



ADAPTIVE NEUROMODULATION AND BIO-PHYSICO-METRIC APPROACH IN THE MANAGEMENT OF CERVICOGENIC HEADACHE: A SINGLE-ARM PILOT OBSERVATIONAL STUDY

G. Barassi¹, C.E. Gallenga², L. Prosperi^{1*}, V. Guglielmi¹, A. Younes¹, F. Papa¹, M. Noce¹, M.P. Della Rovere¹ and M. Panunzio³

¹ Center for Physiotherapy, Rehabilitation and Re-Education (Ce.Fi.R.R.), Venue “G. d’Annunzio” University of Chieti-Pescara, Chieti, Italy;

² Section of Ophthalmology, Department of Biomedical Sciences and Specialist Surgery, University of Ferrara, Ferrara, Italy;

³ Responsible Research Hospital, Campobasso, Italy.

**Correspondence to:*

Loris Prosperi,

Center for Physiotherapy, Rehabilitation and Re-Education (Ce.Fi.R.R.) venue “G. d’Annunzio”,

University of Chieti-Pescara,

66100 Chieti, Italy.

e-mail: cefirr.ricerca@gmail.com

ABSTRACT

Headache is a disorder affecting roughly 47% of population worldwide, which is also usually underestimated in its severity and spread due to its complexity. Indeed, it still remains insufficiently diagnosed and treated today. This single-arm pilot study aims to evaluate the effectiveness of a Bio-Physico-Metric (BPM) approach, based on organized and systematic assessment and stimulation of Myofascial Trigger Points at a global musculoskeletal level, in the treatment of Cervicogenic Headache (CH). A group of 10 CH patients was enrolled after medical examination and observed while undergoing treatment with Adaptive Neuromodulation (ANM) applied following the BPM approach. Patients received BPM-ANM treatments 2 times a week every 48/72 hours, for eight weeks in total, with each treatment session lasting 20 minutes. They were evaluated before the start of the protocol (T0) and after the end of it (T1) through the Neck Disability Index, pressure-based Muscle Strength Analysis and Digitized Bio-Metric Assessment. Statistical analysis showed an overall improvement in values between T0 and T1, which was not statistically significant but was characterized by a generally good effect size. The BPM-ANM approach might be a safe and valid therapeutic option for CH patients but further studies are necessary to clarify the validity of the approach.

KEYWORDS: *Cervicogenic headache, transcutaneous electrical stimulation, physical therapy, rehabilitation*

INTRODUCTION

Headache is a disorder that affects 47% of population around the world, being among the ten most disabling condition for both sexes and the five most disabling for women, according to the classification of causes of disability made by the World Health Organization (1). In spite of the complexity of headache disorders, they are underestimated in their severity and spread, still remaining insufficiently diagnosed and treated today (1). In particular, Cervicogenic Headache (CH) is a chronic pain syndrome belonging to the class of secondary headaches. Its origin depends on dysfunctions of the joints, bones or soft tissues of the cervical compartment, that cause painful symptoms referred in the head and neck region, up to the ocular, temporal and occipital areas. Bogduk, to describe areas and characteristics of the condition, defined CH as

Received: 28 July, 2025

Accepted: 28 August, 2025

ISSN 2038-4106 print

ISSN 2975-044X online Copyright © by BIOLIFE 2025

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. Disclosure: All authors report no conflicts of interest relevant to this article.

a "pain perceived in any region of the head, caused by a primary nociceptive source in the musculoskeletal tissues innervated by the cervical nerves" (2). The prevalence of CH is more than 53% in patients with whiplash cervical spine injury (3-5), and it differs depending on the clinical and diagnostic criteria considered. When clinical criteria are used, the prevalence of CH is estimated at 1%, 2-5% or 4-10% in the general population and up to 17-25% among patients with severe CH (5).

Headache from cervicogenic origin could cause also other disorders in the cervical structures. The correlation between head and neck dysfunctions and headache is attributable to the relationship between nerve roots of the upper cervical vertebrae and trigeminal sensory fibers (6). This somatic dysfunction can be traced back to the presence of Myofascial Trigger Points (MTrPs) in the region affected by the pathology, which could generate altered proprioceptive and exteroceptive feedback, resulting in pain and other neurovegetative symptoms (7). The alteration of these nervous feedback mechanisms attributed to the presence of MTrPs can over time lead to the genesis of somatosensory alterations even at a distance from the primarily symptomatic area, especially in the presence of chronic pathologies such as CH (8). The state of perpetual contraction and dysfunction of some muscular areas affected by the presence of active MTrPs leads to the genesis of pain, other biomechanical-postural alterations and symptoms that are reflected at a visceral level (9). Therefore, it is possible that the treatment of MTrPs could determine a modification of the spinal and cortical afferents, resulting in a resolution of the various hierarchically established dysfunctions starting from the presence of Key MTrPs.

The Key MTrPs are the primary objective of the Bio-Physico-Metric (BPM) approach, which is based on the direct identification and treatment of these dysfunctional points through various types of assessments and therapeutic methods (10). One of the therapeutic approaches that can be used in this regard is Adaptive Neuromodulation (ANM) (11).

The aim of this study is to preliminarily investigate the short-term efficacy and safety of a BPM-ANM therapy in the treatment of CH.

MATERIALS AND METHODS

This research is a single-arm pilot retrospective analytical observational study carried out under the organization of the Center for Physiotherapy Rehabilitation and Re-Education (Ce.Fi.R.R.) of Chieti (Italy), from June to September 2021.

All the procedures applied complied with the Italian safety regulations and the protocol was open for anyone who did not highlight specific contraindications during the initial medical evaluation. The main major contraindications to access the protocol were acute infectious disease, cancer disease, neurological disease, sleep disorders, gastrointestinal disorders, bruxism, emotional stress and a feeling of instability or dizziness, pregnancy, epilepsy, electrical implants, and tuberculosis. The protocol was not an experimental practice, since it applied the same procedures used at the study facility for all patients who did not present the above-mentioned contraindications. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained at enrolment from participants who were willing and able. Furthermore, the Ce.Fi.R.R. owns the ISO 9001:2015 certification for the realization of "Clinical observational studies in the rehabilitation field" (Certificate from the Italian Accreditation Body "Accredia" n. IT15/0304). Due to these considerations and the lack of incontrovertible national legislation regarding the need for the submission of retrospective and/or non-pharmacological observational studies to an ethics committee, normal ethics committee clearance was not required (12,13).

We have recovered the data of 10 patients (2 males and 8 females, mean age 38 ± 22 years) affected by CH, who, during the reference period, referred to the study center for their condition, receiving an initial medical evaluation, a treatment protocol, and a subsequent re-evaluation at the end of the therapeutic cycle. Based on the first medical evaluation, all patients were diagnosed with CH as defined by ICHD 3 criteria (14).

To assess the musculoskeletal health status of patients before (T0) and after (T1) the therapeutic protocol, a routine evaluation of the patients was carried out using the following diagnostic tools:

- Neck Disability Index (NDI): a questionnaire used to assess different problems such as neck pain, chronic pain in patients with whiplash cervical spine injury or cervical radiculopathy and cervicogenic headache. It showed good factorial structure and psychometric properties which replicated results of other versions (15-17);
- Muscle Strength Analysis (MSA): assessed with the Stabilizer Pressure Biofeedback (Chattanooga Group Inc., Vaudreuil, Canada). It is an inflatable cushion connected to a pressure gauge, which allows to monitor the pressure applied by specific body parts on the cushion itself (18). Specifically, the cranio-cervical flexion test was performed by having the patient lie supine on a rigid examination table and placing the cushion, inflated to a base pressure of 20 mmHg, in the hollow space at the nape of the neck. The patient was then asked to assume a chin tuck position, applying pressure with the occiput on the pillow, while the therapist recorded the instant maximal pressure developed by the patient (MSA-MAX) and the maximum pressure reached in a 10-second isometric hold

(MSA-ISO), both expressed in mmHg. Pressure values detected in the range of 20-24 mmHg were considered a symptom of muscle weakness, while values above 25 mmHg were considered a sign of adequate muscle strength.

- Digitized Biometric Assessment (DBA): assessed through a high-resolution 2D platform that captures plantar pressure distribution changes with 4 sensors per cm² (Diasu Health Technologies, Rome, Italy) (19). It is a non-invasive investigation to provide quantitative and qualitative values about the posture and balance of a patient. The evaluation made for the study included the record of the Static Pressure Test (SPT), equivalent to the percentage difference in load between the right and left foot, and the Sway Path Length (SPL), corresponding to the sway path of the center of pressure of the foot in a time of 30 seconds, expressed in mm.

Furthermore, patients were instructed to report verbally or in writing to the study center staff any adverse reactions or side effects they experienced during individual treatment sessions and for up to 48 hours afterward.

The observed patients underwent BPM-ANM treatment sessions lasting 20 minutes, twice a week for 8 weeks, with an interval of 48/72 hours between sessions. The treatment was carried out in standard environmental conditions by instructed physical therapists, using the ENF Studio device (Fast Therapies Srl, Carpenedolo, Italy). The device exploits low-grade electrical biphasic, sinusoidal, damped impulses, applied by a bipolar electrode on the skin surface (Pulse frequency between 15 and 354 Hz, pulse duration between 3 and 483 ms, pulse voltage between 20 and 450 V, maximum current intensity of 20mA). It records the impedance of the skin and creates an operative feedback alternating skin resistance input and therapeutic response current output, constantly adjusting the emitted current to the skin conductivity, to avoid nervous adaptation processes. The device detects a First Reaction (FR) value, which is a dimensionless parameter expressing the conductivity of the skin in the assessed point. According to the BPM approach, muscles showing the greater Δ FR between the right and left side are considered the ones presenting dysfunctional Key MTrPs. In the patients studied, the Δ FR assessment was performed in every session bilaterally on 17 muscles (Pectoralis Major, Rectus Abdominis, Rectus Femoris, Adductor Magnus, Tibialis Anterior, Quadratus Plantae, Abductor Hallucis, Abductor Digiti Minimi, Splenius Cervici, Upper Trapezius, Lower Trapezius, Paraspinal-Longissimus Dorsi, Gluteus Maximus, Hamstrings, Gastrocnemius, Soleus, Quadratus Lumborum). In each session, the 4 muscle districts with the most unbalanced FR values were recorded, identifying the 4 Key MTrPs to be treated in the session on the side characterized by the highest FR value in that asymmetric district. The Current Intensity (CI) to perform the scan was set at a standard value of 30%. The device application is shown in Figure 1 (Fig.1).

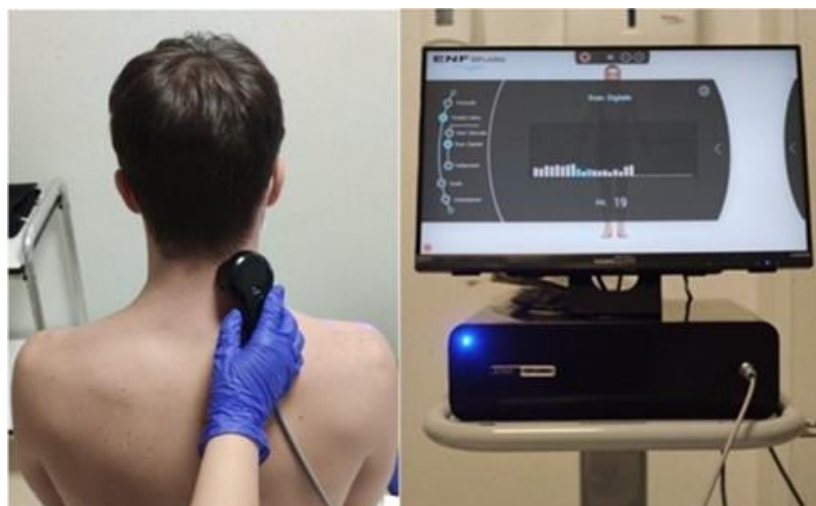


Fig. 1. Example of application of the ENF Studio device. On the left, the application of the handpiece equipped with a detection and treatment electrode on the skin of the target points (in this case on the Upper Trapezius) is shown. On the right, the device screen is shown during the detection phase, highlighting the First Reaction (FR) values detected in sequence at various points, also representing them graphically with vertical bars.

The 4 Key MTrPs identified for each session were then treated using the same instrumentation, applied for 5 minutes on each point (CI = 30%), using the "Automatic Rebalancing" mode, that is automatically started by the device when the handpiece electrode is left in contact with a scanned area for approximately 3 seconds. The selected treatment mode determines the establishment of a self-managed bioelectrical exchange between skin impedance input and current response output, with parameters varying within the operating ranges of the device. This exchange of currents aims to normalize the resistance to current flow offered by the target area. As a result, the BPM-ANM treatment was personalized

not only from one patient to another, but also within the same patient between sessions, focusing the treatment not only on the cervical area but also on areas located at a great anatomical distance from it.

Given the relatively small size of the observed group of patients, the data collected at time T0 and T1 were processed through the application of a non-parametric Wilcoxon signed-rank test. Data analysis was performed through the Statistics Kingdom open online calculator software (<https://www.statskingdom.com>, Melbourne, Australia). The observed changes were considered significant for p values < 0.05 . Effect size (r) was also calculated.

RESULTS

Statistical analysis highlighted non-significant variations in the data considered, although effect sizes ranging from medium to very large were observed for most of the variations, with the exception of the SPT value which had a very small effect size. The results of the data analysis have been reported in detail in Table I (Table I).

Table I. Results of the data analysis.

Variable	Count	Mean $\pm$ SD	p	r	% variation
NDI (T0)	10	24.8 $\pm$ 12.4	n.s.	-0.23	-11.3%
NDI (T1)	10	22.0 $\pm$ 14.9			
MSA-MAX (T0)	10	24.8 $\pm$ 3.3 mmHg	n.s.	0.52	+8.5%
MSA-MAX (T1)	10	26.9 $\pm$ 3.9 mmHg			
MSA-ISO (T0)	10	24.2 $\pm$ 3.4 mmHg	n.s.	0.64	+7.0%
MSA-ISO (T1)	10	25.9 $\pm$ 3.8 mmHg			
SPT (T0)	10	2.6 $\pm$ 1.3 %	n.s.	0.09	+4.6%
SPT (T1)	10	2.7 $\pm$ 1.5 %			
SPL (T0)	10	422.3 $\pm$ 414.8 mm	n.s.	-0.41	-37.2%
SPL (T1)	10	265.3 $\pm$ 212.1 mm			

No reports of adverse events or side effects were recorded in any of the treatment sessions of each patient.

DISCUSSION

The present study highlighted a relationship between the implementation of a BPM-ANM protocol and the changes in biometric parameters and perceived disability in CH patients. Although the observed changes were not statistically significant, all data, except for SPT, improved, with a moderate to large effect size, indicating good clinical relevance of the treatment-associated effects. Furthermore, the treatment appears to be characterized by a high level of short-term safety, as confirmed by the absence of reports of adverse reactions and/or side effects during or after the treatment sessions.

It is possible that the localization and the treatment of Key MTrPs according to the BPM approach generated a reduction of aberrant stimulation and increased positive feedback and adaptations in the musculoskeletal system. Several therapeutic approaches dedicated to the treatment of MTrPs in cervical pathologies have shown an improvement in the disability perceived by patients, as measured by NDI, without any specific approach proving superior to others (20). It follows that, probably, to improve the symptomatology of musculoskeletal patients, the correct identification of MTrPs associated with a specific pathological condition is more important than the therapeutic modality applied to resolve MTrPs. The assessment phase is core part of the BPM approach that was observed, which could significantly contribute to correctly targeting therapeutic stimulation of MTrPs, which proved to be a valid strategy also for the management of CH (21).

Not surprisingly, the BPM-ANM treatment applied in the present study was also associated with slight improvements in cervical muscle strength, measured by MSA tests, and in overall body stability of patients, as indicated by SPL values, with the distribution of the foot load remaining substantially unchanged. It is believed that the presence of MTrPs in the musculoskeletal system can determine deficits in strength and muscle recruitment of various kinetic chains, so much so that the treatment of these MTrPs could restore strength to the pathological districts, although it is still unclear to what extent and in what timeframe (22,23). Even in the field of stabilometry and plantar pressure, the treatment of MTrPs is associated with variable modifications in the postural alignment of patients, making it necessary to investigate new

evaluative and therapeutic approaches to contextualize the role of MTrPs in these adaptation reactions of the human body (24,25).

Some studies have already highlighted how the distribution of MTrPs in the musculoskeletal system follows a hierarchical pattern, the logical reconstruction of which allows for the deactivation of Satellite MTrPs by stimulating Key MTrPs (26,27). Typically, this tracking of MTrPs distribution is performed fairly effectively through a manual evaluation, although this leads to some variability in assessment consistency between different practitioners (28). It follows that a structured and instrumentally supported assessment and treatment approach, such as the BPM-ANM observed in this study, could contribute to more precise identification of Key MTrPs and their treatment.

Indeed, musculoskeletal dysfunction could be related to problems from different systems of the body, for instance somatic, autonomic or neurodegenerative systems. In detail, dysfunctions of somatic or visceral systems could produce discordant impulses afferent to the posterior horn of the spinal cord that excites the same somatic segments (29). When the activation threshold of spinal interneurons is lowered, pain perception could increase, causing a reflex increase in muscle tone (30). This muscle contraction state could produce a palpable modification of the tissue texture, resulting in the presence of MTrPs. Consequently, the tension produced by MTrPs could reduce the range of motion of related joints (31). Considering that various forms of electrotherapies have been shown to be systematically effective in the treatment of MTrPs (32), ANM applied according to the BPM scheme could represent a non-invasive, rapid, efficient and safe strategy for a condition strongly associated with muscular tension states such as CH. Considering that phenomena such as headaches and migraines are characterized by a strong neuromuscular component, especially of the oculomotor, trigeminal and occipital type (33), electrical neuromodulation, in the form of ANM, could be even more suitable for CH, given its nature of stimulation dedicated to neuromuscular structures. Furthermore, the fact that the observed treatment apparently also had effects on the postural stability of patients is significant, since it is well known that CH is also associated with stability disorders due to altered cervical proprioception and sensorimotor dysfunction (34). In particular, CH could determine a reduced efficiency of the vestibulo-ocular reflex and sensory fibers in the neck muscles, especially in the deeper parts of the suboccipital muscles, which make central and automatic links to the systems that control balance, vision, and posture (34).

Nevertheless, the present study is characterized by a series of important limitations that prevent from making clear generalizations of the results. First, the observed sample is very small. Second, the observational single-arm nature of the study limited the possibility of making a comparison between the observed sample and a sample of subjects undergoing sham treatment or no treatment. Finally, the assessments, being based on routine, rapid, and minimally invasive methods, were probably not sufficiently thorough. Therefore, more in-depth studies on the topic should consider larger and better stratified samples, combined with the presence of a control group and the use of additional assessment systems, such as thermographic and sonographic analyses of MTrPs, myometric assessments of muscle tone, and assessments of the pressure threshold of pain.

CONCLUSIONS

The observed BPM-ANM treatment appears to produce positive effects in CH patients, maintaining an excellent short-term safety profile. Given the non-invasive nature of the treatment, its rapid application, and the reduced fatigue it entails for the therapist, it would be appropriate to continue investigating the efficacy of the method in larger and better structured studies to better define its advantages and limitations in the clinical context.

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Stovner LJ, Hagen K, Jensen R, et al. The global burden of headache: a documentation of headache prevalence and disability worldwide. *Cephalalgia*. 2007; 27(3):193-210.
2. Bogduk N. The anatomical basis for cervicogenic headache. *Journal of Manipulative and Physiological Therapeutics*. 1992; 15(1):67-70.
3. Sjaastad O. Cervicogenic headache: comparison with migraine without aura; Vågå study. *Cephalalgia*. 2008; 28(1): 18-20.

4. Lord SM, Barnsley L, Wallis BJ, et al. Third occipital nerve headache: a prevalence study. *Journal of Neurology, Neurosurgery & Psychiatry*. 1994; 57(10):1187-1190.
5. Bogduk N. Cervicogenic headache: anatomic basis and pathophysiologic mechanisms. *Current Pain and Headache Reports*. 2001; 5(4):382-386.
6. Piovesan EJ, Kowacs PA, Oshinsky ML. Convergence of cervical and trigeminal sensory afferents. *Current Pain and Headache Reports*. 2003; 7(5):377-383.
7. Shah JP, Thaker N, Heimur J, et al. Myofascial trigger points then and now: a historical and scientific perspective. *PM&R*. 2015; 7(7):746-761.
8. Farkhodovich HB, Tajiyevna XD. Psychovegetative Changes and Posture Disorders in Tension Headaches. *Journal of Advanced Zoology*. 2023; 44:289.
9. Kostopoulos D, Rizopoulos K. The manual of trigger point and myofascial therapy. Routledge. New York, 2024.
10. Barassi G, Spina S, D'Alessandro F, et al. Cardio-Respiratory, Functional and Antalgic Effects of the Integrated Thermal Care Protocol After Breast Cancer Surgery. *Life*. 2025; 15(3):374.
11. Fidalgo-Martin I, Ramos-Álvarez JJ, Murias-Lozano R, et al. Effects of percutaneous neuromodulation in neuromusculoskeletal pathologies: A systematic review. *Medicine*. 2022; 101(41):e31016.
12. De Sanctis V, Soliman AT, Daar S, et al. Retrospective observational studies: Lights and shadows for medical writers. *Acta Bio Medica Atenei Parmensis*. 2022; 93:e2022319.
13. Winter EM, Maughan RJ. Requirements for ethics approvals. *Journal of Sports Sciences*. 2009; 27:985.
14. Arnold M. Headache classification committee of the international headache society (IHS) the international classification of headache disorders. *Cephalalgia*. 2018; 38(1):1-211.
15. MacDermid JC, Walton DM, Avery S, et al. Measurement properties of the neck disability index: a systematic review. *Journal of Orthopaedic & Sports Physical Therapy*. 2009; 39(5):400-417.
16. Bakhtadze MA, Lusnikova IV, Bolotov DA, et al. Neck disability index in patients with cervicogenic headache. *Russian Journal of Pain*. 2021; 19(1):25-30.
17. Monticone M, Ferrante S, Vernon H, et al. Development of the Italian Version of the Neck Disability Index: cross-cultural adaptation, factor analysis, reliability, validity, and sensitivity to change. *Spine*. 2012; 37(17):E1038-E1044..
18. Tsiringakis G, Dimitriadis Z, Triantafylloy E, et al. Motor control training of deep neck flexors with pressure biofeedback improves pain and disability in patients with neck pain: a systematic review and meta-analysis. *Musculoskeletal Science and Practice*. 2020; 50:102220.
19. Barassi G, Di Simone E, Galasso P, et al. Posture and health: are the biomechanical postural evaluation and the postural evaluation questionnaire comparable to and predictive of the digitized biometrics examination?. *International Journal of Environmental Research and Public Health*. 2021; 18(7):3507.
20. Lew J, Kim J, Nair P. Comparison of dry needling and trigger point manual therapy in patients with neck and upper back myofascial pain syndrome: a systematic review and meta-analysis. *Journal of Manual & Manipulative Therapy*. 2021; 29(3):136-146.
21. Dolina A, Baszczowski M, Wilkowicz W, et al. Trigger Point Therapy Techniques as an Effective Unconventional Method of Treating Tension Headaches: A Systematic Review. *Healthcare* 2024; 12(18):1868.
22. Kim HA, Hwang UJ, Jung SH, et al. Comparison of shoulder strength in males with and without myofascial trigger points in the upper trapezius. *Clinical Biomechanics*. 2017; 49:134-138.
23. Devereux F, O'Rourke B, Byrne PJ, et al. Effects of myofascial trigger point release on power and force production in the lower limb kinetic chain. *The Journal of Strength & Conditioning Research*. 2019; 33(9):2453-2463.
24. Mukhametova ER, Mukhametshina EA, Esin RG, et al. Correlation Cervical Myogenic Trigger Points and Equilibrium Function in Relevantly Healthy Individuals. *BioNanoScience*. 2016; 6(4):513-515.
25. Mukhametova ER, Mukhametshina EA, Esin RG, et al. Correlation Cervical Myogenic Trigger Points and Equilibrium Function in Relevantly Healthy Individuals. *BioNanoScience*. 2016; 6(4):513-515.

26. Martín-Sacristán L, Calvo-Lobo C, Pecos-Martín D, et al. Dry needling in active or latent trigger point in patients with neck pain: a randomized clinical trial. *Scientific reports*. 2022; 12(1):3188.
27. Hsieh YL, Kao MJ, Kuan TS, et al. Dry needling to a key myofascial trigger point may reduce the irritability of satellite MTrPs. *American Journal of Physical Medicine & Rehabilitation*. 2007; 86(5):397-403.
28. Bron C, Franssen J, Wensing M, et al. Interrater reliability of palpation of myofascial trigger points in three shoulder muscles. *Journal of Manual & Manipulative Therapy*. 2007; 15(4):203-215.
29. Mørch CD, Hu JW, Arendt-Nielsen L, et al. Convergence of cutaneous, musculoskeletal, dural and visceral afferents onto nociceptive neurons in the first cervical dorsal horn. *European Journal of Neuroscience*. 2007; 26(1):142-154.
30. Zholudeva LV, Abaira VE, Satkunendrarajah K, et al. Spinal interneurons as gatekeepers to neuroplasticity after injury or disease. *Journal of Neuroscience*. 2021; 41(5):845-854.
31. Sabeh AM, Bedaiwi SA, Felemban OM, et al. Myofascial Pain Syndrome and its Relation to Trigger Points, Facial Form, Muscular Hypertrophy, Deflection, Joint Loading, Body Mass Index, Age and Educational Status. *Journal of International Society of Preventive and Community Dentistry*. 2020; 10(6):786-793.
32. Rickards LD. The effectiveness of non-invasive treatments for active myofascial trigger point pain: a systematic review of the literature. *International Journal of Osteopathic Medicine*. 2006; 9(4):120-136.
33. Rodríguez-Almagro D, Barassi G, Bertollo M, et al. Manual Therapy Approach to the Extraocular Muscles in Migraine Treatment: A Preliminary Study. *Advances in Experimental Medicine and Biology*. 2022; 1375:29-37.
34. Elshibly MM, Darwesh AAEM, Fahmy EM, et al. Balance Impairment in Patients With Cervicogenic Headache: A Narrative Review. *Deraya International Journal for Medical Sciences and Rehabilitation*. 2025; 1(1):83-86.