

Underutilization of Respiratory Assessment and Management in Chronic Neck Pain: Exploring Physiotherapists' Practice Patterns

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ABSTRACT: Background: A significant link has been reflected between the respiratory dysfunction and chronic neck pain. Patients with chronic neck pain (CNP) experience various symptoms related to respiratory dysfunction due to its close relationship between muscular attachments and thoracic cage movements. Therefore, it is essential to include respiratory assessment and management while treating patients with CNP. Hence, the present study aims to determine whether physiotherapists incorporate respiratory assessment and management in their practice while treating patients with CNP. Methodology: It was a cross sectional, observation study, carried out using a Google form, which included a self-structured questionnaire inquiring about the current practice pattern of physiotherapists for managing patients with CNP. Total of 141 Physiotherapists managing patients with CNP were recruited through personal contacts and snowball sampling. Frequency and proportions of responses were analyzed. Results: Of 141 responses collected, only 3 physiotherapists (2.13%) included respiratory assessment and management in their practice for CNP patients, while majority focus on neuro-musculoskeletal system to be addressed while assessing and managing patients with CNP. Conclusion: A notable awareness and knowledge gap is revealed by the low number (2.13%) of physiotherapists who treat respiratory dysfunction in CNP patients. This highlights the necessity of better instruction and training in order to understand the importance of respiratory assessment and care for patients with CNP.

KEYWORDS: Chronic neck pain, respiratory dysfunction, respiratory assessment, respiratory management, physiotherapy practice.

Introduction

Neck pain is one of the most common musculoskeletal disorders which carries the economic burden including treatment costs, work related problems and reduced efficiency.

Globally in 2020, around 203 million people suffered from neck pain, and by 2050, this number is expected to reach 269 million (219-322), with an increase of 32.5% [1,2].

Chronic neck pain (CNP) is characterized by the pain which lasts for more than three months [3].

Clinical signs of CNP include headache, decreased range of motion, forward head position, radiating pain, and psychological symptoms such as anxiety and fear of performing movement.

The movements of cervical spine, shoulder, or scapula may aggravate these symptoms, leading to substantial disability and reduced quality of life [4,5,6,7].

CNP is influenced by various physical, psychological, and biological factors [Figure 1].

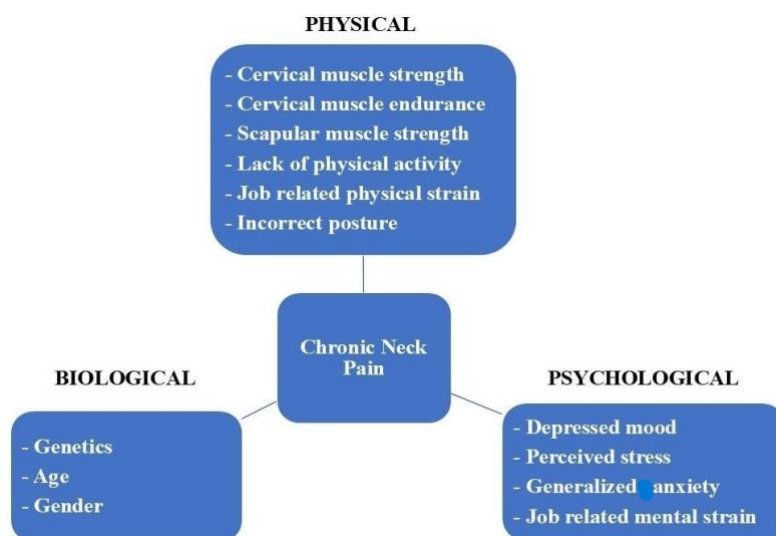


Figure 1. Risk factors associated with chronic neck pain.

Risk factors include weak cervical muscles, poor scapular stability, sedentary behavior, repetitive movements, poor posture, degenerative changes, and psychological factors such as depression, stress, and anxiety [8,9,10].

There is a close relationship between chronic neck pain and respiratory dysfunction.

The key factors responsible for this relationship include reduced range of motion (ROM) of cervical spine, reduced cervical muscle strength and endurance especially the deep cervical muscles, hyperactivity of superficial neck flexors, decreased proprioception, pain and psychological factors like stress [11].

Various studies have discovered reduction in the strength and endurance of the deep neck flexors, which include the rectus capitis anterior and lateralis, longus colli, and longus capitis, in addition to weak extensor muscles.

Additionally, it has been demonstrated that there are alterations in muscle coordination, which may lead to ineffective neuromuscular activation, inadequate support, and possible strain on cervical structures [11,12,13].

The role of central nervous system modifications leading to greater fatigability of superficial structures including upper trapezius (UT), anterior scalene (AS), and sternocleidomastoid (SCM) has also been reported in the literature, suggesting the impact of multiple factors on change in normal biomechanics of the cervical spine and surrounding structures in patients with CNP.

This further leads to reduction in proprioception, reduced overall cervical spine ROM [14].

The precise and complete cooperation of the neurological, skeletal, and muscular systems is necessary for the process of respiration.

A variety of biomechanical, physiological, and psychological variables can affect respiration, making it an open-loop system that is susceptible to adaptation.

Numerous variables that might predispose the patient to respiratory dysfunction are present in the patient with CNP due to close physical proximity of the cervical and thoracic spine, as well as the musculoskeletal and neurological connections they share [11].

Reduction in strength and endurance of the local muscles (deep neck flexors and extensors) may affect kinetic control not just in the affected location but also in associated articulations like the thoracic spine or shoulder [15].

During respiration, the thoracic and cervical spines need to be stabilized for the surrounding muscles to work and expand the rib cage.

When there is instability, the rib cage may exhibit mechanical changes, which alters the length tension relationship of the muscles around the rib cage, resulting in inadequate respiratory function.

Another mechanism includes the role of weak and fatigued superficial muscles leading to changes in their recruitment and functional length.

This alteration in their length tension relationship again alters the normal mechanics of rib cage expansion and generates altered breathing pattern.

These muscles, being the accessory muscles of respiration, help to increase the dorsoventral rib diameter and hence the lung volumes.

Affection of these muscles greatly contribute to reduced rib cage expansion during deep breathing, and hence reduced lung volumes [16].

In general, individuals with affection in the cervical spine have altered thoracic cage biomechanics, which results in decreased respiratory muscle strength and ventilatory capacity, ultimately causing respiratory dysfunction.

Apart from these well documented alterations, pain and psychological symptoms like anxiety and fear are amongst the other hypothesis responsible for altered respiratory mechanics.

These symptoms may have both stimulatory as well as inhibitory effect on respiratory drive leading to either hyperventilation or hypoventilation [17,18].

The breathing mechanism of CNP patients is frequently disregarded in routine clinical practice, despite the proven link between respiratory mechanics and persistent neck discomfort.

According to a research, people with persistent neck discomfort may have modest effects on their arterial carbon dioxide levels, chest mechanics, maximum voluntary ventilation, and respiratory muscle strength.

Significant gains in cervical flexion and extension range, neck flexor and extensor strength and endurance, neck disability index (NDI), forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC have been shown when breathing re-education is paired with regular physical therapy treatment [19].

Both respiratory function and more general therapeutic results can be improved by incorporating respiratory evaluation and treatment into physical therapy practice.

In order to effectively treat patients with persistent neck pain, it is crucial to acknowledge the significance of integrating respiratory examination and management as part of routine practice.

Thus, the present study aims to identify the practice pattern of physiotherapists for inclusion of assessment and management of respiratory system while treating patients with chronic neck pain.

Material and Methods

It was a cross-sectional observational study.

Physiotherapists currently working in various settings including academics, clinics or both and engaged in treating chronic neck pain patients were recruited for the study through personal contacts and snowball sampling while those who were pursuing a master's degree and not dealing with chronic neck pain patients were excluded.

Minimum sample size of 139 was considered based on an assumption that at least 10% Physiotherapists incorporate assessment and management of respiratory system in their rehabilitation protocol while dealing with chronic neck pain patients.

The level of significance and acceptable error was set at 5%.

Questionnaire Development and Validation

A self-structured questionnaire was prepared to gather information from physiotherapists regarding their clinical practices for managing patients with CNP.

The demographic profile of the participating physiotherapists, including their age, affiliations, and experiences, was included in the questionnaire.

It also included open-ended questions on their current approach to diagnosing and treating patients with CNP, as well as the factors that influenced their choices.

After preparation, the questionnaire was distributed among five physiotherapists who were not part of the recruited sample in order to verify its content accuracy and understanding.

After the back-and-forth rounds of validation, and based on the suggestions received, the final questionnaire was prepared to guarantee its reliability, clarity, and applicability for

measuring physiotherapists' practice patterns for managing patients with CNP.

After receiving the consensus from all, the questionnaire was circulated among 58 physiotherapy graduates for a pilot study, and based on the responses received, the questionnaire, consisting total of 15 questions, was then revised for the final floating based on the feedback obtained.

Data collection

Once the questionnaire was validated, it was circulated among the physiotherapy graduates via Google Forms through various social media platforms like WhatsApp, and e-mails.

Frequent reminders were sent too to enhance their participation and increase the response rate.

Consent and bias prevention

The questionnaire opened with a consent question to ensure voluntary participation. Only physiotherapists who consented to participate completed the survey. The title of the questionnaire was kept broad as "Current Practice Pattern Among Physiotherapists Regarding Assessment and Management in Patients with Chronic Neck Pain" to reduce the bias.

This was done with the purpose that even if they do not include respiratory assessment and management while treating CNP, they could exaggerate their responses if they are aware that the objective of the study is to identify the inclusion of respiratory assessment and management in persistent neck pain as reflected through the title.

Statistical Plan: After completion of data collection, information was analyzed.

The demographic data and general characteristics of the sample were presented using descriptive statistics (%-percentages).

Frequency distribution analysis was used to determine how many physiotherapists included respiratory assessment and management in their chronic neck pain practice.

Results

A total of 141 physiotherapists participated and submitted the Google form.

The majority of physiotherapists (111, 78.72%) were less than 30 years of age, and most (121, 86%) had less than 12 years of experience, suggesting more participation from the young physiotherapists.

Their observations may offer insightful viewpoints on how newly revised training curricula affect treatment plans, especially when

it comes to respiratory assessment and care for patients with CNP.

Since they are relatively young early in their careers, it might allow them to contribute newer insights and up-to-date clinical procedures to the research.

A smaller sample (16, 11%) showed professional expertise between 12 to 23 years, these physiotherapists might have a stronger background in clinical work, however, the study has limited representation from senior physiotherapists (4, 3%), having more than or equal to 24 years of expertise.

Most of the physiotherapists held bachelor's degree (74, 52%), 60 (43%) held Master degree, whereas very few (7, 5%) held PhD degree.

98 (69%) physiotherapists were directly involved in patient care, whereas 22 (16%) physiotherapists balance both clinical and academic responsibilities, combining hands-on experience with teaching and research.

Only 21 (15%) physiotherapists worked exclusively in academic roles.

104 (73.76%) physiotherapists treat on average 1 to 5 patients with CNP per week, whereas, a few (n=8) physiotherapists treat 11 to 15 CNP patients per week.

The greater number of CNP patients in this group may suggest specialization in this field.

While knowing about the complaints with which the patients with CNP present to them, majority (120, 85.11%) reported radiating pain, tingling and numbness, occipital headaches, muscle weakness, functional impairments, anxiety, and heaviness in limbs along with the primary complaint of neck pain.

Only a small percentage of physiotherapists (3,2%) consider the respiratory system while taking a patient's history, evaluating them, and managing them if they have CNP.

The tables below represent the major components/systems physiotherapists focus on while taking the history, assessment, and management of CNP patients.

The largest proportion (61, 43%) focus on the musculoskeletal system as shown in table 1, which is expected since chronic neck pain is often related to musculoskeletal issues like muscle tension, ligament strain, or joint problems in the cervical spine, whereas, only 1 participant (1%) included respiratory issues in their history-taking, suggesting that respiratory problems are not commonly considered during the history-taking process for CNP patients.

Table 1. Major components/systems physiotherapists focus on while taking a history of patients with CNP.

Major components/systems-History	Frequency (%)
Musculoskeletal system	61 (43%)
Occupation	57 (40.00%)
Others (Age, gender, trauma, life style, chief complaints, comorbidities)	55 (39.00%)
Pain	37 (26.00%)
Neurological complaints	23 (16.00%)
Psychological complaints	7 (5.00%)
Cardiovascular	6 (4.00%)
Systemic	2 (1.00%)
Respiratory	1 (1.00%)

Table 2 presents the major components/systems assessed by physiotherapists when treating chronic neck pain (CNP) patients.

The largest proportion (104, 74%) assessed the musculoskeletal system.

This is expected as the musculoskeletal system is central to chronic neck pain, with issues like muscle strain, joint dysfunction, or spinal misalignment being common causes.

This is followed by pain assessment, neurological evaluation, occupational, psychological components, and least including cardiovascular (1%) and respiratory (2%) evaluation. 3 participants (2%) assessed the respiratory system, suggesting that respiratory function is not commonly assessed in chronic neck pain patients, even though neck pain affects the muscles responsible for breathing pattern.

Table 2. Major components/systems physiotherapist focus while taking the assessment of CNP patients.

Major components/systems-Assessment	Frequency (%)
Musculoskeletal	104 (74%)
Pain assessment	48 (34%)
Neurological	18 (13%)
Occupational	17 (12%)
Psychological	5 (3%)
Respiratory	3 (2%)
Cardiovascular	1 (1%)

Table 3 represents the treatment plans used by physiotherapists for managing chronic neck pain (CNP).

The most common treatment plan is exercise, with 101 participants (72%) using this approach. 50% of participants use modalities like heat, cold, ultrasound, or trans electrical nerve stimulation to reduce inflammation, relieve pain, and improve tissue healing. 67 participants (48%) utilize

manual therapy, such as joint mobilization or soft tissue techniques, which is a commonly used approach to relieve muscle tension, joint restrictions, and pain in neck pain patients.

Only 3 participants (2%) include respiratory exercises as part of their treatment plan.

This suggests that respiratory interventions (e.g., breathing exercises or techniques) are not commonly considered in the treatment of CNP, despite their potential to reduce muscle tension and improve overall wellbeing.

Table 3. Major components/systems physiotherapist while treating patients with chronic neck pain.

Treatment plan	Frequency (%)
Exercise	101 (72%)
Modalities	71 (50%)
Manual Therapy	67 (48%)
Other (life style modification, orthosis, functional training, rest, taping, dry needling)	32 (23%)
Posture	28 (20%)
Ergonomics	15 (11%)
Respiratory	3 (2%)

Majority (135, 95.74%) said that they do include the ergonomics advices as a part of their practice, which mainly focuses on postural corrections (68, 48%), architectural changes (42, 30%), use of appropriate pillow and sleeping habits (30, 21%), exercise including stretching and strengthening (28, 20%), lifting techniques (12, 9%), screen/phone usage (7, 5%), and many others (35, 25%) including stress management, use of cervical collar, frequent rest, and workplace ergonomics.

Also, they include exercises only to focus on range of motion of cervical spine and stretching and strengthening of neck muscles, and postural correction; without focusing much on breathing exercises (3, 2%).

The table 4 presents the factors influencing physiotherapists' decision-making in managing patients with CNP.

The most mentioned factor is the protocol of the workplace, with 79 participants (56%) indicating that workplace protocols or institutional guidelines significantly impact their treatment choices.

This may involve organizational standards or procedures that must be followed within their clinical setting.

Table 4. Factors influencing the practice of physiotherapists while dealing with CNP patients.

Factors	Frequency (%)
Protocol of workplace	79 (56%)
Past experience	76 (54%)
Clinical guidelines	71 (50%)
Research evidence	66 (47%)
UG training	48 (34%)
Time constraints	46 (33%)

Discussion

The results of this study reveal the underutilization of respiratory assessment and management among patients with CNP.

Despite growing evidence about relation between respiratory dysfunction and CNP, the findings show that physiotherapists overwhelmingly focus on musculoskeletal, pain, and neurological aspects of the assessment and treatment, with limited attention to respiratory components.

Limited Respiratory Focus in Practice

The most striking verdict of the present study is the minimal inclusion of respiratory assessment and management in the practice of physiotherapists treating CNP.

While obtaining patients' history, only 1% of physiotherapists addressed respiratory issues, and only 2% incorporated respiratory assessment and management in the overall clinical practice.

This finding is consistent with previous studies.

With the prevalence ranging from 16.7 to 75.1%, CNP is one of the most frequently reported musculoskeletal complaints among the adults; having widespread impact on person's physical, psychological, and social well-being.

Studies have reported that patients with CNP are likely to develop respiratory dysfunction along with many other commonly reported symptoms like pain, muscle weakness, alterations in the posture, and neurological complaints like tingling-numbness.

However, these individuals are generally treated from a musculoskeletal standpoint, with little to no attention paid to the respiratory system alterations [20].

Since CNP is known to impact breathing patterns, muscular tension, and postural control; the fact that relatively few physiotherapists incorporate respiratory examination into their therapeutic procedures is alarming.

It is commonly known that cervical muscles, particularly the sternocleidomastoids and scaleni,

function as accessory inspiratory muscles, helping to elevate the ribs and stabilize the thorax.

The inhibition of the deep cervical muscles and overactive sternocleidomastoids and scaleni leads to alteration in the thoracic cage movement affecting the breathing pattern, causing hypocapnia, along with more pain and anxiety.

According to earlier research, hypomobility of cervical spine, reduced cervical muscle strength, decreased proprioception, and altered psychological state may influence respiratory mechanics [19].

Additionally, discomfort and agony can make people more stressed, which might change how they breathe [21].

The conventional emphasis on musculoskeletal components of CNP therapy may be the cause of this underutilization of respiratory management.

Physiotherapists must broaden their treatment paradigms to include respiratory evaluation and management techniques since respiratory dysfunction may have an impact on the intensity of CNP symptoms.

Participants Demographics and Training Influence

Majority of the physiotherapists in present study are young; 86% have less than 12 years of professional experience, and 78.72% are under 30.

These results imply that most respondents had their training recently, which may reflect changes in curricula and methods for treating musculoskeletal disorders.

When it comes to managing CNP, this younger group may be more open to incorporating novel therapeutic approaches, such as those that target the respiratory system.

The underutilization of respiratory therapies, however, indicates that respiratory management is still not a common component of the physiotherapy approach to CNP, even with modern training.

It's also noteworthy that just 11% of physiotherapists had more than 12 years of experience, according to the survey.

These physiotherapists could have more established therapeutic procedures based on traditional methods, which could cause them to ignore more recent research that connects musculoskeletal pain with respiratory dysfunction.

This may suggest that although younger physiotherapists have more recent training, it may take some time for professional practice to adopt the clinical use of these therapies.

Current Focus on Musculoskeletal Components

As would be expected in the treatment of CNP, there is a strong focus on musculoskeletal evaluations (74%) and therapies including manual therapy (48%) and exercise (72%).

The musculoskeletal system plays a major role in the pathophysiology of CNP, with the cervical spine and associated soft tissues playing a key role in the patient's symptoms.

This emphasis on musculoskeletal elements aligns with worldwide patterns in CNP physiotherapy practice [22].

This approach, however, is limited because it ignores the possible roles that other systems—especially the respiratory system—may have in sustaining or aggravating chronic pain.

Integration of Ergonomics and Lifestyle Modifications

It's important to note that 95.74% of physiotherapists said they included ergonomic recommendations in their treatment plans, with posture modifications accounting for 48% of these recommendations.

Since bad posture and repeated stress can exacerbate cervical spine dysfunction, ergonomics is essential to the prevention and treatment of CNP [23].

The focus on postural correction without including respiratory treatments is an indication of the limited approach that many physiotherapists still take while managing patients with CNP, even being a positive aspect of the treatment regimen.

While range-of-motion and neck muscle strengthening exercises are important, they might be supplemented with diaphragmatic breathing and relaxation activities, which have been demonstrated to ease muscular tension and enhance patient results [24].

The Role of Respiratory Exercises in CNP

One noteworthy conclusion is that just 2% of treatment programs include respiratory exercises.

It has been demonstrated that respiratory exercises, especially those that focus on diaphragmatic breathing, help individuals with chronic pain achieve better physical and psychological results.

Respiratory exercises may assist patients with CNP relax, lower sympathetic arousal, and alleviate tension in the accessory muscles of breathing.

Furthermore, better breathing techniques can lessen upper thoracic and cervical muscular fatigue and help with posture [24].

Given how rarely respiratory exercises are used in this situation, it appears that physiotherapists have failed to address respiratory component while managing CNP.

Influence of Workplace Protocols and Institutional Guidelines

With 56% of participants reporting that institutional standards influence their treatment decisions, workplace protocol is a key factor affecting physiotherapists' decision-making in CNP management.

Physiotherapists, those who reported inclusion of respiratory system while managing CNP patients, reported following the workplace protocol for the same.

The underutilization of pulmonary assessments in CNP treatment may result from these protocols' frequent emphasis on musculoskeletal evaluations and therapies.

The emphasis on well-established techniques like exercises and ergonomics in institutional standards may limit the flexibility to include more recent techniques like respiratory management.

This emphasizes how medical facilities must modernize clinical procedures to include all-encompassing care plans that include respiratory evaluations and treatments.

Although workplace procedures guarantee uniformity, treatment results may be enhanced by modifying them to incorporate evidence-based methods for comprehensive CNP management.

Conclusion

Present study concludes that respiratory assessment and management are mainly underused, which represents a major gap in the existing physiotherapy techniques for managing CNP.

Even while musculoskeletal treatments are common, physiotherapists do not always take into account how respiratory dysfunction may exacerbate CNP symptoms.

Patients with persistent neck pain may benefit from more thorough care and improved treatment results if respiratory examination and focused therapies are included.

It is imperative that physiotherapists broaden their therapeutic techniques to incorporate respiratory therapy into their care plans in light of the growing body of research demonstrating its advantages.

Although workplace protocols are essential for directing clinical practice, organizations must revise and modify their policies to take into account a more comprehensive view of CNP management.

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Author Contributions

Conceptualization- V.D., N.P., G.V.; Methodology- V.D., N.P., G.V.; Investigation- V.D., G.V.; Data analysis- V.D., N.P., G.V.; Manuscript writing and initial draft preparation- V.D.; Manuscript review and editing- V.D., N.P., G.V.; Supervision- V.D., N.P.

All authors have read and approved the final manuscript.

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Conflicts of interest

The authors declare no competing interests.

Institutional Review Board

The study was conducted according to the guidelines of the Declaration of Helsinki; the study and the protocols utilised therein were approved by the Institutional Review Board - Institutional Ethics Committee (IEC/BU/152/Faculty/04/165/2024).

Consent Statement

Informed consent was obtained from all participants through a Google Form prior to their participation in the study, including the consent of publishing their anonymized data.

Data availability

All data presented in the manuscript are available from the authors upon request.

References

1. Kazeminasab S, Nejadghaderi SA, Amiri P, Pourfathi H, Araj-Khodaei M, Sullman MJ, Kolahi AA, Safiri S. Neck pain: global epidemiology, trends and risk factors. *BMC musculoskeletal disorders*, 2022, 23:1-3.

2. Wu AM, Cross M, Elliott JM, Culbreth GT, Haile LM, Steinmetz JD, Hagins H, Kopec JA, Brooks PM, Woolf AD, Kopansky-Giles DR. Global, regional, and national burden of neck pain, 1990–2020, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021. *The Lancet Rheumatology*, 2024, 6(3):e142-55.
3. Pawaria S, SuDhan DS, Kalra S. Effectiveness of cervical stabilisation exercises on respiratory strength in chronic neck pain patients with forward head posture-a pilot study. *J Clin Diagn Res*, 2019, 13(4):6-9.
4. de Zoete RM, Brown L, Oliveira K, Penglaze L, Rex R, Sawtell B, Sullivan T. The effectiveness of general physical exercise for individuals with chronic neck pain: a systematic review of randomised controlled trials. *European Journal of Physiotherapy*, 2020, 22(3):141-147.
5. Beltran-Alacreu H, López-de-Uralde-Villanueva I, Calvo-Lobo C, Fernández-Carnero J, La Touche R. Clinical features of patients with chronic non-specific neck pain per disability level: A novel observational study. *Revista da Associação Médica Brasileira*, 2018, 64(8):700-709.
6. Magee DJ, Manske RC. Cervical spine. In: Waldman M, Morrissey D (Eds): *Orthopedic physical assessment*, Elsevier Health Sciences, 2020, Missouri, 121-176.
7. Kaljić E, Jurišić M, Katana B, Trtak N, Vranešić AE, Jevtić N, Bajić G, Mujezinović A. Incidence and impact of neck pain on daily life activities of the student population. *Journal of Health Sciences*, 2022, 12(2):116-121.
8. Kazeminasab S, Nejadghaderi SA, Amiri P, Pourfathi H, Araj-Khodaei M, Sullman MJ, Kolahi AA, Safiri S. Neck pain: global epidemiology, trends and risk factors. *BMC musculoskeletal disorders*, 2022, 23:1-3.
9. Shahidi B, Curran-Everett D, Maluf KS. Psychosocial, Physical, and Neurophysiological Risk Factors for Chronic Neck Pain: A Prospective Inception Cohort Study. *J Pain*, 2015, 16(12):1288-1299.
10. Javdaneh N, Ambroży T, Barati AH, Mozafaripour E, Rydzik Ł. Focus on the scapular region in the rehabilitation of chronic neck pain is effective in improving the symptoms: a randomized controlled trial. *Journal of Clinical Medicine*, 2021, 10(16):3495.
11. Kapreli E, Vourazanis E, Strimpakos N. Neck pain causes respiratory dysfunction. *Medical hypotheses*, 2008, 70(5):1009-13.
12. Falla D, Bilenkij G, Jull G. Patients with chronic neck pain demonstrate altered patterns of muscle activation during performance of a functional upper limb task. *Spine*, 2004, 29(13):1436-1440.
13. Falla D, Jull G, Edwards S, Koh K, Rainoldi A. Neuromuscular efficiency of the sternocleidomastoid and anterior scalene muscles in patients with chronic neck pain. *Disability and Rehabilitation*, 2004, 26(12):712-717.
14. Falla D, Rainoldi A, Jull G, Stavrou G, Tsao H. Lack of correlation between sternocleidomastoid and scalene muscle fatigability and duration of symptoms in chronic neck pain patients. *Neurophysiologie Clinique/Clinical Neurophysiology*, 2004, 34(3-4):159-165.
15. Key J, Clift A, Condie F, Harley C. A model of movement dysfunction provides a classification system guiding diagnosis and therapeutic care in spinal pain and related musculoskeletal syndromes: a paradigm shift-Part 2. *Journal of Bodywork and movement therapies*, 2008, 12(2):105-120.
16. Legrand A, Schneider E, Gevenois PA, De Troyer A. Respiratory effects of the scalene and sternomastoid muscles in humans. *Journal of Applied Physiology*, 2003, 94(4):1467-1472.
17. Wilhelm FH, Gevirtz R, Roth WT. Respiratory dysregulation in anxiety, functional cardiac, and pain disorders: assessment, phenomenology, and treatment. *Behavior Modification*, 2001, 25(4):513-545.
18. Nishino T, Shimoyama N, Ide T, Isono S. Experimental pain augments experimental dyspnea, but not vice versa in human volunteers. *Anesthesiology*, 1999, 91(6):1633-1638.
19. Anwar S, Arsalan A, Zafar H, Ahmad A, Hanif A. Effects of breathing reeducation on cervical and pulmonary outcomes in patients with non specific chronic neck pain: A double blind randomized controlled trial. *PLoS one*, 2022, 17(8):e0273471.
20. Nair SP, Panchabhai CS, Panhale V. Chronic neck pain and respiratory dysfunction: a review paper. *Bulletin of Faculty of Physical Therapy*, 2022, 27(1):21.
21. Lehrer P. Anger, stress, dysregulation produces wear and tear on the lung. *Thorax*, 2006, 61(10):833-834.
22. Sterling M, de Zoete RM, Coppieters I, Farrell SF. Best evidence rehabilitation for chronic pain part 4: neck pain. *Journal of clinical medicine*, 2019, 8(8):1219.
23. Dandale C, Telang PA, Kasatwar P. The effectiveness of ergonomic training and therapeutic exercise in chronic neck pain in accountants in the healthcare system: a review. *Cureus*, 2023, 15(3):e35762.
24. Cefali A, Santini D, Lopez G, Maselli F, Rossetini G, Crestani M, Lullo G, Young I, Dunning J, de Abreu RM, Mourad F. Effects of Breathing Exercises on Neck Pain Management: A Systematic Review with Meta-Analysis. *Journal of Clinical Medicine*, 2025, 14(3):709.

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