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Effects of Post-Isometric Relaxation with Deep Neck Flexor Exercises to Improve Occupational Neck Pain and Quality of Life in the Teaching Profession: A Randomised Controlled Trial

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ABSTRACT

Extended periods of standing, sitting, and stationary posture are associated with shoulder and neck pain, as reported by 48.7% of school instructors. In order to alleviate neck discomfort, DCF training is advised to strengthen the endurance of particular postural muscles. Therefore, the aim of the study is to assess the effects of Post isometric relaxation with Deep neck flexor (DNF) exercises to improve occupational neck pain and quality of life in Teaching Profession. A total of 80 participants selected between 25- 55 years of age. In experimental group Post Isometric Relaxation with Deep neck flexor strengthening exercises and Ergonomical advice was given to the participants. In control group Neck Stabilization exercises was given to the participants. The 40-minute intervention was administered three times a week for ten weeks. The outcomes of the intervention were assessed using NDI and WHOQOL-BREF outcome measure. Following the intervention, there was remarkable improvements across all domains: physical health increased to 73.03, psychological health to 75.73, social relationships to 74.25, and environmental satisfaction to 75.67. This study provides compelling evidence that the combination of Post Isometric Relaxation (PIR) and Deep Neck Flexor (DNF) exercises is highly effective in reducing occupational neck pain and improving quality of life among teaching professionals. The better efficacy of the PIR and DNF exercise program was shown by the comparison study, which showed that the experimental group underwent more favorable changes than the control group.

KEY WORDS: DEEP NECK FLEXOR, NECK DISABILITY INDEX, POST ISOMETRIC RELAXATION, WHOQOL-BREF, WILCOXON SIGNED RANKS TEST.

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INTRODUCTION

Non-traumatic musculoskeletal discomfort most frequently occurs in the neck. At some point in their life, almost two-thirds of the general population will have neck pain, with the prevalence being highest in middle age. The prevalence of neck discomfort has been observed to be higher in women and to have an increasing trend up to the age of 50, after which it declines. Up to 37% of people with neck discomfort experience persistent symptoms, making it a condition that places a significant financial strain on the medical system [1]. In terms of frequency, mechanical neck discomfort is second only to low back pain, and it significantly impairs the general population [2].

Musculoskeletal pain disorders are highly prevalent among school instructors, according to numerous international studies. It has been shown that compared to other occupational groups, school teachers generally report a greater prevalence of musculoskeletal problems. While the prevalence of musculoskeletal pain varied among the populations tested, it was evident that teachers had a higher probability of experiencing it (ranging from 23.7% to 95.1%) [1].

Teachers' mental health and quality of life are severely impacted by the high degree of stress they experience at work, making it one of the most stressful professions3. The primary reason for early retirement and absence in this group is musculoskeletal pain. Stress from teaching affects instructor's performance in the classroom. Teacher's jobs frequently require them to spend a lot of time with their heads lowered, such as when they are marking homework and reading a lot. In addition to instructing students, teachers are also responsible for lesson planning, grading student work, and taking part in several committees at school Due to the complexity of job tasks, this could result in negative mental and physical health consequences for teachers [1].

The most common health issues among teachers are related to their musculoskeletal system, with low back pain ranking 10th, neck pain ranking 7th, and shoulder discomfort ranking sixth. The neck, shoulders, low back, and upper limbs are the most commonly reported musculoskeletal pain sites among school teachers, perhaps due to their heavy workload and incorrect posture. 48.7% of school teachers report having neck and shoulder pain, which is linked to extended standing, sitting, and immobile posture. On the other hand, it has been claimed that between 40% and 75% of instructors experience low back pain [4].

Teachers also frequently experience upper limb pain, which has been linked to higher psychological demands when doing tasks requiring the use of the upper limbs alone. School teachers' high prevalence of musculoskeletal discomfort has been linked to a number of causes these included hard lifting, extended sitting, bad posture, anxiety, a demanding profession with a lot of work, a lack of support from peers and colleagues, and mental health issues. Risk factors for considerable musculoskeletal discomfort included age, gender, fixed posture, state of the patient's mind, and present job conditions5.

A key postural role of the deep cervical flexor (DCF) is to support and straighten the cervical lordosis. It has been discovered that some cervical spine muscles, most often the DCF, have a tendency to deteriorate in NP. In fact, there is growing data that suggests when NP sufferers are distracted, they tend to adopt a more forward head position (FHP). Cranio-cervical flexion (CCF) is the primary function of the deep cervical flexor muscle, which supports the deep cervical flexor motion segments. Therefore, DCF training is clinically advised for NP management [6]. The Deep Cervical Flexor muscles (DCF) are believed to be crucial for preserving the head-on-neck position. According to one notion, the balance between the DCFs and the stabilizers on the back of the neck would be thrown off when there was a disturbance in muscle function resulting in a loss of proper posture and alignment. This will therefore probably make cervical injury worse. Therefore, DCF training is recommended to increase the endurance of specific postural muscles in order to improve NP [7].

Effective interventions are necessary to prevent and manage occupational neck pain, reducing absenteeism and improving productivity. Thus, this study aims to investigating the effects of PIR with DNFE and contribute to the development of effective exercise programs for teaching professionals, ultimately improving their health and well-being.

MATERIAL AND METHODS

A randomized control trial comparing the effect of Post isometric relaxation with Deep neck flexor (DNF) exercises with control group was designed. This study was reviewed, discussed and approved by the Santosh Occupational Therapy institutional ethical committee (Ref No.-SCOT/NOV-24/ECOrtho-01). Based on the 80% power and an alpha value of .05 the sample size calculated to be 40 participants in each group.80 participants were selected from Arun Modern Public Senior Secondary School, North – East Delhi, Children's Valley Public School, Jagriti Public School, Nav Saraswati Inter College and Daya Public School as per inclusion and exclusion criteria. Prior to participate in the study, participants were explained about the study.

The participants provided their written consent. Convenient sampling was used to assign the individuals to the control and experimental groups. Eligible participants included male and female teachers aged between 25 and 55 iyears who experienced neck pain lasting from six weeks to three months. Additional inclusion criteria required participants

to report limited neck mobility and work-related neck discomfort.

According to the exclusion criteria, people who had a history of recent trauma, people who worked in any occupation other than teaching, people with a diagnosis of any other musculoskeletal condition, and people who had any neck pain that spread to their arms and upper extremities were not allowed to participate. The experimental group's participants received ergonomical guidance, deep neck flexor strengthening exercises, and post-isometric relaxation. Participants in the control group performed neck stabilization exercises. Both groups' participants underwent a 10i-week intervention consisting of three 40i-minute sessions each week. The WHOQOL-BREF outcome measure and the NDI were used to evaluate the intervention's results.

The Intervention Program includes Post isometric relaxation exercises - 20% maximum isometric contraction for 10i repetitions of the upper trapezius, levator scapulae, and pectoralisi major muscles, followed by 7–10i seconds of rest2, DNF exercises – These include 3 exercises, in first exercise the patient should lie on their back with their knees comfortably bent, place a little towel folded up underneath the head. After that, the patient will be told to avoid sticking out their chin by making a tiny nodding motion as though they are looking towards their toes and after holding this posture for ten seconds, the patient moves back to its initial position.

The patient is told to lie supine with their knee comfortably bent for the second exercise. The patients will be instructed to nod slightly without protruding their chins, and they will remain in this position for 10i seconds before returning to it. In Third exercise, the patient is told to lie on their side with their head hanging off the edge of the bed and the subject is required to tuck his chin in and hold it there for ten seconds. All exercises performed with ten repetitions followed by a ten-second rest. Neck Stabilization exercise - The initial 20 minutes of the session were dedicated to stretching exercises targeting the scapular region, pectoral muscles, shoulders, and neck. For the following twenty minutes, the patient does isometric neck exercises, which include flexion, extension, lateral flexion, and rotation. 10i repetitions followed by a ten-second rest in the first week and 15 repetitions in the following weeks [8].

Outcome Measures: The following outcome measurements were taken at baseline and again after 10 weeks of training. The assessment tools included Neck Disability Index (NDI)-The purpose of this questionnaire is to gather information on how your neck discomfort has impacted your capacity to function in daily life. There are ten sections in this questionnaire: Pain Intensity, Personal Care (Washing, Dressing, etc.), Lifting, Reading, Headaches, Concentration, Work, Driving, Sleeping, Recreation9 and WHOQOL – BREF -There are 26 questions. The WHOQOL-BREF (Field Trial Version) is usedi to assess an individual's qualityi of lifei across multiple dimensions. Iti provides four domain scores, each representing a specific aspect of quality of life. Each domain score reflects the individual's subjective assessment within that category. Scores are interpreted in a positive direction, meaning that higher values correspond to a better quality of life10.

RESULTS

There were 40 participants in each group (control and experimental), assuring a comparable sample size. The experimental group's average age was 36.22 years, which is marginally older than the control group's mean age of 31.85 years. The experimental group consisted of 7 males and 33 females, while the icontrol group included 6 males and 34 females. Overall, both groups were relatively similar in terms of gender distribution and age range, with only minor differences observed.

Table 1. Demographic characteristics of the participants

S. No.	Baseline Characteristics	Experimental Group	Control Group
1	No. of Subjects	40	40
2	Mean Age	36.22	31.85
3	Gender M/F	7/33	6/34

The Wilcoxoni Signed Ranks Test results showed that both thei control and experimental groups experienced statistically significant improvements in occupational neck pain and quality of life following the intervention, with p-values less than 0.001 across all measured domains (NDI, D1–D4).

A closer comparison of the Z-values between the 2 groups reveals that the experimental group demonstrated greater improvement overall. Specifically, the experimental group had more negative Z-values across all domains—NDI (-5.516), physical health (-5.523), psychological health (-5.517), social relationships (-5.520i), and environment (-5.515)—compared to the control group, whose corresponding Z-values were slightly less negative. These more negative Z-scores suggest a larger shift in post-test scores relative to pre-test scores in the experimental group. Therefore, it can be concluded that the group receiving Post Isometric Relaxation combined with Deep Neck Flexor (DNF) exercises experienced a more substantial reduction in neck pain and a more pronounced improvement in all aspects of quality of life. This indicates that the experimental group intervention was more effective than the control condition.

DISCUSSION

This study investigates the impact of combining iPost-Isometric iRelaxation (PIR) iwith Deep Neck iFlexor (DNF) exercises on ireducing occupational neck pain and improving the quality of life among teaching professionals. At baseline, the experimental group had a mean NDI score of 21.17, indicating moderate neck disability. Following the intervention involving PIR combined with DNF exercises, the mean score significantly decreased to 11.25,

corresponding to mild disability. This nearly 10i-point reduction was both statistically and clinically meaningful, highlighting notable improvements in cervical function and pain reduction [11].

Supporting these findings, Chauhan, Attrey, and Singh (2021)2 demonstrated that combining ipost-isometric relaxation with deep neck flexor exercises was more effective in relieving ipain, reducing disability, iand enhancing cervical range of motion than deep neck flexor iexercises alone in ipatients with subacute mechanical neck pain.

Table 4. Comparison of Control and Experimental Group

Stats	Control Group					Experimental Group				
	NDI (POST - TEST) - NDI (PRE - TEST)	Post-D1 - pre-D1	Post-D2 - pre-D2	Post-D3 - pre-D3	Post-D4 - pre-D4	NDI (POST - TEST) - NDI (PRE - TEST)	Post-D1 - pre-D1	Post-D2 - pre-D2	Post-D3 - pre-D3	Post-D4 - pre-D4
Z	-5.379[b]	-5.446[c]	-5.515[c]	-5.458[c]	-5.515[c]	-5.516[b]	-5.523[c]	-5.517[c]	-5.520[c]	-5.515[c]
Asymp. Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Beyond physical symptom relief, the intervention also significantly improved participants' iquality of life, as imeasured by the iWHOQOL-BREF across four idomains: physicalihealth, ipsychological well-being, isocial relationships, and ienvironmental satisfaction12. Initially, ithe experimental group scored moderately low across these domains, with physical health at 39.82, psychological health at 36.88, social relationships at 31.73, and environmental factors at 32.65, indicating moderate dissatisfaction or impairment at baseline.

Following the intervention, post-test scores showed remarkable improvements across all domains: physical health increased to 73.0i3, psychological health to 75.73, social relationships to 74.25, and environmental satisfaction to 75.67. These post-test scores not only reflect statistically significant gains ($p < 0.001$ across all domains) but also indicate a near-doubling of satisfaction levels in certain aspects of life, particularly in social and psychological domains. Zivkovic et al. conducted a study on Relationship Between Physical Activity and Quality of Life in High School Educators which provides new insights into how occupational inactivity affects this particular workforce3. The findings revealed gender differences in quality of life: female teachers reported higher satisfaction in social relationships and environmental domains, whereas male teachers demonstrated better quality of life in physical and psychological health areas [13].

The robustness of these outcomes is further demonstrated through inon-parametric istatistical ianalysis usingi the Wilcoxoni Signedi Ranksi Test. In the experimental group, all 40i participants exhibited a reduction in neck disability, with no instances of worsening or unchanged symptoms. The corresponding Z-value for the NDI was -5.516, and the p-valuei was lessi thani 0.001, iindicating an extremely isignificant shift unlikely to be due to chance. Similarly, in the iquality-of-lifei domains, every participant ini the iexperimental igroup showed improvement—40 out of 40 had positive rank changes in D1 through D4, with mean ranks of 20.50 and no negative ranks or ties. Z-values were -5.523 for physical health, -5.517 for psychological health, -5.520 for social relationships, and -5.515 fori environmental satisfaction, all with p values below 0i.0i0i1. These consistently strong negative Z-values across all measures provide unequivocal support for the efficacy of the PIR plus DNF intervention.

Moreover, a comparative analysis between the experimental and control groups adds another layer of evidence favouring the intervention. While the control group also demonstrated some level of improvement, likely due to the passage of time or generic interventions, the gains observed in the experimental group were markedly superior. This is evident from the fact that the Z-values for thei experimentali groupi werei more strongly negative thani thosei in the control igroup, highlighting a more substantial shift in both NDI and WHOQOL– BREF scores. In terms of hypothesis testing, the null hypothesis—that PIR combined with DNF exercises would have no significant effect on neck disability and quality of life—was clearly rejected. Instead, the alternate hypothesis was strongly supported, with all outcome measures pointing toward the intervention's effectiveness. These findings suggest that incorporating PIR techniques alongside DNF strengthening exercises may offer a more holistic and powerful approach to treating work-related neck pain than traditional single-component strategies.

These results are statistically robust, clinically meaningful and consistent across all participants, suggesting that this protocol could serve as an effective model for managing occupational neck pain in similar populations. The study thus contributes valuable insights to the existing body of literature and encourages broader implementation of multi-

dimensional rehabilitation strategies in occupational health settings. The Limitation of this study is it did not have a sufficient follow-up period to assess the long-term effects of the combination of Post Isometric Relaxation (PIR) and Deep Neck Flexor (DNF) iexercises iand Only Teaching Profession was considered. Future research could include the investigation of the effectiveness of delivering DNF and PIR exercises through mobile health applications or virtual platforms to increase accessibility for teachers with time constraints and could also include the assessment of participants in the middle of intervention period and other Professions could be taken into consideration.

CONCLUSION

This study provides compelling evidence that the combination of Post Isometric iRelaxation i (PIR) and iDeep Neck Flexor (DNF) exercisesi is highly effective in ireducing occupational neck ipain and iimproving quality of life among teaching professionals. Significant improvements were observed in neck disability and WHOQOL-BREF scores, following the intervention. The consistent statistical significance across all measures, with Z-values strongly negative and p-values below 0i.0i0i1, confirms that these improvements are unlikely to be due to chance. Comparative analysis demonstrated that the experimental group experienced greater positive changes than the control group, underscoring the superior effectiveness of the PIR and DNF exercise regimen.

Ethical Clearance:
Ref No.-SCOT/NOV-24/ECOrtho-01 ,11/11/2024.

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