International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 24s, 2025
https://theaspd.com/index.php

Effects Of Combined Motor Imagery And Deep Neck Flexor Training On Kinesiophobia And Function In Chronic Neck Pain: A Pilot Study

Sakshi Arora[1], Krishna V. Reddy[2], Niranjan Kaushik[3]

[1]Department Of Physiotherapy, Phd Scholar, School of Allied Health Sciences, Galgotias University, Greater Noida 203201, Uttar Pradesh, India, Sakshi.arora@galgotiasuniversity.edu.In
[2]Department Of Physiotherapy, Professor, School of Allied Health Sciences, Galgotias University, Greater Noida 203201, Uttar Pradesh, India, V.reddy@galgotiasuniversity.edu.In
[3]Department Of Pharmacy, Professor, School of Pharmacy, Galgotias University, Greater Noida 203201, Uttar Pradesh, India, Niranjan.kaushik@galgotiasuniversity.edu.In

Abstract

Background: *Chronic neck pain (CNP) is associated with functional impairment and kinesiophobia. Although Deep Neck Flexor (DNF) training has established itself on rehabilitation grounds, new evidence suggests that, through the rearrangement of central motor circuits, motor imagery (MI) can enhance outcomes.*

Objective: *The purpose of the study is to determine the effect of deep neck flexor training and motor imagery combined in reduction of kinesiophobia and improving the level of functioning in patients with chronic neck pain.*

Methodology: *Chronic neck pain was chosen, and twenty participants were randomly divided into two groups including Control (DNF only) and Experimental (MI + DNF training). The intervention took four weeks. As outcome measures both the Neck Disability Index (NDI) and the KINESIOPHOBIA measuring (TSK) scale were given before and after the intervention.*

Results: *NDI and TSK showed an improvement of a greater value in the experimental group (NDI = 10.93; TSK = 6.24) than in the control group (NDI = 6.75; TSK = 3.59). The result indicated statistically significant differences between and within groups ($p < 0.05$).*

Conclusion: *Deep Neck Flexor training and Motor Imagery can address functional outcomes and reduce kinesiophobia in patients experiencing chronic neck pain.*

Keywords: *kinesiophobia, deep neck flexor training, motor imagery, chronic neck discomfort, and neck disability index*

1.INTRODUCTION

Chronic neck pain (CNP) is a musculoskeletal disorder that is known to afflict 30-50 percent of the global adult population annually making it a leading cause of disability especially among the sedentary community or members of occupations that demand prolonged exposure to sitting at a computer [1]. One of the most common issues associated with the disorder is the structural, functional, and psychological changes, including a reduction in the deep cervical muscle activation, the proprioception change, and the development of maladaptive attitudes including kinesiophobia and fear-avoidance behaviour [2,3].

Such fear of movement that is caused by anticipation of pain or damage and referred to as kinesiophobia curtails physical activity, magnifies muscular dysfunction, and increases pain cycles into chronicity and disability [4,5]. Kinesiophobia has been studied in musculoskeletal rehabilitation research, where the Tampa Scale of Kinesiophobia (TSK) has been widely used, as it is a valid instrument [6]. Functional ability on the other hand is measured using Neck Disability Index (NDI) which is an index commonly used to measure disability [7].

Therapeutic exercise continues to influence the management process of CNP. Deep neck flexor (DNF) training is a well-researched way of strengthening deep cervical flexors such as longus colli and longus capitis, which are often limited in CNP [8,9]. With specific DNF exercises, cervical stability and motor control are reinstated, reduced pain, and improved function.

METHODOLOGY

A randomized, comparative pilot study was conducted to evaluate the effects of combining Motor Imagery (MI) with Deep Neck Flexor (DNF) training on kinesiophobia and functional disability in individuals with chronic neck pain (CNP). The study duration was 4 weeks, and participants were randomly allocated into two groups: Experimental (MI + DNF) and Control (DNF only).

Participants

A total of 20 participants (n = 10 per group) were recruited using convenience sampling from the physiotherapy outpatient department of Galgotias University, Greater Noida, U.P. Informed consent was obtained from all participants. Subjects aged 25 to 50 years diagnosed with chronic mechanical neck pain (duration ≥ 3 months) with Neck Disability Index (NDI) score ≥ 20% and Tampa Scale for Kinesiophobia (TSK) score ≥ 25 were included in the study. Also, those who were able to follow verbal commands and perform exercises were included. Subjects with a history of cervical spine surgery or fracture, any neurological disorders (e.g., cervical radiculopathy, myelopathy), Vestibular dysfunction, Systemic conditions affecting the musculoskeletal system (e.g., rheumatoid arthritis), recent trauma or whiplash injury. Participants on psychotropic medications or under psychological therapy. The study protocol was reviewed and approved by the Institutional Ethics Committee DEC/FEA/PT/05/25. Participants were informed of their right to withdraw at any time without any consequences.

Randomization and Group Allocation

Participants were randomly assigned using a sealed envelope method into: Group A (Experimental): Received Motor Imagery + Deep Neck Flexor Training and Group B (Control): Received Deep Neck Flexor Training only

Intervention Protocol (4 Weeks)

Common Protocol for Both Groups:

- 5 sessions/week for 4 weeks (total 20 sessions) each session: 35 minutes
- Standard physiotherapy warm-up and ergonomic advice included

Group A – Experimental Group (MI + DNF Training):

1. Motor Imagery Training (10–15 mins/session):
- Guided imagery with a structured audio script
- Rehearsal: chin tuck, cervical nod, rotation
- 5 repetitions of each movement

2. Deep Neck Flexor (DNF) Training (15–20 mins/session):
- Crook lying position with pressure cuff (20 mmHg baseline)
- Chin tuck, hold 10 sec, 10 repetitions, progressing from 22 to 30 mmHg

Group B – Control Group (DNF Training Only):

- Same DNF protocol as above, without any Motor Imagery

Outcome Measures were Neck Disability Index (NDI): Measures functional disability; 10-item questionnaire, Tampa Scale for Kinesiophobia (TSK): 17-item self-report questionnaire; higher scores indicate greater fear of movement. Both outcomes were measured pre and post-intervention (after 4 weeks)

Data Analysis

Data analysed using SPSS v26.0. Paired t-tests used for within-group comparison; independent t-tests for between-group differences. Statistical significance set at $p < 0.05$.

RESULTS

Variables	Mean ± SD
Age (yrs)	35 ± 7
Gender (N=20)	M(12), F(8)
Pain Duration(months)	18±5

There was no significant difference in age and gender representation between the two groups, which means that the baseline demographics were well matched and did not have a likelihood of affecting results.

Internal validity will be enhanced since the gender ratio is approximately equal and the average age of both groups is not so different approximately 35 years.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 24s, 2025
https://theaspd.com/index.php

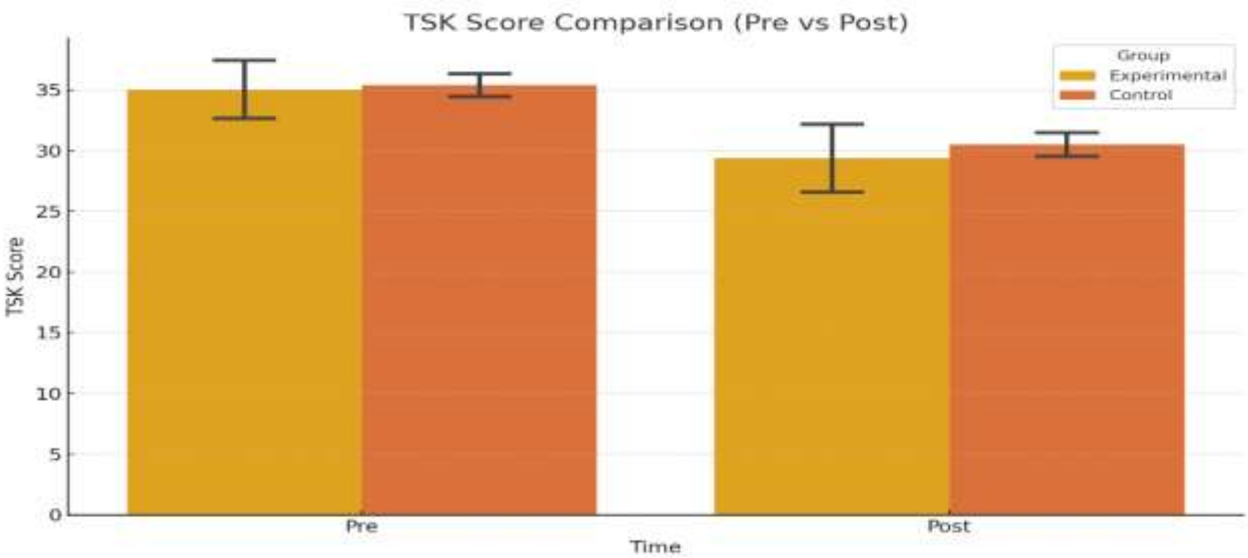
Primary Outcomes

Measure	Pre-Intervention	Post-Intervention	p-value
NDI (INTERVENTION)	42.6 ± 2.9	31.7 ± 4.2	<0.001
TSK (INTERVENTION)	35.6 ± 2.9	29.4 ± 2.7	<0.001
NDI (CONTROL)	32.5 ± 3.9	39.2 ± 3.4	<0.001
TSK (CONTROL)	34.7 ± 2.5	31.1 ± 2.8	<0.001

Pre-Post Measures (Within-Group Comparisons)

Outcome	Group	Pre (Mean ± SD)	Post (Mean ± SD)	p-value (within group)
NDI	Experimental	42.6 ± 2.9	31.7 ± 4.2	<0.001
NDI	Control	39.2 ± 3.4	32.5 ± 3.9	<0.01
TSK	Experimental	35.6 ± 2.9	29.4 ± 2.7	<0.001
TSK	Control	34.7 ± 2.5	31.1 ± 2.8	<0.01

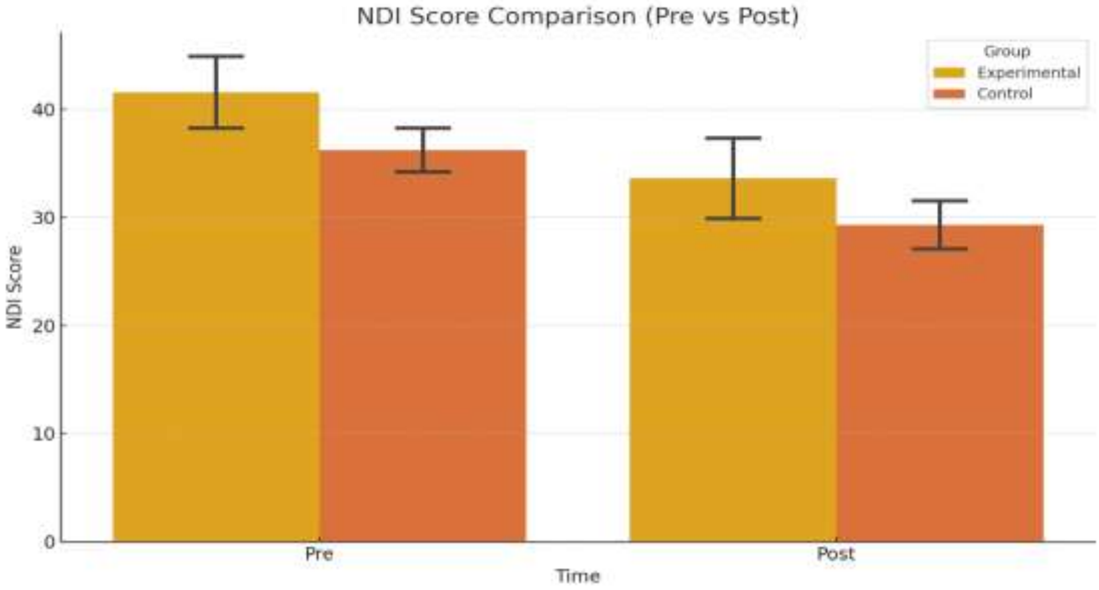
The NDI (Neck Disability Index) measurements of both groups decreased significantly indicating that the two interventions improved functional activities.
The **experimental group** showed a larger reduction (from 42.6 to 31.7), suggesting more improvement and the control group improved (having increased by 39.2 to 32.5), at a slightly lesser rate. A rather noteworthy reduction in TSK (Tampa Scale for kinesiophobia) indices was also registered implying the reduction of the fear of movement:
There was an improvement in the experimental subgroup, 35.6 to 29.4.
The control group improved between 34.7 to 31.1.



Both groups had significant p-values of less than <0.001 and <0.01, which helped determine the statistical

Outcome	Mean Difference (Exp – Ctrl)	t-value	p-value
NDI	-4.7	2.54	0.02*
TSK	-2.9	2.12	0.045*

Between Group Comparisons (Post Scores)



The experimental group significantly improved in comparison with the control group after 4 weeks of the intervention. The NDI displayed better functional recovery as its average post-intervention score was 4.7 points below the average of the control group. There was a greater reduction of TSK by 2.9 points in the kinesiophobia of the experimental group compared to that of the control group.

These differences occur and are statistically significant as is seen in the p-values (0.02 and 0.045) which further confirms that combination of Deep Neck Flexor training and Motor Imagery gave better results when compared to Deep Neck Flexor training alone.

Meaning statistically significant differences, the presence of a will demonstrate vastly important variations at the $p < 0.05$ level, implying that the results will be probably unlikely to be due to accident. Throughout the four weeks, both interventions effectively reduced kinesiophobia and neck impairment but there was a significantly superior improvement in the psychological preparedness (TSK) and physical functioning (NDI) using the combination of DNF training and motor imagery.

These findings give relevance to the application of a multimodal undertaking as they have considered both the psychological and the physical components of chronic neck rehabilitation pain. The significance of within-group changes in both NDI and TSK.

DISCUSSION

According to the results of the pilot study, persons with chronic neck pain reported a major reduction in kinesiophobia and functional impairment in the case of using only DNF training and in combination with MI + DNF. The increase in NDI and TSK, respectively of every group, was confirmed by significant results indicating the effectiveness of both interventions. The experimental group was somewhat better also, so there might be some additive benefits of motor imagery even though the between-groups comparisons were not significant.

A decline in NDI score implies that there is an increase in cervical functioning and daily living skills. This improvement was likely caused in large part by DNF training, which is known to enhance postural stability as well as neuromuscular control [8,9]. It may also be facilitated by adding Motor Imagery, which contributes to the motor planning and cortical excitability [10,11].

Reduction in the level of TSK scores also demonstrates that movement anxiety has decreased, and it is one of the barriers known to affect CNP recovery [4,6]. To reduce emotional and cognitive barriers that enable chronicity, MI could help to dissociate the anticipation of pain with movement [13,14]. This psychological reconditioning could lead to an encouraging loop of rehabilitation which will in turn lead to the enhancement of physical activities.

These findings are in line with the previous studies which indicated the effectiveness of the MI in stroke and orthopaedic patients [11,15,16]. Since the application of MI in the treatment of musculoskeletal pain rehabilitation is an emerging field, our findings further add to the growing body of evidence that encourages the implementation of MI.

The absence of statistically significant intergroup effects should, however, be considered with caution. The low sample size constricts the statistical power and the short follow-up period may be insufficient to obtain the benefits of central nerve modulation. The brain correlates of such gains could be explained by neuroimaging, longer follow-up, and larger cohorts in the future.

In clinical practice, the possible use of MI as part of standard physiotherapy procedures CNP can offer a cheap, non-invasive, and scalable solution to enhance outcomes, especially among patients with low rates of active therapy adherence or fear-avoidant personality.

Conclusion

Motor imagery and Deep Neck Flexor training complement each other in their effectiveness to enhance functional outcomes and reduce kinesiophobia among individuals with chronic neck pain. These findings support the multidimensional approach toward CNP rehabilitation, which is more embrarkatory in nature where both central and peripheral approaches are integrated.

Limitations

This study is subject to several limitations. First, the small sample size restricts the statistical power and limits the generalizability of the findings to the broader population. Second, the intervention was conducted over a short duration of four weeks, which may not be sufficient to capture long-term outcomes or sustained effects. Lastly, the lack of blinding among both participants and evaluators introduces the potential for performance and detection bias, which may have influenced the results.

REFERENCES

1. Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. European spine journal. 2006 Jun;15:834-48.
2. Jull G, Sterling M, Kenardy J, Beller E. Does the presence of sensory hypersensitivity influence outcomes of physical rehabilitation for chronic whiplash?–A preliminary RCT. Pain. 2007 May 1;129(1-2):28-34.
3. Sterling M, Jull G, Wright A. Cervical mobilisation: concurrent effects on pain, sympathetic nervous system activity and motor activity. Manual therapy. 2001 May 1;6(2):72-81.
4. Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain. 2000 Apr 1;85(3):317-32.
5. Leeuw M, Goossens ME, Linton SJ, Crombez G, Boersma K, Vlaeyen JW. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. Journal of behavioral medicine. 2007 Feb;30:77-94.
6. Swinkels-Meewisse IE, Roelofs J, Oostendorp RA, Verbeek AL, Vlaeyen JW. Acute low back pain: pain-related fear and pain catastrophizing influence physical performance and perceived disability. Pain. 2006 Jan 1;120(1-2):36-43.
7. Vernon H. The Neck Disability Index: state-of-the-art, 1991-2008. Journal of manipulative and physiological therapeutics. 2008 Sep 1;31(7):491-502.
8. Falla DL, Jull GA, Hodges PW. Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. Spine. 2004 Oct 1;29(19):2108-14.
9. Jull G, Kristjansson E, Dall'Alba P. Impairment in the cervical flexors: a comparison of whiplash and insidious onset neck pain patients. Manual therapy. 2004 May 1;9(2):89-94.
10. Decety J. Do imagined and executed actions share the same neural substrate?. Cognitive brain research. 1996 Mar 1;3(2):87-93.
11. Lotze M, Halsband U. Motor imagery. Journal of Physiology-paris. 2006 Jun 1;99(4-6):386-95.
12. Jackson PL, Lafleur MF, Malouin F, Richards C, Doyon J. Potential role of mental practice using motor imagery in neurologic rehabilitation. Archives of physical medicine and rehabilitation. 2001 Aug 1;82(8):1133-41.
13. Malouin F, Richards CL. Mental practice for relearning locomotor skills. Physical therapy. 2010 Feb 1;90(2):240-51.
14. Lesur MR, Weijs ML, Simon C, Kannape OA, Lenggenhager B. Psychometrics of disembodiment and its differential modulation by visuomotor and visuotactile mismatches. IScience. 2020 Mar 27;23(3).
15. Schwoebel J, Friedman R, Duda N, Coslett HB. Pain and the body schema: evidence for peripheral effects on mental representations of movement. Brain. 2001 Oct 1;124(10):2098-104.
16. Moseley GL. Graded motor imagery is effective for long-standing complex regional pain syndrome: a randomised controlled trial. Pain. 2004 Mar 1;108(1-2):192-8.
17. MacIntyre TE, Calogiuri G, Donnelly AA, Warrington G, Beckmann J, Lahart I, Brick N. Societal challenges, methodological issues and transdisciplinary approaches. InPhysical Activity in Natural Settings 2019 Oct 8 (pp. 15-35). Routledge.
18. Carrasco DG, Cantalapiedra JA. Effectiveness of motor imagery or mental practice in functional recovery after stroke: a systematic review. Neurología (English Edition). 2016 Jan 1;31(1):43-52.
19. Stanton TR, Latimer J, Maher CG, Hancock MJ. How do we define the condition 'recurrent low back pain'? A systematic review. European Spine Journal. 2010 Apr;19:533-9.
20. Tsao H, Hodges PW. Immediate changes in feedforward postural adjustments following voluntary motor training. Experimental brain research. 2007 Aug;181:537-46.
21. Moseley GL, Flor H. Targeting cortical representations in the treatment of chronic pain: a review. Neurorehabilitation and neural repair. 2012 Jul;26(6):646-52.

22. Vogt S, Thomaschke R. From visuo-motor interactions to imitation learning: behavioural and brain imaging studies. Journal of sports sciences. 2007 Mar 1;25(5):497-517.
23. Deconinck FJ, Smorenburg AR, Benham A, Ledebt A, Feltham MG, Savelsbergh GJ. Reflections on mirror therapy: a systematic review of the effect of mirror visual feedback on the brain. Neurorehabilitation and neural repair. 2015 May;29(4):349-61.
24. Van Dieën JH, Reeves NP, Kawchuk G, Van Dillen LR, Hodges PW. Analysis of motor control in patients with low back pain: a key to personalized care?. Journal of orthopaedic & sports physical therapy. 2019 Jun;49(6):380-8.