EFFICACY OF GRADED MOTOR IMAGERY COMBINED WITH CONVENTIONAL EXERCISES IN INDIVIDUALS WITH CHRONIC NON-SPECIFIC NECK PAIN: A RANDOMIZED EXPERIMENTAL STUDY

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Abstract: Chronic non-specific neck pain (CNSNP) is a common musculoskeletal disorder that causes pain, disability, and reduced quality of life. This study aimed to compare the effectiveness of Graded Motor Imagery (GMI), Conventional Exercises (CE), and GMI combined with Conventional Exercises in individuals with chronic non-specific neck pain. A randomized experimental study was conducted among 30 participants aged 18–30 years, who were randomly assigned to three groups (n = 10 each). Group A received GMI, Group B received Conventional Exercises, and Group C received a combination of GMI and Conventional Exercises for 4 weeks. Outcome measures included the Neck Disability Index (NDI), Numeric Pain Rating Scale (NPRS), and Pressure Pain Threshold (PPT). Statistical analysis was performed using one-way ANOVA followed by Tukey's post hoc test ($p < 0.05$). All groups showed significant improvement after the intervention. However, the combined intervention group demonstrated greater improvements in pain reduction, functional disability, and pressure pain threshold compared with the other groups. The findings suggest that combining Graded Motor Imagery with Conventional Exercises is an effective rehabilitation approach for managing chronic non-specific neck pain.

INTRODUCTION

Chronic non-specific neck pain (CNSNP) is one of the most common musculoskeletal disorders worldwide and a major cause of pain, disability, and reduced quality of life. It is defined as pain in the cervical region persisting for more than three months without any specific pathological cause. The increasing use of computers and smartphones, poor posture, repetitive occupational activities, and sedentary lifestyles have contributed to the growing prevalence of chronic neck pain, particularly among young adults.

The etiology of chronic non-specific neck pain is multifactorial, involving peripheral musculoskeletal dysfunction as well as alterations in central pain processing. Conventional physiotherapy, including cervical range-of-motion exercises, stretching, strengthening exercises, and postural correction, is widely used to reduce pain and improve functional ability. However, persistent symptoms are frequently observed because conventional rehabilitation primarily targets peripheral impairments and may not adequately address cortical reorganization and central sensitization associated with chronic pain.

Graded Motor Imagery (GMI) is a neuroscience-based rehabilitation approach consisting of left–right discrimination, explicit motor imagery, and mirror therapy. It aims to improve cortical representation, reduce pain, and restore normal movement without provoking symptoms. Recent studies have reported beneficial effects of GMI in chronic musculoskeletal pain conditions, suggesting that combining GMI with conventional physiotherapy may enhance treatment outcomes.

However, limited evidence is available comparing the effectiveness of Graded Motor Imagery alone, Conventional Exercises alone, and their combined application in individuals with chronic non-specific neck pain, particularly in the Indian population. Therefore, the present study was undertaken to compare the effectiveness of Graded Motor Imagery, Conventional Exercises, and their combination on pain intensity, functional disability, and pressure pain threshold in individuals with chronic non-specific neck pain. The findings of this study may help physiotherapists identify a more effective rehabilitation approach for managing chronic non-specific neck pain.

Aim and Objectives of the Study

Aim

To compare the effectiveness of **Graded Motor Imagery, Conventional Exercises, and their combination** in individuals with chronic non-specific neck pain.

Objectives

- To assess pain intensity, functional disability, and pressure pain threshold before and after the intervention.
- To compare the effectiveness of **Graded Motor Imagery, Conventional Exercises, and their combination** in individuals with chronic non-specific neck pain.

METHODOLOGY

The present study was a **randomized experimental study with a pre-test and post-test design** conducted to compare the effectiveness of **Graded Motor Imagery (GMI), Conventional Exercises (CE), and Graded Motor Imagery combined with Conventional Exercises** in individuals with chronic non-specific neck pain. The study was carried out at the **Outpatient Department of Physiotherapy, ACS Medical College and Hospital, Chennai, Tamil Nadu, India**, after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to the commencement of the study.

A total of **30 participants** aged **18–30 years** with chronic non-specific neck pain of more than three months' duration were recruited using **convenience sampling**. Eligible participants were randomly allocated into three groups (**n = 10 each**) using the **lottery method**. Group A received **Graded Motor Imagery**, Group B received **Conventional Exercises**, and Group C received **Graded Motor Imagery combined with Conventional Exercises**. Each intervention was administered under physiotherapist supervision for **45 minutes per session, five sessions per week, for four consecutive weeks**.

Pain intensity, functional disability, and pressure pain threshold were assessed before and after the intervention using the **Numeric Pain Rating Scale (NPRS)**, **Neck Disability Index (NDI)**, and **Pressure Pain Threshold (PPT)** measured with a digital algometer, respectively. The collected data were analyzed using **IBM SPSS Statistics Version 24.0**. Descriptive statistics were expressed as

mean and standard deviation. **One-way Analysis of Variance (ANOVA)** followed by **Tukey's post hoc test** was used to compare the outcomes among the three groups. A **p-value < 0.05** was considered statistically significant.

RESULTS AND DISCUSSION

A total of **30 participants** with chronic non-specific neck pain completed the study and were equally distributed into three groups: **Group A (Graded Motor Imagery), Group B (Conventional Exercises), and Group C (Graded Motor Imagery combined with Conventional Exercises)**. Baseline characteristics were comparable among the groups ($p > 0.05$). Following four weeks of intervention, all groups demonstrated significant improvements in **Neck Disability Index (NDI), Numeric Pain Rating Scale (NPRS), and Pressure Pain Threshold (PPT)**. However, **Group C showed the greatest improvement** compared to Groups A and B.

Table 1. Comparison of Pre- and Post-test Mean Scores of NDI, NPRS and PPT

Outcome	Time	Group A	Group B	Group C	*p* value
NDI	Pre	38.92 ± 14.26	38.85 ± 10.02	38.26 ± 12.34	0.991
	Post	29.03 ± 10.37	26.66 ± 6.27	**21.04 ± 4.23**	**0.049***
NPRS	Pre	7.30 ± 1.49	7.10 ± 1.37	7.10 ± 0.87	0.921
	Post	4.90 ± 1.44	4.20 ± 1.13	**3.70 ± 0.95**	**0.049***
PPT	Pre	1.87 ± 0.08	1.86 ± 0.53	1.90 ± 0.51	0.976
	Post	2.52 ± 0.48	3.92 ± 0.44	**4.40 ± 0.44**	**<0.001***

Values are expressed as Mean ± SD. $p < 0.05$ indicates statistical significance.

Table 2. Post Hoc Comparison of Post-test Scores

Comparison	NDI (*p*)	NPRS (*p*)	PPT (*p*)
Group A vs Group B	0.718	0.286	<0.001*
Group A vs Group C	**0.049***	**0.049***	<0.001*
Group B vs Group C	0.189	0.520	0.077

NS – Not Significant; $p < 0.05$ indicates statistical significance.

The present study demonstrated that all three interventions significantly improved pain, functional disability, and pressure pain threshold. However, **Graded Motor Imagery combined with Conventional Exercises** produced greater improvements than either intervention alone. These findings support the effectiveness of combining neuroscience-based rehabilitation with conventional physiotherapy for the management of chronic non-specific neck pain.

The findings are consistent with **Moseley (2006)**, who reported that graded motor imagery reduces pain by improving cortical reorganization. Similarly, **Mueller et al. (2023)** concluded that exercise-based rehabilitation significantly improves pain and functional outcomes in individuals with chronic non-specific neck pain, supporting the benefits of combining exercise with motor imagery techniques.

The study was limited by the **small sample size, short intervention duration, and lack of long-term follow-up**, which may limit the generalizability of the findings.

Future studies should include **larger sample sizes, longer intervention periods, and long-term follow-up** to further establish the effectiveness of combined Graded Motor Imagery and Conventional Exercises in individuals with chronic non-specific neck pain.

Conclusion

The present study concludes that **Graded Motor Imagery combined with Conventional Exercises** is more effective than Graded Motor Imagery or Conventional Exercises alone in reducing pain, improving functional disability, and increasing pressure pain threshold in individuals with chronic non-specific neck pain. Although all three interventions produced significant clinical improvements, the combined intervention demonstrated superior outcomes, suggesting that addressing both central pain mechanisms and peripheral musculoskeletal impairments enhances rehabilitation effectiveness. Therefore, the integration of Graded Motor Imagery with Conventional Exercises may be considered an effective and evidence-based physiotherapy approach for the management of chronic non-specific neck pain.

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