exercise. Although EMS can result in a revelent data increase in quadriceps muscular power, more research is required because the proof is of less certainty (5).

## Review: -

Transcutaneous electrical nerve stimulation (TENS) is a modality to treat painful disorders which involves passing pulsed charged currents through the inner layer of the skin to activate peripheral nerves. TENS be a less-cost, non-dangerous, and easy-to-use therapy. For some people, TENS can be a useful addition to help them participate in exercise and daily activities by reducing pain during movement(6). ES is a sort of assistive device that can aid in the healing of upper-limb function following a hit. It operates by triggering muscular contractions with electrical current via electrodes, allowing a weak or paralyzed limb to move. It's been around from the mid-1960s, largely for help with mobility by treating injured-foot, but it's also being looked into as a prospective upper-limb healing therapy. ES has also used to treat higher motor neuron disability in people having brain Palsy, Parkinson's disease, Many Sclerosis, with central nervous system injury(7-18).

## CONTRAINDICATION AND PREACAUTIONS FOR TENS AND NMES: -

If here is an odd tactile sensation, the electrodes must be moved to a different location to ensure that the stimulation is efficient. Electrodes should never be used to cover the eyes. Patients who react to the electrodes, gel, or tape because they are allergic to them Electrode placement over dermatitis, eczema, and other dermatological lesions. Application to the front of the neck or the carotid sinus. "TENS is an charged sensation therapy which focus to provide representative wound healing through activating sensory nerves and triggering the injury gate mechanism and/or the narcotic system." These diverse physiological systems correspond to the various TENS application methods. The effectiveness of TENS varies depending on the type of clinical pain being treated, but evidence suggests that when used correctly, it provides significantly more pain relief than a placebo. While this summary does not provide a thorough appraisal of the literature, it does reference the main studies. TENS has a wide research base in both clinical and laboratory settings. It's worth noting that TENS can refer to any sort of electrical stimulation that stimulates neurons using skin-surface electrodes. It is most commonly thought of in a therapeutic context to refer to the application of electrical sensation with the express objective of symptomatic injury relief. You'll undoubtedly come across many of 'alternative' types of encouragement if you search the literature on TENS.

Traumatic brachial plexus injury (BPI) is among the biggest common upper-extremity wound, necessitating specialized treatment & a protracted healing period (8). Injuries to the peripheral nerves and brachial plexus usually result in substantial disability in affected limb. Neuropathic pain is common, within till 95% of sufferers experiencing it, necessarily if a cervical root avulsion has done. Neuropathic injury is caused by injury to the somatosensory system, and it progresses to chronicity as a result of both peripheral and central nervous system disruptions. Starting with first-line pharmaceutical treatments including tricyclic antidepressants and calcium channel ligands, mixed physical and occupational therapy, TENS, & mental support, managing these painful conditions requires the collaboration of a multidisciplinary team.

Neurosurgical procedures such as nerve decompression or repair, as well as ablative/modulatory approaches, are available for people who do not respond to first-line therapy (19-30). Muscle strengthening, muscle bulk and power maintenance over long time of paralysis, specific muscle re strengthening, & edema power have all been used with neuromuscular electrical stimulation (NMES) in sports medicine. These findings were achieved using the burst-modulated differentiating current Russian stimulator, twin-spiked monophasic pulsed current stimulators, & biphasic pulsed current stimulators (10). The Dorsal Root Entry Zone (DREZ) treatment can be used to treat recurring pain. The procedure's purpose is to prevent nerve signals from reaching the secondary central sensory center. Similar to TENS, the Spinal Cord Stimulator (SCS) masks pain signals before they reach the brain. It uses a small device and cables that are implanted under the skin. Cervical SCS may be a helpful therapy option for people suffering from neuropathic pain as a result of abrasion of the brachial plexus (11). Peripheral nociception sensitization, peripheral ectopic discharges, central sensitization with alterations in the dorsal horn of the spinal

cord, and cortical remodeling are all causes of neuropathic pain. Interdisciplinary treatment should include both pharmacological (TCA, calcium channel inhibitors) and non-pharmacological (TENS, topical medications, and physiotherapy, among other things) methods. Surgical procedures are accessible in a variety of forms. The most extensively used and acknowledged therapy are primary nerve repair, DREZ lesioning for avulsion pain, non-avulsion neuropathic pain, and spinal cord stimulation for non-avulsion neuropathic pain. (31-43).

## SUMMARY AND FUTURE PERSPECTIVE: -

NMES (Neuromuscular Electrical Stimulation) is a treatment that includes sending electrical impulses to nerves. Muscles contract as outcome of the stimulation. Charged stimulation can help with strength and range of motion development while also combating the effects of inactivity. It's regularly utilized to "re-train" or "re-educate" a muscle to perform properly & increase power following operation or inactivity. Because of lack of neurons innervation induced by brain disability, muscles are at loss to produce power. Researchers have employed electrical stimulation to try to restore movement and the ability to do daily activities. Electrical stimulation (ES), neuromuscular electrical stimulation (NMES), transcutaneous electrical nerve stimulation (TENS), and functional electrical stimulation are all electrical current-based methods of influencing neuromuscular activity (FES). This overview covers the aspects of electrical stimulation used for rehabilitative and functional goals. Frequency, pulse width/duration, duty cycle, intensity/amplitude, ramp time, pulse pattern, programme duration, programme frequency, and muscle group activated are all explored in relation to exhaustion in the stimulated muscle. Electrical impulses given to the muscles via electrodes implanted on the skin generate muscular spasms in NMES. NMES is commonly utilized in healthy adults and athletes for strength training. NMES has been used to boost muscle bulk and activation in animal models and human investigations. NMES has been shown to help adults with heart failure, long term obstructive pulmonary disease (COPD), central nervous system injury, critically ill patients with septicemia, and inactive elderly people (13).

Adult volunteers with persistent neck pain (average age 31.7 to 55.5 years) received .TENS alone or in combination with another intervention. The majority of studies employed traditional TENS with a frequency of 60-100 Hz, a pulse beat with 40-250 seconds, & a comfortable frequency, followed by burst TENS and acupuncture like TENS. The subjects got daily TENS sessions ranging from 20 minute to 1 hour long, for all over of one upto sixty sittings. The maximum period of follow-up (intermediate term) was six months. The most bothersome area of the neck, including the upper trapezius muscle, was treated with electrodes. In most circumstances, TENS settings and dosages are used that are in line with current practice, such as a frequency of less than 200 Hz, a pulse width of 50 to 250 seconds, and an intensity of 50 to 250 seconds (14).

## REFERENCES


1. Transcutaneous Electrical Nerve Stimulation (TENS) - Physiopedia [Internet]. [cited 2022 Apr 27]. Available from: https://www.physio-pedia.com/Transcutaneous_Electrical_Nerve_Stimulation_(TENS)
2. Treatment Options for Brachial Plexus Injuries - PMC [Internet]. [cited 2022 Apr 27]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4045367/
3. Doucet BM, Lam A, Griffin L. Neuromuscular Electrical Stimulation for Skeletal Muscle Function. Yale J Biol Med. 2012 Jun 25;85(2):201–15.
4. Maffiuletti NA, Roig M, Karatzanos E, Nanas S. Neuromuscular electrical stimulation for preventing skeletal-muscle weakness and wasting in critically ill patients: a systematic review. BMC Medicine. 2013 May 23;11(1):137.
5. Electrical muscle stimulation. In: Wikipedia [Internet]. 2021 [cited 2022 Apr 27]. Available from: https://en.wikipedia.org/w/index.php?title=Electrical_muscle_stimulation&oldid=1056938189
6. Transcutaneous electrical nerve stimulation (TENS) for fibromyalgia in adults - Johnson, MI - 2017 | Cochrane Library [Internet]. [cited 2022 Apr 27]. Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD012172.pub2/full
7. Electrical Stimulation - Its role in upper limb recovery post-stroke [Internet]. Physiopedia. [cited 2022 Apr 27]. Available from: https://www.physio-pedia.com/Electrical_Stimulation_-_Its_role_in_upper_limb_recovery_post-stroke
8. Chagas A, Wanderley D, Ferro K, Alves de Moraes A, Souza F, Tenorio A, et al. Physical Therapeutic Treatment For Traumatic Brachial Plexus Injury In Adults: A Scoping Review. PM&R. 2021 Feb 5;14.
9. Lovaglio AC, Socolovsky M, Masi GD, Bonilla G. Treatment of neuropathic pain after peripheral nerve and brachial plexus traumatic injury. Neurology India. 2019 Jan 1;67(7):32.
10. Neuromuscular Electrical Stimulation | SpringerLink [Internet]. [cited 2022 Apr 27]. Available from: https://link.springer.com/article/10.2165/00007256-199213050-00003
11. Brachial Plexus Injury [Internet]. Physiopedia. [cited 2022 Apr 27]. Available from: https://www.physio-pedia.com/Brachial_Plexus_Injury
12. Treatment of neuropathic pain after peripheral nerve and brachial plexus traumatic injury Lovaglio AC, Socolovsky M, Di Masi G, Bonilla G Neurol India [Internet]. [cited 2022 Apr 27]. Available from: https://www.neurologyindia.com/article.asp?issn=0028-3886;year=2019;volume=67;issue=7;spage=32;epage=37;aulast=Lovaglio
13. Neuromuscular Electrical Stimulation - an overview | ScienceDirect Topics [Internet]. [cited 2022 Apr 27]. Available from: https://www.sciencedirect.com/topics/medicine-and-dentistry/neuromuscular-electrical-stimulation

14. Martimbianco ALC, Porfírio GJ, Pacheco RL, Torloni MR, Riera R. Transcutaneous electrical nerve stimulation (TENS) for chronic neck pain. Cochrane Database Syst Rev. 2019 Dec 12;2019(12):CD011927.
15. Nirmal, Apoorva, Gajendra Agrawal, Sunil Kumar, Sourya Acharya, Akshay Dafal, and Dwivedi Bhushan. "Echocardiographic Assessment of Cardiac Function in Liver Cirrhosis: A Cross-Sectional Study." JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH, 2021. https://doi.org/10.7860/JCDR/2021/45792.14881.
16. Nisargandha, Milind Abhimanyu, and Shweta Dadarao Parwe. "Evaluation of Spermatogenic Action in the Management of Oligospermia." International Journal of Pharma and Bio Sciences 11, no. 2 (April 15, 2021): 218–23. https://doi.org/10.22376/ijpbs/lpr.2021.11.2.P218-223.
17. "[No Title Found]." INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH 12, no. 1 (n.d.).
18. Padmane, Ekta, and Samruddhi Gujar. "Case Report on Hydatid Cysts with Hydropnemonothorax." Journal of Pharmaceutical Research International, November 15, 2021, 1–5. https://doi.org/10.9734/jpri/2021/v33i50A33375.
19. Padmawar, Shubham, Dr. Suhas Landge, Prateek Upadhyay, and Mitali Madhusmita. "A Functional and Radiological Outcome Analysis of Hip Forage Procedure, Done for Early Stages(Ficat and Arlet Grade 1 and 2A) of Avascular Necrosis of Head of Femur." Journal of Pharmaceutical Research International, December 11, 2021, 97–105. https://doi.org/10.9734/jpri/2021/v33i54B33770.
20. Palkrit, Sakshi, Waqar M. Naqvi, and Tasneem Burhani. "Physiotherapeutic Approach in Stress Urinary Incontinence with Prolapsed Uterus: A Case Report." Journal of Pharmaceutical Research International, June 30, 2021, 54–59. https://doi.org/10.9734/jpri/2021/v33i34A31822.
21. Panbude, Mahima Dipak, Mayuri Manikrao Paropate, Mansi Vinod Pande, Priyanka Dayaram Pal, Chatur Kamlakar Patil, and Ranjana Premnath Sharma. "Evaluation of Effectiveness of Information Booklet Regarding Self-Care among Patients Receiving Chemotherapy in Selected Hospitals of Wardha and Nagpur, India." Journal of Evolution of Medical and Dental Sciences 10, no. 18 (May 3, 2021): 1329–33. https://doi.org/10.14260/jemds/2021/280.
22. Pandey, Aishvarya. "Neuroligical Disorders Due To Malnourishments." Bioscience Biotechnology Research Communications 14, no. 6 (June 15, 2021): 45–48. https://doi.org/10.21786/bbrc/14.6.10.
23. Pandey, Milind, Sunita Vagha, Raunak Kotecha, and Anchal Manchanda. "Primary Gastric Lymphoma (Diffuse Large B Cell Type)." Journal of Pharmaceutical Research International, July 13, 2021, 54–57. https://doi.org/10.9734/jpri/2021/v33i37A31979.
24. Pandey, Milind, Sunita Vagha, Gaurav Mahajan, and Anchal Manchanda. "A Brief Study on Retroperitoneal Paraganglioma." Journal of Pharmaceutical Research International, July 31, 2021, 64–66. https://doi.org/10.9734/jpri/2021/v33i39B32184.
25. Pandey, Vidya Bhushan, Renu Bharat Rathi, Bharat Rathi, and Jitesh Verma. "Evaluation of Comparative Efficacy of Brahmi vs. Haritaki Extract in the Management of Academic Stress in Adolescent Students- A Prakriti Based Double-Blind Randomized Controlled Trial." Journal of Pharmaceutical Research International, November 6, 2021, 159–69. https://doi.org/10.9734/jpri/2021/v33i48A33233.
26. Pandya, Naman Kirit, and Utsav Umang Bhatt. "Inflammatory Myofibroblastic Tumor of Hard Palate: A Lesion of Extreme Rarity." Pan African Medical Journal 38 (2021). https://doi.org/10.11604/pamj.2021.38.267.28236.
27. Pandya, Naman Kirit, and Anendd Arroon Jadhav. "Descending Necrotising Fasciitis of Head and Neck Secondary to Insect Bite: Report of a Rare Case." Pan African Medical Journal 38 (2021). https://doi.org/10.11604/pamj.2021.38.271.28594.
28. Parate, Ashutosh, Vasant Gawande, Suvarn Gupta, Ankit Jaiwal, Ashwin Chavan, and Kunal Saoji. "A Comparative Study of Functional Outcome of Olecranon Fractures Managed with Tension Band Wiring Using K Wires with Tension Band Wiring Using Cancellous Screws Fixation." Journal of Pharmaceutical Research International, July 15, 2021, 193–98. https://doi.org/10.9734/jpri/2021/v33i37A31996.
29. Pardasani, Rajiv, and Sohan Lohiya. "Study of Changes in Corneal Thickness and Corneal Endothelial Cell Density after Phacoemulsification Cataract Surgery." Journal of Evolution of Medical and Dental Sciences 10, no. 12 (March 22, 2021): 866–72. https://doi.org/10.14260/jemds/2021/187.
30. Pardhekar, Ashvini Dineshrao, Sadhana Misar(Wajpeyi), and Vinod Ade. "Protocol on Comparative Clinical Efficacy of Tryushanadi Guggul and Navaka Guggul in Sthoulya (Overweight)." Journal of Pharmaceutical Research International, June 2, 2021, 169–75. https://doi.org/10.9734/jpri/2021/v33i30A31628.
31. Parihar, Pratapsingh Hanumantsingh, and Sharvari Shashikant Gulve. "Mediastinal Extension of Pancreatic Pseudocyst – A Case Report." Journal of Evolution of Medical and Dental Sciences 10, no. 5 (February 1, 2021): 316–18. https://doi.org/10.14260/jemds/2021/70.
32. Parsodkar, Rucha P., Aliabbas A. Husain, Gargi D. Mudey, Lokendra R. Singh, and Rajpal S. Kashyap. "Diagnosis of Bacterial Meningitis and AMR Profile Using Molecular and Immunological Techniques." Journal of Pharmaceutical Research International, July 22, 2021, 89–105. https://doi.org/10.9734/jpri/2021/v33i38A32063.
33. Parveen, Sana, Shraddha Jain, Sunil Kumar, Sourya Acharya, and Dhruv Talwar. "Evolution of Middle Ear Modelling Techniques: A Review." Cureus, December 30, 2021. https://doi.org/10.7759/cureus.20829.
34. Parwe, Shweta, Poonam Ashtankar, Piyush Bhagwat, and Milind Nisargandha. "Study the Efficacy of Rodhradigana Vasti in the Management of Sthaulya (Overweight)." Journal of Pharmaceutical Research International, July 2, 2021, 158–66. https://doi.org/10.9734/jpri/2021/v33i34B31858.
35. Parwe, Shweta, Sandip Jadhav, and Milind Nisargandha. "Comparative Clinical Trial on Aragwadha Erand and Trivrutta Eranda Nitya Virechana in Gridhrasi (Lumbago Sciatica Syndrome): A Study Protocol." Journal of Pharmaceutical Research International, July 29, 2021, 68–74. https://doi.org/10.9734/jpri/2021/v33i39A32143.
36. Parwe, Shweta, Manju Mohan, Piyush Bhagwat, and Milind Nisargandha. "Effect of Rodhradi Gana Udavartana in the Management of Sthaulya (Overweight) with Special Reference to Obesity." International Journal of Pharma and Bio Sciences 11, no. 3 (May 4, 2021). https://doi.org/10.22376/ijpbs/lpr.2021.11.1.L30-37.
37. Parwe, Shweta, Swati Tikale, Puja Shrivastav, and Milind Nisargandha. "A Critical Review on Formulations Used in the Management of Malavstambha (Constipation)." Journal of Pharmaceutical Research International, June 30, 2021, 92–100. https://doi.org/10.9734/jpri/2021/v33i34A31828.
38. (Pate), Meenakshi Yeola, Kushagra Singh, Darshana Tote, Azeem Javed Aalam, and Pankaj Gharde. "Metastatic Carcinoma Breast Presenting as Appendicular Abscess." JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH, 2021. https://doi.org/10.7860/JCDR/2021/44398.14412.
39. Patel, Abhi, Swarupa Chakole, and Neha Bhatt. "Psychological Stress Due to Covid-19 on Pregnant Women in Post Partal Period." Journal of Pharmaceutical Research International, December 16, 2021, 458–61. https://doi.org/10.9734/jpri/2021/v33i58B34225.
40. Patel, Aditya, Samrudhi Gujar, Savita Pohekar, Ruchira Ankar, Arati Raut, Sheetal Sakharkar, Vaishali Tembhare, and Pranali Wagh. "Non-Hodgkin's Lymphoma: A Case Report." Journal of Pharmaceutical Research International, December 8, 2021, 264–67. https://doi.org/10.9734/jpri/2021/v33i53B33705.
41. Patel, Divyank, Zainab Gandhi, Rupak Desai, Jilmil Raina, Vikram Itare, Fariah Asha Haque, Taha Saeed, et al. "Impact of Alcohol Use Disorder on Stroke Risk in Geriatric Patients with Prediabetes: A Nationwide Analysis." International Journal of Clinical Practice 75, no. 9 (September 2021). https://doi.org/10.1111/ijcp.14477.
42. Patel, Drashti. "Covid-19 In Pregnant Women." Bioscience Biotechnology Research Communications 14, no. 6 (June 15, 2021): 275–79. https://doi.org/10.21786/bbrc/14.6.58.
43. Patel, Leksha Atul, Vaishnavi Dilip Yadav, Moli Jai Jain, and Om C. Wadhokar. "Positive Outcomes of Comprehensive Exercise Program on Restoration of Functional Level and Quality of Life in a Patient with Rheumatic Heart Disease Undergone Mitral Valve Replacement: A Case Report." Journal of Pharmaceutical Research International, October 15, 2021, 379–84. https://doi.org/10.9734/jpri/2021/v33i46A32879.