



# Immediate Effect of Deep Neck Muscles Activation on Migraine Headaches in Students

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## Abstract

**Background:** Migraine is a common episodic neurological disorder with complex pathophysiology that manifests as recurrent attacks of typically throbbing and unilateral, often severe headache with associated features such as nausea, phonophobia, and photophobia. It has been found that neck pain has a significant link with migraine headaches. It is necessary to provide an adjunctive treatment to help reduce the occurrence and adverse effects of migraine headaches. This study aims to establish the effect of neck muscles activation on migraine headaches in students. **Aim:** To determine the immediate effect of deep neck muscles activation on migraine headaches in students. **Methods:** A total 35 subjects between 18–25 years diagnosed with migraine were selected for study. Subjects received exercises for deep neck muscle activation. Each session was conducted for 30 minutes duration, 4 days per week for 3 weeks. Outcome measure used was Migraine Disability Index scale (MIDAS). **Statistical Analysis:** Statistical analysis was done using unpaired t test. **Results:** The results of the study demonstrate that there was a significant effect of the deep neck muscles activation on MIDAS scores ( $p = 0.0031$ ), frequency of headaches ( $p = 0.0138$ ) and intensity of pain experienced during migraine headaches ( $p < 0.0001$ ) during the pre and post intervention assessment. **Conclusion:** Activation of deep neck muscles effectively reduced the disability caused by migraine, frequency of headaches and intensity of pain experienced during migraine headaches in students.

**Keywords:** Deep Neck Muscles Activation, Migraine, Migraine Disability Index Scale, Students

## 1. Introduction

Migraine is defined as a common episodic neurological disorder manifesting as recurrent attacks of typical throbbing and unilateral severe headache with associated features such as nausea, phonophobia and photophobia<sup>1</sup>. Migraine can be classified into two types depending on occurrence of transient neurological symptoms. Migraine without aura are migraine headaches which occur without any premonitory symptoms. Migraine with aura are migraine headaches which are preceded by transient neurological symptoms lasting for about 20–30 mins which may be accompanied with difficulty in reading (more frequently encountered), speech such as difficulty in speaking, increased emotionality and sensory hypersensitivity. It has been demonstrated that sensory stimuli hypersensitivity occurs between attacks in migraineurs<sup>1</sup>. Migraine headaches can be triggered by a number of internal and external factors. Common trigger factors of migraine include stress, sleep deprivation, cigarette smoking, exertional activities, fasting, certain fragrances and pre-menstrual period to an extent<sup>2</sup>. Migraine attacks can occur at any age. However, they are known

to peak between early to mid-adolescence age. These attacks are considered to be episodic and vary within and among patients<sup>3</sup>. For quantifying migraine headache burden, disability caused by headaches is focused. An individual's reduced ability to perform, known as impairment, can be assessed with the help of disability measures. MIDAS questionnaire i.e., Migraine Disability Assessment is the most commonly employed instrument used to detect the effects of migraine. It comprises of 5 questions which records information about how migraine affects 3 areas resulting in days lost and decreased productivity: academic work, household work and social activities. The MIDAS score is calculated on basis of the total number of work days lost due to migraine headaches. The score also includes the total days when the productivity lowered to a minimum of half of the actual productivity. Further 2 questions based on the frequency and intensity of pain are also included which are not integrated in the MIDAS score. The MIDAS score is classified into a 4-point grading system – Grade I – the MIDAS scores range between 0–5 → little or no disability

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Grade II – the MIDAS scores range between 6–10 → mild disability

Grade III – MIDAS scores range between 11–20 → moderate disability

Grade IV – the MIDAS score is more than 21 → severe disability<sup>5</sup>

It has been reported that migraine headaches are remarkably seen in the ophthalmic distribution of the trigeminal nerve, yet some migraineurs have described pain to be felt in the neck (39.7%), and occiput (39.8%) during their migraine attacks. Certain researchers have reported that neck pain is considered to be a common and vital feature of migraine and people who have high muscle tension in the neck are more prone to the occurrence of migraine headaches. The studies report that neck pain could be either as an originating site of pain radiating and resulting in migraine or as an additional site of pain with acute migraine attack<sup>6</sup>.

Migraine headaches can be managed either pharmacologically or by using non pharmacological therapies. Pharmacological therapy comprises of taking drugs which can be divided into drugs taken daily where or not the headache is present to reduce the severity of attacks and drugs taken to treat attacks as they arise. Commonly employed method of managing migraine is with the help of medication, but some patients are unable to tolerate acute/prophylactic medications. Nonpharmacologic therapies are given to such patients. These include educating the patient about the disorder and mechanism of migraine, changes in lifestyle to avoid triggers of migraine as well as educating the patients about the possible approaches for migraine treatment<sup>3</sup>. Many studies have documented the effects of manual therapies as an adjunctive treatment for migraine<sup>4</sup>. In a study conducted among European population to determine the role of exercise in migraine, it was documented that isometric neck exercises play an important role in providing treatment for migraine associated with neck pain<sup>9</sup>. It is necessary and of utmost importance to devise an intervention to help reduce the intensity as well as the frequency of migraine headaches in students. Hence, this study is conducted to determine the effect of deep neck muscles activation on migraine headaches and provide an adjunctive treatment for pharmacological therapies.

## 2. Materials and Methods

### 2.1 Participant Selection

All students between the age of 18–25 years in Krishna college of physiotherapy who were suffering from migraine headaches were identified as the target population.

### 2.2 Duration and Type of Study

An experimental study was carried out in which effect of deep neck muscle activation was checked on migraine headache

with the help of MIDAS questionnaire as the outcome measure. Study duration was from December 2020 to May 2021.

### 2.3 Sampling Method

The participants were selected using the stratified sampling method, a method of simple random sampling technique according to the inclusion and exclusion criteria.

### 2.4 Sample Size Calculation

Formula for sample size

$$N = \frac{Z^2pq}{L^2}$$

Z = standard normal variate at 95% confidence interval

p = estimated prevalence for migraine by using reference studies

$$= 2.34$$

q = 100-p = no prevalence

$$= 100-p = 100-2,34 = 97.66$$

L = allowable error = 5%

$$N = \frac{(1.96)^2(2.34)(97.66)}{(5)^2}$$

$$= \frac{877.53}{25} = 35$$

Source: Raieli V, Raimondo D, Cammalleri R, Camarda R. Migraine headaches in adolescents: a student population-based study in Monreale. Cephalalgia. 1995 Feb;15(1):5–12.

### 2.5 Inclusion Criteria

1. Participants experiencing migraine headaches for more than 3 months
2. Students between the age group of 18–24 years
3. Having no associated disorders or cervical spine or TMJ

### 2.6 Exclusion Criteria

1. Participants taking certain medications for systemic illness/ disorders
2. Participants diagnosed with other conditions of head or neck

### 2.7 Data Collection Procedure

The students between the age of 18–26 studying in Krishna college of physiotherapy were scanned. Those who were diagnosed with migraine for more than 3 months were chosen for the study. The participants were explained about the MIDAS questionnaire and treatment to be given in detail.

About 100 participants had enrolled for the study out of which 35 were selected on basis of the sample size. The participants were administered with the consent form followed by MIDAS questionnaire, on basis of which 3 components were used as outcome measures – MIDAS score, frequency of headaches and intensity of pain experienced during migraine headaches. The exercise protocol was explained to the participants along with the duration for which the treatment will last. Following 3 weeks of protocol administration, MIDAS questionnaire was given to check the pre-intervention and post-intervention values thus determining the effect of the exercise protocol.

The study was conducted after the permission was acquired from the respected authorities. MIDAS questionnaire was used. The questionnaire consisted of 5 questions total of which is called the MIDAS with an additional 2 questions for recording the frequency and intensity of migraine headache pain. The process of the study was duly explained to the selected participants. The study was undertaken following approval granted from the Institutional Ethical Committee of Krishna Institute of Medical Sciences “Deemed to be University” Karad.

### 2.8 Migraine Diagnosis

The International Criteria for Diagnosis of Headaches (ICHD-IIR1) was used<sup>14</sup>.

## 3. Protocol

Techniques	Application
Hot moist pack application	10 minutes on cervical region and upper trapezius region on both sides
Cervical muscle strengthening	Isometrics for Neck flexors, Neck Extensors, Lateral flexors and rotators – 10 seconds hold and relax x 3 sets of each <sup>13</sup>
Stretching	Neck flexors, extensors, lateral flexors and rotators – 10 seconds hold and relax x 3 sets
Postural Correction	Biofeedback using Mirror training by correcting forward head posture and rounded shoulders
Exercises	Chin tuck exercises – 3 sets x 10 counts each set

### 3.1 Outcome Measures

MIDAS questionnaire – consisting of 5 questions total of which is known as MIDAS score.

Consists of additional 2 questions acquiring information about the frequency of headaches and intensity of pain experienced respectively<sup>14</sup>.

## 4. Results

The results were analysed with the aid of unpaired t test of the InStat software. The version utilised during the study was the Graph Pad in stat 3.1.

On the basis of data analysis, it can be seen that from Figure 1 and Table 1, there was a significant effect of deep neck muscles activation on disability caused by migraine (MIDAS score).

### 4.1 MIDAS Score

Figure 2 and Table 2 depict the effect of the study on frequency of migraine headaches.

Figure 3 and Table 3 depict the effect on intensity of pain experienced during migraine headaches.

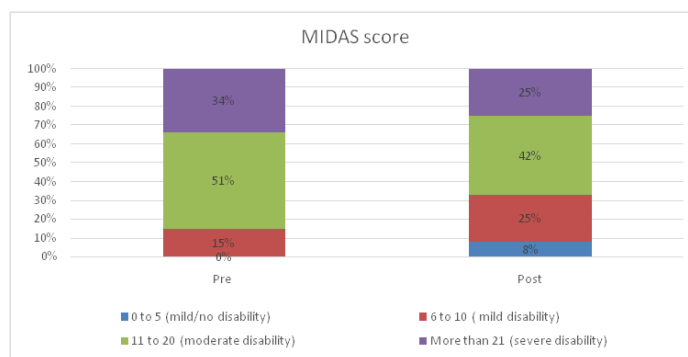


Figure 1. MIDAS score before and after the study performed.

Table 1. MIDAS score before and after the study performed

	Pre-test	Post-test
Mean	18.085	14.085
Standard Deviation	5.21	5.69
P Value	0.0031 (significant)	
T Value	3.064	

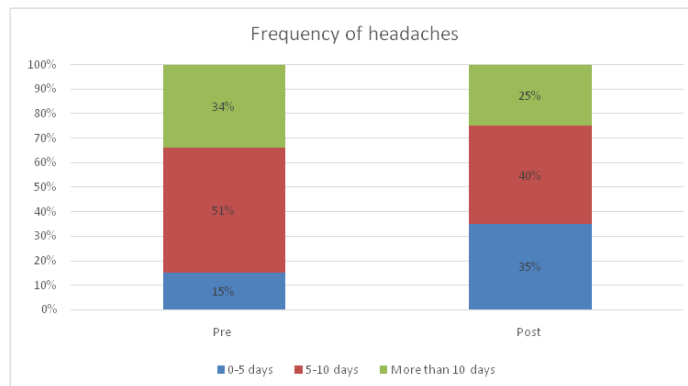
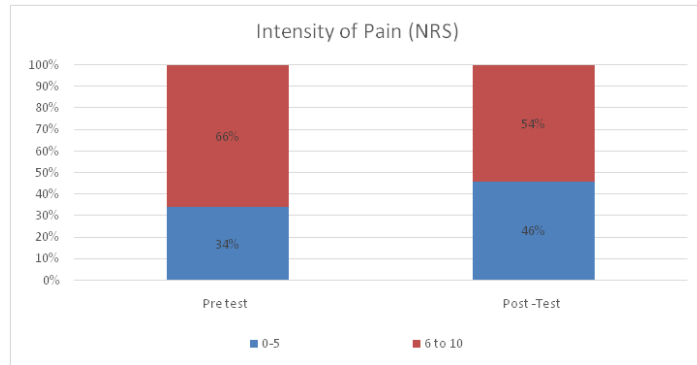


Figure 2. Frequency of headaches before and after the study performed.

**Table 2.** Frequency of headaches before and after the study performed

	Pre-test	Post-test
Mean	10.30	8.11
Standard Deviation	4.16	3.14
P Value	0.0138 (significant)	
T Value	2.586	



**Figure 3.** Intensity of pain experienced before and after study performed.

**Table 3.** Intensity of pain experienced before and after the study performed

	Pre-test	Post-test
Mean	6.35	3.25
Standard Deviation	1.51	2.02
P Value	<0.0001 (significant)	
T Value	5.837	

## 5. Discussion

Migraine is defined as a common episodic neurological disorder with complex pathophysiology manifesting as recurrent attacks of throbbing, unilateral severe headaches accompanied with associated features such as nausea, photophobia and phonophobia<sup>1</sup>. Migraine with aura are migraine headaches which are preceded by transient neurological symptoms lasting for about 20-30 mins which maybe visual such as difficulty in reading (more frequently encountered), speech such as difficulty in speaking, increased emotionality and sensory hypersensitivity<sup>1</sup>. Migraine can occur due to number of trigger factors, some of which include migraine due to fasting, stress, lack of sleep, alcohol intake, cigarette smoking, etc<sup>2</sup>. It is recorded that the most common age group of occurrence of migraine is during the adolescent period<sup>3</sup>. A study has recorded the recent non-pharmacological advances done to treat migraine as well as other types of headaches<sup>4</sup>. However, no study has recorded the effect of deep neck muscle activation

on migraine headaches in students. MIDAS questionnaire was used as an outcome measure for this study<sup>5</sup>. The study which demonstrated the prevalence of neck pain in migraine concluded that neck pain accompanied migraine headaches ( $r = 0.032$ ). A direct correlation between neck pain and the range of migraine headache frequency was also deduced from the above study<sup>6</sup>. This study was done to check the effectiveness of activation of deep neck muscles on migraine headaches in students. The study results were divided into 3 components as per the MIDAS questionnaire, i.e., MIDAS score, frequency of headaches and intensity of headaches. In the results, from Figure 1, it could be seen that there was a substantial difference in the MIDAS scores of the pre-intervention and the post-intervention data collected ( $p = 0.0031$ ). Figure 2 represents the effect of the intervention on frequency of headaches, which also showed a considerable difference in the values pre and post intervention ( $p = 0.0138$ ). It can be seen from Figure 3 that the intensity of headaches also reduced after the intervention took place ( $p < 0.0001$ ). Hence, the graphs and the tables depict that activation of deep neck muscles would have a significant effect on migraine headaches. A study done to determine the effect of exercise on migraine headaches in European population, showed that isometric neck exercises proved to be effective in treatment of neck pain accompanied with migraine. The study also showed that due to less side effects of exercises, migraineurs should be encouraged to follow exercises to reduce the incidence of headaches while monitoring the frequency and intensity of exercises to prevent exertional headaches<sup>7</sup>. A study conducted to determine whether aerobic exercises have an effect on migraine headaches, concluded that a significant reduction of 0.6 migraine days was seen. The study also reported that to an extent aerobic exercises had a relation with migraine duration and pain intensity<sup>9</sup>. In a study done to determine the effect of massage therapy on migraine, 2 groups were selected. One was the control group and one group received massage therapy. Frequency of headaches, perceived stress and coping efficacy were assessed before and after intervention, which showed considerable improvements in the group which received massage therapy<sup>10</sup>. A study conducted on efficacy of biofeedback on migraine and tension type headache, concluded that simple relaxation and explanation of simple pain theory should be an integral part of treatment for migraine. However, use of biofeedback for treatment should be avoided as it does not provide any significant therapeutic benefit<sup>11</sup>. Another study done on reduction of current migraine headache pain following neck massage and spinal manipulation, showed the results that there was a significant reduction in pain intensity in acute migraine attacks on application of massage and manipulation<sup>12</sup>. Multiple studies have been done to assess the effect of various physical therapy interventions on migraine headaches. However, very

few studies have found the effect of activation of deep neck muscles on migraine headaches in students. Thus this study provides a quantitative analysis and an adjunctive intervention in the treatment as well as a preventive measure for migraine attacks.

## 6. Conclusion

The results indicate that activation of deep neck muscles have a significant effect on disability caused by migraine, frequency of migraine headaches and intensity of pain experienced during migraine headaches.

## 7. Ethics Approval and Patient Consent

The study was approved by the “Institutional Ethics Committee” of Krishna Institute of Medical Sciences, “Deemed to be” University, Karad, Maharashtra. The author had explained the study and the intervention to be given the participants and had taken participants consent prior to beginning of the study on every participant.

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## 9. References

- Pietrobon D, Moskowitz MA. Pathophysiology of migraine. *Annual Review of Physiology*. 2013; 75:365–91. <https://doi.org/10.1146/annurev-physiol-030212-183717>. PMID:23190076
- Fukui PT, Gonçalves TR, Strabelli CG, Lucchino NM, Matos FC, Santos JP, et al. Trigger factors in migraine patients. *Arquivos de neuro-psiquiatria*. 2008; 66(3A):494–9. <https://doi.org/10.1590/S0004-282X2008000400011>. PMID:18813707
- Goadsby PJ, Lipton RB, Ferrari MD. Migraine-current understanding and treatment. *New England Journal of Medicine*. 2002; 346(4):257–70. <https://doi.org/10.1056/NEJMra010917>. PMID:11807151
- Luedtke K, Allers A, Schulte LH, May A. Efficacy of interventions used by physiotherapists for patients with headache and migraine-systematic review and meta-analysis. *Cephalalgia*. 2016; 36(5):474–92. <https://doi.org/10.1177/0333102415597889>. PMID:26229071
- Bigal ME, Rapoport AM, Lipton RB, Tepper SJ, Sheftell FD. Assessment of migraine disability using the migraine disability assessment (MIDAS) questionnaire: A comparison of chronic migraine with episodic migraine. *Headache: The Journal of Head and Face Pain*. 2003; 43(4):336–42. <https://doi.org/10.1046/j.1526-4610.2003.03068.x>. PMID:12656704
- Calhoun AH, Ford S, Millen C, Finkel AG, Truong Y, Nie Y. The prevalence of neck pain in migraine. *Headache: The Journal of Head and Face Pain*. 2010; 50(8):1273–7. <https://doi.org/10.1111/j.1526-4610.2009.01608.x>. PMID:20100298
- Silberstein SD, Olesen J, Bousser MG, Diener HC, Dodick D, First M, et al. The International Classification of Headache Disorders, (ICHD-II)-revision of criteria for 8.2 medication-overuse headache. *Cephalalgia*. 2005; 25(6):460–5. <https://doi.org/10.1111/j.1468-2982.2005.00878.x>. PMID:15910572
- Koseoglu E, Yetkin MF, Ugur F, Bilgen M. The role of exercise in migraine treatment. *The Journal of Sports Medicine and Physical Fitness*. 2014; 55(9):1029–36.
- Lemmens J, De Pauw J, Van Soom T, Michiels S, Versijpt J, Van Breda E, Castien R, De Hertogh W. The effect of aerobic exercise on the number of migraine days, duration and pain intensity in migraine: A systematic literature review and meta-analysis. *The Journal of Headache and Pain*. 2019; 20(1):1–9. <https://doi.org/10.1186/s10194-019-0961-8>. PMID:30764753 PMID:PMC6734345
- Lawler SP, Cameron LD. A randomized, controlled trial of massage therapy as a treatment for migraine. *Annals of Behavioral Medicine*. 2006; 32(1):50–9. [https://doi.org/10.1207/s15324796abm3201\\_6](https://doi.org/10.1207/s15324796abm3201_6). PMID:16827629
- Mullally WJ, Hall K, Goldstein R. Efficacy of biofeedback in the treatment of migraine and tension type headaches. *Pain Physician*. 2009 Nov 1; 12(6):1005–11. <https://doi.org/10.36076/ppj.2009/12/1005>
- Noudeh YJ, Vatankhah N, Baradaran HR. Reduction of current migraine headache pain following neck massage and spinal manipulation. *International Journal of Therapeutic Massage and Bodywork*. 2012; 5(1):5. <https://doi.org/10.3822/ijtmb.v5i1.115>. PMID:22553478. PMID:PMC3312646
- Kisner C, Colby LA. Therapeutic exercise, foundation and techniques, editin-6. Chapter 16. p. 522–3.
- International Headache Society. The International Classification of Headache Disorders, 2nd Edition. 1st Revision. Headache Classification Subcommittee of the International Headache Society. Oxford, UK: Blackwell Publishing; 2005.