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Original Article

Effect of Integrated Neuromuscular Inhibition Technique and Posture Correction in the Management of Mechanical Neck Pain

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ABSTRACT

Background: This study aimed to compare the effectiveness of the Integrated Neuromuscular Inhibition Technique (INIT)—a manual therapy approach combining Muscle Energy Techniques (MET), Ischemic Compression (IC), and Strain-Counterstrain (SCS)—with posture correction using a postural belt in individuals with mechanical neck pain.

Methods: In this single-blinded randomized clinical trial, 40 participants with mechanical neck pain (mean age: 34.32 ± 7.90 years) were randomly assigned to two groups. Group A received INIT, while Group B received posture correction through a postural belt. Interventions were administered three times per week over three weeks. Pain intensity, craniovertebral angle (CVA), and neck disability were assessed at baseline and after the third week of intervention.

Results: Both groups showed statistically significant improvements in pain, CVA, and neck disability scores after the intervention ($p < 0.05$). However, the INIT group demonstrated superior outcomes across all measured variables compared to the posture correction group.

Conclusion: INIT proved more effective than posture correction in reducing pain and disability and improving craniovertebral angle in individuals with mechanical neck pain. Nonetheless, posture correction using a belt may still serve as a viable secondary treatment option due to its simplicity, ease of use, and demonstrated benefits in pain relief and functional improvement.

Introduction

Neck pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage in the cervical region, extending from the superior nuchal line to the scapular spine [1]. It is recognized as one of the 36 major musculoskeletal disorders contributing significantly to global disability. The condition has a high lifetime prevalence, affecting approximately 80% of individuals at some point in their lives [2].

Mechanical neck pain, also referred to as non-specific neck pain, is typically characterized by symptoms that are not attributed to severe underlying cervical conditions such as cancer, trauma, or radiculopathy. In such cases, the likelihood of significant tissue damage is minimal. A common contributor to mechanical neck pain is

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inflammation or dysfunction of the facet joints. Notably, neck pain affects approximately 30% of the population and ranks as the fourth leading cause of disability worldwide [3].

Myofascial trigger points (MTrPs) are hyperirritable spots within skeletal muscle, characterized by a hypersensitive palpable nodule in a taut band of muscle fibers. These trigger points are a common source of mechanical neck pain and may contribute to associated symptoms such as tension-type headaches [4,5]. MTrPs typically develop in response to factors that excessively strain the muscle, including sustained postures, poor ergonomic practices, occupational demands, sports participation, or certain leisure activities. This overexertion causes muscle activity to surpass the muscle's physiological capacity, impairing its ability to recover effectively [6].

INIT is reportedly used to treat such conditions. It is a manual therapy that incorporates three maneuvers to provide pain relief: muscle energy techniques (MET), ischemic compression (IC), and strain-counterstrain (SCS). In trigger point release, compression is applied to the trigger point region and maintained for 15 seconds. In the strain-counterstrain technique, the superficial fascia is stretched, while MET operates on the principle of reciprocal inhibition. The principles of reciprocal inhibition and post-isometric relaxation are reported as the foundation of the effectiveness of the INIT technique [7]. Studies have shown that manual therapies effectively manage tension-type headaches, particularly in cases where pharmacologic interventions fail [8]. Moreover, post-isometric relaxation techniques have demonstrated improvements in postural balance following relaxation of cervical musculature in individuals with tension-type headaches [9]. INIT has also been found effective in alleviating pain and stiffness associated with MTrPs and may enhance functional capacity beyond what is achieved with isolated interventions [6].

Due to the change in the cervical spine’s position in mechanical neck pain, the scapula and thoracic vertebrae adopt a position that differs from their normal physiological alignment, potentially resulting in conditions such as forward head posture. The axioscapular muscles become unbalanced due to improper cervical spine and scapular alignment, affecting the length–tension relationship [10]. Additionally, the mechanical load increases due to changes in position and mobility, leading to pain and stiffness in the neck region. Even alterations in scapular alignment can modify mechanical stress in the cervical region [11]. Faulty posture or musculoskeletal biomechanics—even in the foot—can contribute to problems as distant as the neck or head, such as tension-type headaches [12].

To address these issues, scapular belts are commonly used as a corrective measure to realign the scapula based on assessments of scapular posture. Positional changes guide the placement of the scapular belt to correct improper scapular posture that may contribute to neck pain. This involves retracting the shoulders backward and securing them in that position using a support or brace arranged in a figure-of-eight pattern, as described in a previous study [13].

Neck pain and poor posture often go hand in hand. Due to sedentary lifestyles and the demands of the digital era, individuals tend to adopt improper postures. Moreover, students and office workers increasingly spend extended periods working on laptops, computers, or smartphones, which results in prolonged postural deviations that can ultimately lead to neck pain.

INIT and posture correction effectively manage musculoskeletal disorders such as mechanical or non-specific neck pain. However, to our knowledge, no direct comparison between these two techniques has been conducted. This study aimed to determine which method is more beneficial in treating mechanical neck pain. Therefore, the purpose of this study was to compare the effects of INIT and posture correction in participants with mechanical neck pain, to identify a more effective intervention that can be implemented in clinical practice to provide greater benefits to these patients.

Methods

Study Design

This was a single-blinded randomized clinical trial (patients were blinded), ethically approved by the Institutional Ethical Committee (vide letter no. PTY/2023/174, Department of Physiotherapy, Guru Jambheshwar University of Science and Technology, Hisar). CTRI registration was completed under registration number CTRI/2023/06/054212. The study interventions were performed following the guidelines and with the approval of the ethical committee. The sample size was estimated using a standard sample size calculation formula, based on the Minimal Clinically Important Difference (MCID) for the Neck Disability Index (NDI) reported in a previous study on neck pain patients [14]. After fully explaining the study, participants were interviewed, assessed for eligibility, and provided written informed consent.

Participants

Patients with mechanical neck pain who agreed to participate were included in this study, aged 20 to 45 years. Inclusion criteria required participants to have at least two active myofascial trigger points (MTrPs) and a neck pain severity score of 4 or above on the Visual Analog Scale (VAS). Exclusion criteria included a history of any major neurological or musculoskeletal disorders, cardiovascular or respiratory diseases, neck pain due to cervical spine pathology, any history of cervical trauma, fractures or dislocations, carcinoma, uncooperative behavior, and unwillingness to participate. The participant selection process is illustrated in Figure 1. All participants provided written informed consent to be part of the study.

A simple random sampling technique was used for participant selection. Forty participants with mechanical

neck pain were recruited based on the eligibility criteria from the university's physiotherapy outpatient department (OPD) and other hospital OPDs in the city. They were randomly allocated into two equal groups using the lottery method. Allocation concealment was maintained through an open list of random numbers. Group A received the Integrated Neuromuscular Inhibition Technique (INIT), while Group B was provided with a posture correction belt, which was applied for 20 minutes daily. Standard conventional exercises were administered to both groups.

The data collection form recorded basic demographic data of the participants, including name, age, gender, weight, height, and BMI. Weight and height were measured using a weighing machine and a measuring tape, and the Body Mass Index (BMI) was calculated using the standard formula.

The primary study outcomes were Craniovertebral Angle (CVA), pain, and neck disability. Pain was measured using the Visual Analog Scale (VAS), and CVA was assessed with the Kinovea mobile application. Participants were asked to stand upright while a side-view photograph was taken using a phone camera mounted on a tripod 2 meters away. A pre-marked position on the floor ensured consistent patient placement near a wall. Adhesive markers were placed over the C7 vertebra and the tragus of the ear as anatomical reference points. The tragus was also used to align the camera height [15]. The photograph was then uploaded to the application, and the CVA was measured.

Neck disability was evaluated using the Neck Disability Index (NDI) questionnaire. All outcome measures were assessed at baseline and after the final treatment session at the end of the third week. The treatment was administered three times per week for three weeks.

The treatment began with advice on maintaining correct posture, emphasizing the importance of good posture and proper ergonomics. At the start of the intervention, an informational pamphlet illustrating correct postural patterns to be adopted while working, along with general postural and ergonomic care, was provided to all participants.

Group A received the Integrated Neuromuscular Inhibition Technique (INIT). The patient was instructed to lie on their back on a plinth to reduce stress on the neck muscles. The treatment arm was positioned in slight shoulder abduction with the elbow flexed and the hands resting on the abdomen. Myofascial Trigger Points (MTrPs) were identified using a pincer grasp technique by palpating across the muscle fibers.

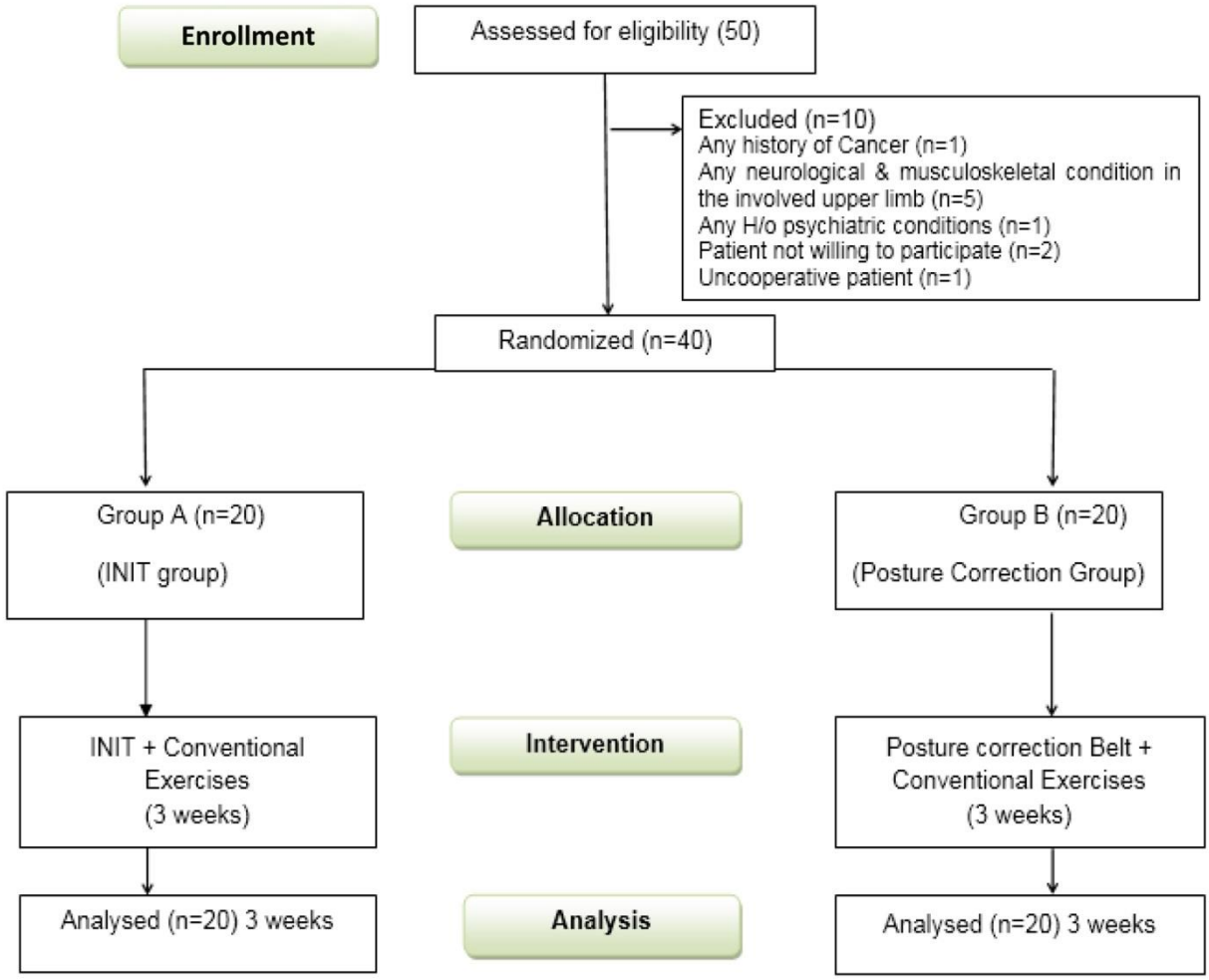

Figure 1: CONSORT Flow Chart for the Study

The Integrated Neuromuscular Inhibition Technique consisted of the following three components [6]:

1) Ischemic Compression: After identifying the MTrPs using a pincer grasp, this was applied. Pressure was gradually increased over 5 seconds and then released for 2–3 seconds. This cycle was repeated until a perceptible reduction in the trigger point was palpated.

2) Strain-Counterstrain Technique: Once the pain began to subside, moderate pressure was applied using the pincer grasp at the MTrP. Participants were asked to rate their pain from 1 to 10. The muscle was then passively moved into a shortened position until a position of ease was identified and maintained for 20 to 30 seconds. A reduction of at least 70% in perceived pain was required in this position.

3) Muscle Energy Technique: The patient was instructed to perform an isometric contraction of the muscle containing the MTrP for 7 to 10 seconds. This was followed by a 30-second soft tissue stretch, repeated three times.

Group B received the posture correction belt. The postural belt was wrapped around the shoulders in a figure-of-eight pattern, ensuring that the scapulae were realigned in the correct position to prevent forward rounding of the shoulders, as shown in Fig. 2 [13]. Appropriate pressure was adjusted individually to correct faulty posture without exerting excessive strain on the muscles. The belt was firm, non-elastic, and tied according to the participant's comfort, without compromising the primary goal of adequate posture correction.

Conventional exercises, common to both groups, included: chin tucks, cervical extension, shoulder shrugs, shoulder rolls, scapular retraction, isometric exercises for neck muscles, and resistance exercises for upper limb flexion, abduction, internal and external rotation using manual resistance. Stretching exercises were performed for the trapezius, levator scapulae, and pectoralis muscles. Each exercise was performed for 10–15 repetitions progressively [16].

Data Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software, version 21. The paired t-test was used to compare within-group differences, while the independent t-test was employed to compare differences between the groups. The significance level was set at $p < 0.05$. Data were expressed as mean ± standard deviation. Group differences at each time point were calculated with 95% confidence intervals (CI).

Results

The study included 40 patients, divided into two intervention groups: Integrated Neuromuscular Inhibition Technique (INIT) and Posture Correction (PC). The average age, weight, height, and BMI of the study participants were 34.32 ± 7.90 years, 71.78 ± 12.59 kg, 1.68 ± 0.09 m, and 25.43 ± 3.50 kg/m², respectively. Table 1 presents the demographic characteristics and baseline readings of the study variables. The findings indicate no significant differences between the groups at the beginning of the study.

Both interventions effectively improved the craniovertebral angle (CVA) and reduced pain and disability in the study participants, as shown in Table 2. The results were statistically significant at $p < 0.05$, indicating that both groups effectively treated patients with mechanical neck pain.

CVA showed greater improvement in the INIT group. Similar findings were observed for pain and disability, which also improved significantly in the INIT group compared to the Posture Correction group. All these differences were statistically significant at $p < 0.05$, as shown in Table 3.

Table 1: Demographic Characteristics and Baseline Readings of Study Participants

Variables	Group A INIT	Group B PC	95% C.I.		t	p value
			Lower	Upper		
Age	34.55±8.23	34.10±7.59	4.61	5.51	0.18	0.85
Weight	70.90±13.10	72.65±12.07	9.81	6.31	0.43	0.67
Height	1.68±0.12	1.68±0.09	0.06	0.07	0.14	0.89
BMI	25.00±3.24	25.87±3.77	3.11	1.38	0.78	0.44
CVA	44.02±2.94	44.49±3.19	2.44	1.49	0.49	0.62
VAS	6.55±1.43	6.15±1.59	0.58	1.38	0.83	0.41
NDI	19.05±4.95	16.90±5.89	1.33	5.63	1.24	0.21

Abb: INIT – Integrated Neuromuscular Inhibition Technique, PC- Posture Correction, BMI- Body Mass Index, CVA- Craniovertebral angle, VAS- Visual Analogue Scale, NDI- Neck Disability Index, *P<0.05 significant

Table 2: Pre and Post-Intervention Comparison of Study Variables in Both Groups

Variable	Groups			95% C.I.		t	p value
		Pre	Post	Lower	Upper		
CVA	**INIT**	44.02±2.94	49.06±2.90	5.57	4.51	20.186	0.00*
	PC	44.49±3.19	47.03±2.71	2.82	2.25	18.44	0.00*
VAS	**INIT**	6.55±1.43	1.85±1.08	4.35	5.04	28.687	0.00*
	PC	6.15±1.59	2.95±1.35	2.91	3.49	23.24	0.00*
NDI	**INIT**	19.05±4.95	3.85±2.62	13.71	16.68	21.428	0.00*
	PC	16.90±5.89	8.50±2.66	6.37	10.42	8.69	0.00*

Abb: INIT – Integrated Neuromuscular Inhibition Technique, PC- Posture Correction, BMI- Body Mass Index, CVA- Craniovertebral angle, VAS- Visual Analogue Scale, NDI- Neck Disability Index, *P<0.05 significant

Table 3: Comparison Between Groups for Study Variables

Variables	Group A INIT	Group B PC	95% C.I.		t	p value
			Lower	Upper		
CVA	5.04±1.11	2.54±0.62	1.92	3.08	8.77	0.00*
VAS	4.70±0.73	3.20±0.61	1.93	1.07	7.01	0.00*
NDI	15.20±3.18	8.40±4.32	9.22	4.38	5.68	0.00*

Abb: INIT – Integrated Neuromuscular Inhibition Technique, PC- Posture Correction, BMI- Body Mass Index, CVA- Craniovertebral angle, VAS- Visual Analogue Scale, NDI- Neck Disability Index, *P<0.05 significant

Discussion

Neck pain is a significant public health concern, ranking 21st in the Global Burden of Disease study [17,18] out of 291 conditions assessed in terms of overall burden, and fourth in terms of overall disability. Globally, the most prevalent musculoskeletal disorders are low back pain (ranked first) and neck pain (ranked fourth) [19].

This study aimed to compare the effects of the Integrated Neuromuscular Inhibition Technique (INIT) and posture correction using a belt in participants with mechanical neck pain. Forty patients were selected according to the inclusion and exclusion criteria and randomly allocated into two groups of 20 participants each. Group A received INIT, and Group B received posture correction using a belt. Conventional exercises for neck pain were administered to both groups.

The results of this study showed that during the intervention period, all variables assessed in both groups demonstrated significant improvement compared to baseline. However, the INIT group showed greater progress and more pronounced improvement in all study parameters than the posture correction group.

In Group A, Integrated Neuromuscular Inhibition Technique (INIT) combined with exercises was effective in reducing neck pain and disability, as well as improving the CVA, in participants after three weeks. INIT is superior in previous studies when compared to other interventions for neck pain, either alone or in combination with other therapies such as myofascial release, Instrument-Assisted Soft Tissue Mobilization (IASTM), or extracorporeal shockwave therapy [20,21,22]. INIT consists of three techniques: ischemic compression, strain-counterstrain, and muscle energy technique. The possible reason for INIT yielding better results than other techniques is its mechanisms of action, which are based on reciprocal inhibition and post-isometric relaxation to relieve muscle spasms and reduce discomfort.

Intermittent ischemic compression, applied with alternating pressure, produces a flushing or pumping effect that initially reduces blood flow, followed by a sudden increase, leading to reactive hyperemia. This response decreases sensitivity and alleviates pain in tender muscle nodules. Muscle pain and spasm are further reduced as the maneuver helps restore sarcomere length in muscles harboring trigger points.

The muscle typically undergoes a cycle of strain and counter-strain, which improves both range of motion and function. This occurs because the muscle is placed optimally for myofascial trigger point (MTrP) release. Physiologically, this is attributed to the involvement of the muscle spindle system and reflex mechanisms, leading to appropriate spindle firing and the development of proper muscle tension. As a result, adequate tone is achieved in the surrounding soft tissues.

The final technique is Muscle Energy Technique (MET), which plays a crucial role in enhancing function by targeting autogenic muscle inhibition and increasing range of motion (ROM) through changes in muscle extensibility. These include reflex relaxation, viscoelastic changes, and stretch-induced adaptations [7]. INIT is more effective than stretching or strengthening exercises alone for managing trigger points in patients with non-specific low back pain [23]. It has also been shown to be superior to MET alone in cases of neck pain [24]. Even a single session of INIT has been reported to be effective in reducing pain intensity in patients with trigger points in the upper trapezius [25].

However, when INIT was compared with dry needling, the latter was more effective in patients with active myofascial trigger points in the upper trapezius, which causes neck pain. Dry needling resulted in a significant increase in pain pressure threshold and a significant decrease in disability and pain [6]. INIT has also been used to treat other disorders, such as piriformis syndrome, where it reduced buttock pain radiating to the ipsilateral lower limb [26]; in non-specific low back pain, where it improved trigger point tenderness and functionality and was also found to be superior to stretching and strengthening exercises [23]; and in knee osteoarthritis, where it enhanced iliotibial band tightness and reduced trigger points [27].

In Group B, posture correction using a belt effectively reduced pain, improved CVA, and decreased neck disability in patients with mechanical neck pain after 3 weeks. The mobility and position of the scapulae and thoracic vertebrae are influenced by changes in the cervical spine's position, such as forward head posture (FHP). Unhealthy lifestyles, unstable posture, trauma, and deterioration of the musculoskeletal system can lead to FHP, causing overload in the neck tissues and exacerbating vertebral kyphosis due to sustained pressure on the anterior region of the vertebrae, which worsens with age. FHP impairs the spinal column’s ability to function stably and creates an imbalance in the axioscapular muscles, contributing to neck pain. Because the upper trapezius and levator scapulae—two axoscapular muscles—attach to the cervical motion segments, their

extensibility decreases, which can result in excessive compressive, rotational, and shear stresses that predispose individuals to neck pain. Moreover, tight pectoral muscles cause rounded shoulders, contributing to forward head posture [28,29].

We used a scapular belt to correct posture and address axioscapular muscle imbalance, similar to the study conducted by Chaurasia et al., which applied the belt in the same region and demonstrated improvement in scapular repositioning in patients with non-specific neck pain. The belt was tied in a comparable figure-of-eight pattern over the shoulders [13].

Barbari et al. developed a scapular repositioning intervention to enhance the activity of the axoscapular muscles. This technique modifies and corrects the scapular position to achieve optimal alignment, leading to posture correction by reducing tension in tight muscles. Additionally, it alleviates discomfort by decreasing the imbalance between the axioscapular muscles, which in turn affects the neck muscles [30].

Braces and orthoses can also be employed, similar to the figure-of-eight strap belt used in our study to correct posture, scapular alignment, and axoscapular muscle balance, thereby alleviating neck pain. Most orthoses utilize the Jordan principle, which operates through a three-point force system that applies corrective or assistive forces to the orthosis surface via the skin. These forces are then transmitted to the underlying soft tissues and bones, potentially making them more effective in improving posture. Various orthoses and braces designed for forward head posture are readily available to relieve strain on the neck and upper back, such as the posture pump—a stationary brace intended for use at home or in the office. However, it is limited to stationary use and requires considerable space [31].

Moreover, the use of orthoses may be associated with specific side effects such as muscular atrophy, skin irritation, poor patient compliance, and difficulty in self-application, particularly among the elderly population [32]. In contrast, the posture correction belt is a cost-effective, side-effect-free alternative that is easier to don and doff. It helps correct and maintain proper posture and address muscle imbalances, alleviating neck pain.

For patients unable to attend physiotherapy clinics regularly, due to travel limitations, financial constraints, demanding schedules, or other barriers, the posture correction belt, when used alongside conventional exercises, can be an effective home-based intervention to reduce neck pain and disability. Many patients in the present study favored the belt due to its affordability, as it was provided free of cost. Additionally, low-cost alternatives, such as a long piece of cloth tied in the same figure-of-eight configuration, can offer similar proprioceptive feedback and postural correction benefits as the belt.

Based on the findings of this study, future research could explore the effectiveness of these interventions in managing other musculoskeletal conditions involving the neck, shoulder, and head regions. Additionally, examining their impact across different populations and age groups would help improve the generalizability of the results. Long-term follow-up studies are also warranted to evaluate the sustainability of treatment outcomes over time. One limitation of the present study was the unequal gender distribution, which could be addressed in future research to assess potential gender-specific effects. Furthermore, the duration of posture belt application was limited to 20 minutes; future studies could investigate optimal usage durations tailored to specific populations. These considerations also highlight certain limitations of the current study.

This study demonstrates that Integrated Neuromuscular Inhibition Technique (INIT) and posture correction provide effective treatment options for mechanical neck pain. INIT requires the expertise of a trained therapist to administer the intervention. In contrast, posture correction involves a one-time comprehensive instruction on the correct application of the posture belt and adherence to proper ergonomics by the patient. Given their effectiveness, the choice between INIT and posture correction can be made based on resource availability. Although INIT showed superior outcomes and has been reported to reduce pain even after a single session, the posture correction belt offers a feasible, cost-effective alternative, especially in settings where access to trained therapists is limited. This study highlights a practical and accessible intervention option for neck pain management. Additionally, the combination of techniques used in INIT—namely ischemic compression, strain-counterstrain, and muscle energy technique—constitutes a robust therapeutic approach for neck pain relief.

Conclusion

In the present study, Integrated Neuromuscular Inhibition Technique (INIT) and posture correction belt interventions effectively improved mechanical neck pain, associated disability, and craniovertebral angle (CVA). However, INIT was more effective than posture correction in reducing pain, correcting forward head posture, and decreasing disability in patients with mechanical neck pain. The posture correction belt offers a valuable alternative treatment option due to its low cost, economic feasibility, and better patient acceptability owing to its ease of use and application.

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Author Contribution

All authors have significantly contributed to various components of this manuscript.

AP, VS: Conception and design. AP, VSY: Analysis and interpretation of data. VS, AP, SJ, and VSY: Drafting and critically reviewing the manuscript for important intellectual content. AP, SJ, and VSY: Final approval of the version to be published.

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