

ORIGINAL RESEARCH ARTICLE

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# Effects of suboccipital inhibition versus soft tissue manipulation on pain intensity and disability in tension-type headache among undergraduate physiotherapy students

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## Abstract

**Background** Tension-type headache (TTH) is prevalent among collegiate students due to academic stress. Manual therapies like suboccipital inhibition and soft tissue manipulation have shown efficacy in TTH management. However, comparative studies between these interventions in collegiate populations are scarce. Understanding their relative effectiveness can enhance treatment strategies and improve outcomes, shedding light on optimal manual therapy approaches for TTH among collegiate students. This study aimed to investigate the effects of suboccipital inhibition and soft tissue manipulation on pain intensity and disability in tension-type headache (TTH) among undergraduate physiotherapy students.

**Methods** Forty undergraduate physiotherapy students diagnosed with TTH were randomly assigned to the suboccipital inhibition group (group A,  $n = 20$ ) and the soft tissue manipulation group (group B,  $n = 20$ ). The suboccipital inhibition group received manual therapy targeting the suboccipital muscles, while the soft tissue manipulation group received manipulation techniques focusing on the cervical and shoulder girdle muscles. Pain intensity and disability were assessed using Visual Analogue Scale (VAS) and Headache Disability Index (HDI) Questionnaire at baseline and after 6 weeks of intervention. The data were collected and analysed using independent  $t$  test.

**Results** Both interventions demonstrated significant reductions in pain intensity and disability after 6 weeks, with the  $t$  value  $-4.3150$  and  $-3.3106$  at  $p < 0.05$  for VAS and HDI respectively.

**Conclusion** Suboccipital inhibition and soft tissue manipulation are effective interventions for reducing pain intensity and disability among undergraduate physiotherapy students with TTH. However, the suboccipital inhibition group showed improvement in pain intensity and disability and it has been statistically significant when compared to the soft tissue manipulation group.

**Keywords** Tension-type headache, Suboccipital inhibition, Soft tissue manipulation, Pain, Disability, Undergraduate physiotherapy students

## Background

According to the Global Burden of Disease (GBD, 2019), headaches rank among the most prevalent conditions globally, with tension-type headaches (TTH) estimated at an average of 26.0% worldwide, affecting 23.4% of men and 27.1% of women [1]. The prevalence of TTH varies geographically, ranging from 11.1% in Southeast and East

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Asia and Oceania to 33.1% in South Asia. However, when considering population adjustments, the prevalence of TTH averages at 21.1%.

TTH is characterized by bilateral, non-pulsatile, oppressive pain of mild to moderate intensity that typically does not worsen with movement and is not associated with nausea or vomiting. Mild nausea may be present exclusively in chronic tension-type headaches [2]. Clinical manifestations include band-like constriction, scalp soreness, occipital tension, temporal tightness or pressure, neck rigidity, exacerbation of pain with pressure on contracted muscles, feeling pressure behind the eyes, and tightening of the neck muscles. Symptoms usually arise during the day and may progressively worsen throughout. Additionally, patients may experience discomfort when exposed to light or noise, but not both simultaneously, and typically endure at least 10 episodes per year lasting from 30 min to 7 days. Pain is typically concentrated in the parietal, frontal, and suboccipital regions of the head [3]. Although tension-type headaches are initially associated with mild symptoms, they can become disabling, leading to increased work absenteeism, decreased social engagement, and in severe cases, depressive states [4]. Stress and anxiety are significant triggering factors in the development of TTH [5].

Episodic TTH may progress to the chronic form due to various factors, including muscle tension, lack of relaxation, poor posture, sleep disturbances, and medication abuse, resulting in more frequent symptom exacerbation and chronicity [6]. Several studies have associated the presence of active myofascial trigger points in suboccipital, upper trapezius, temporal, sternocleidomastoid, and extraocular muscles with headaches of greater intensity, frequency, duration, and hypersensitivity to pressure [7].

Studies show that massage [8], stress management techniques [9], postural techniques, cervical relaxation, and cervical relaxation exercises gentle and progressive stretching or trigger point therapy [10] are effective at reducing pain intensity and disability. Manual therapies like suboccipital inhibition and soft tissue manipulation have shown efficacy in TTH management. However, comparative studies between these interventions in collegiate populations are scarce. Understanding their relative effectiveness can enhance treatment strategies and improve outcomes, shedding light on optimal manual therapy approaches for TTH among collegiate students. This study aimed to investigate the effects of suboccipital inhibition versus soft tissue manipulation on pain intensity and disability among undergraduate physiotherapy students.

A Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of

values and cannot easily be directly measured. Using a ruler, the score is determined by measuring the distance (mm) on the 10-cm line between the “no pain” anchor and the patient’s mark, providing a range of scores from 0 to 100. VAS is widely used as a measure of pain intensity globally. It has been shown that VAS is valid, reliable, and interval scale [11]. VAS has high test–retest reliability and repeatability [12]. In this VAS, it has a continuous scale consisting of a horizontal and vertical line called vertical VAS and horizontal visual analogue scale. There is a good correlation between vertical and horizontal VAS. But the score of horizontal is slightly lower than the vertical VAS [13].

The Headache Disability Index (HDI) questionnaire created by Jacobson et al. in 1994 [14] is one of the instruments used to assess headache disability. The HDI assesses different dimensions related to headache disability and interference with daily life during the last month [15]. The HDI questionnaire contains 25 questions subdivided into functional and emotional scales. Its total score, ranging from 0 to 100 points, ranks the individual from absence to the maximum level of disability. The internal consistency/reliability was strong, as was construct validity. The test–retest reliability for the HDI was acceptable for the total score and functional and emotional subscale scores. A 29-point change (95% confidence interval) or greater in the total score from test–retest must occur before the changes can be attributed to treatment effects. The HDI is useful in assessing the impact of headache, and its treatment, on daily living.

## Methods

A pre- and post-test experimental study design was used to compare the effects of suboccipital inhibition versus soft tissue manipulation on pain intensity and disability among undergraduate physiotherapy students. This study was conducted from November to December 2023 at an Institution in South India. The study was endorsed by the ethics committee of our institution. The study involved participants who provided written informed consent.

Full-time undergraduate physiotherapy students who are suffering from tension-type headache for over 3 months, pain episodes lasting 30 min to 7 days, with episodes of more than 1 day per month of the following characteristics: bilateral location of pain, non-pulsating pain upon pressure, mild to moderate pain, age range between 18 and 25 years of both genders, were included in this study. Students with other types of secondary headache; musculoskeletal disorders or trauma related to the neck, temporomandibular joint, and shoulder; metabolic disorders; any psychiatric illness; or vertigo or dizziness were excluded from this study. We selected students by non-probability and convenience sampling.

Forty undergraduate physiotherapy students who were diagnosed with TTH by a neurologist according to the International Headache Society (ICHD—third edition, beta version criteria) [16] satisfied the inclusion criteria. Students were randomly assigned to the suboccipital inhibition group (group A,  $n = 20$ ) and the soft tissue manipulation group (group B,  $n = 20$ ).

The suboccipital inhibition group received manual therapy targeting the suboccipital muscles for 20 min, 4 days per week for 6 weeks. For group A, suboccipital inhibition was applied with the students in the supine position with the eyes closed and the therapist's hands placed under the student's head, in contact with the



**Fig. 1** Suboccipital inhibition

suboccipital muscles (Fig. 1) [17]. At this point, a deep progressive gliding pressure is applied for 10 min. After the treatment, students are asked to be at rest for 10 min in a supine position with the neck in neutral. The soft tissue manipulation group received manipulation techniques focusing on the cervical and shoulder girdle muscles for 20 min, 4 days per week for 6 weeks. For group B, soft tissue manipulation was applied on the upper trapezius, levator scapulae, suboccipital, sternocleidomastoid, pectoral, cervical deep flexor, serratus anterior, rhomboid, and middle and upper trapezius muscles (Fig. 2) [18].

Before group allocation, students were assessed for pain intensity and disability using Visual Analogue Scale (VAS) and Headache Disability Index (HDI) Questionnaire. Once they had completed the 6-week intervention, students were again assessed with VAS and HDI. An independent  $t$  test was used at  $p < 0.05$ , to examine pain intensity and disability between groups. The SPSS software version 23.0 and Microsoft Excel software were employed to analyse research data.

## Results

A total of 40 undergraduate physiotherapy students were recruited for the study. Table 1 demonstrates the demographic characteristics of the study sample. Comparison of pre-test and post-test scores of the VAS and HDI of both groups is shown in Tables 2 and 3 respectively and in Figs. 3 and 4.

## Discussion

In this study, pain intensity and disability were assessed in both groups, i.e. suboccipital inhibition group and soft tissue manipulation group, using the outcome measures Visual Analogue Scale (VAS) and Headache Disability Index (HDI). The scores of VAS and HDI were reduced



**Fig. 2** Soft tissue manipulation

**Table 1** Demographic characteristics

SN	Characteristics	Group A	Group B
1	Age (years)	19.5±0.9	19.1±1.0
2	Weight (kg)	66.0±3.2	65.9±3.4
3	Height (cm)	162.3±8.3	161.6±6.7
4	BMI (kg/m <sup>2</sup> )	25.2±2.7	25.3±2.6
5	Gender		
	Male	6 (30%)	6 (30%)
	Female	14 (70%)	14 (70%)

Data was expressed as mean ± standard deviation. *BMI*, body mass index

in the suboccipital inhibition group (from pre-test scores of VAS and HDI of group A, 6.2 and 45.5, to post-test scores of VAS and HDI of group A, 3.2 and 35), which is statistically significant than the soft tissue manipulation group (from pre-test scores of VAS and HDI of group B, 5.9 and 45.9, to post-test scores of VAS and HDI of group B, 4.6 and 41.8), by using independent *t* test with the *t*-values -4.3150 and -3.3106 respectively. In line with our results, Espí-López et al. [19] also observed enhancements in self-reported pain levels, headache impact, and disability following a 4-week regimen involving

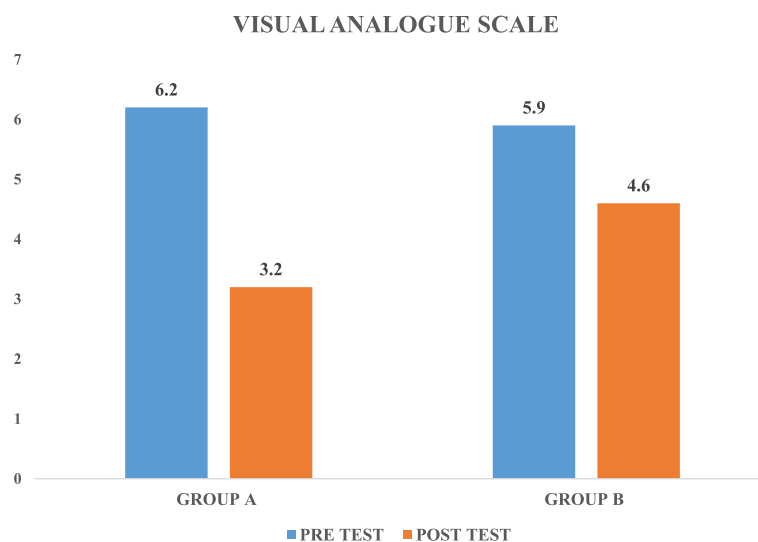
**Table 2** Comparison of pre-test scores of VAS and HDI of both groups

SN	Outcome measures	Group	Pre-test	<i>t</i> value	<i>p</i> value* (< 0.05)
1	Visual Analogue Scale (VAS)	A	6.2	0.70403	0.48570
		B	5.9		
2	Headache Disability Index (HDI)	A	45.5	-0.20008	0.84248
		B	45.9		

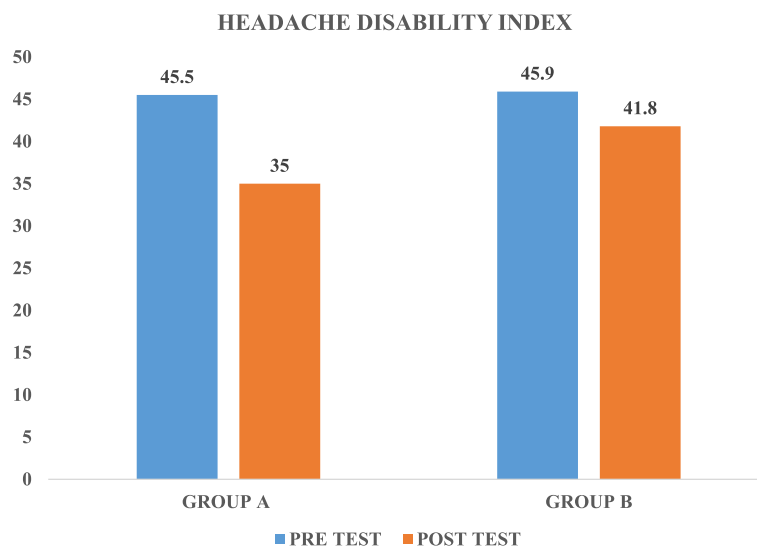
\**p* value not significant at 0.05

**Table 3** Comparison of post-test scores of VAS and HDI of both groups

SN	Outcome measures	Group	Post-test	<i>t</i> value	<i>p</i> value (< 0.05)
1	Visual Analogue Scale (VAS)	A	3.2	-4.3150	0.00011
		B	4.6		
2	Headache Disability Index (HDI)	A	35	-3.3106	0.00204
		B	41.8		



**Fig. 3** Comparison of pre-test and post-test scores of VAS of both groups



**Fig. 4** Comparison of pre-test and post-test scores of HDI of both groups

suboccipital muscle inhibition combined with osteopathic cervical manipulation. The application of suboccipital muscle inhibition alongside interferential current therapy is suggested to induce analgesic effects and alleviate tension in suboccipital muscles by reducing muscle activity [20], thereby mitigating both peripheral and central sensitization.

Furthermore, suboccipital inhibition may enhance muscle elasticity and extensibility, leading to improved muscle function. This treatment approach not only addresses trigger points [21] but also alleviates fascial restrictions, enhances local blood circulation [22], and enhances proprioception [23]. Moreover, it is conceivable that targeting the suboccipital region may impact cerebrospinal fluid flow rates. The presence of the “Myodural bridge,” connecting these muscles to the dura, has been implicated in tension-type headaches, suggesting that this technique’s direct inhibitory effect on suboccipital nerves and muscles may offer relief [24]. Unhealthy postures, such as forward head posture, have been linked to tension headaches among patients [25], with poor daily habits identified as a primary contributor to such postural imbalances. In addition to manual therapy techniques, postural awareness plays a crucial role in alleviating tension-type headaches, particularly among physiotherapy students.

Given the demanding academic and clinical requirements of their profession, physiotherapy students often spend extended periods in static positions, such as sitting or standing, which can exacerbate muscular tension and lead to headaches. By cultivating postural awareness, students can learn to recognize and correct poor postural habits, such as slouching or forward head posture,

which contribute to muscle strain and tension in the cervical and upper thoracic regions. Incorporating ergonomic principles into their daily activities, such as using ergonomic chairs and adjusting workstation setup, can further promote optimal posture and reduce the risk of tension-type headaches. Moreover, integrating regular breaks for stretching and relaxation exercises into their study and practice routines can help alleviate muscular tension and prevent headache recurrence. Thus, fostering postural awareness among physiotherapy students is essential not only for their own well-being but also for optimizing their ability to provide effective care to future patients.

### Conclusion

Suboccipital inhibition and soft tissue manipulation are effective interventions for reducing pain intensity and disability in collegiate students with TTH. However, the suboccipital inhibition group showed improvement in pain intensity and disability and it has been statistically significant when compared to the soft tissue manipulation group. These findings highlight the potential benefits of targeted manual therapy techniques in managing TTH among undergraduate physiotherapy students.

### Implications

This study’s findings could inform clinical practice by highlighting the effectiveness of suboccipital inhibition and soft tissue manipulation in managing tension-type headaches among collegiate students. Understanding the relative efficacy of these interventions can guide health-care professionals in selecting appropriate treatment approaches tailored to individual patient needs. By

optimizing headache management strategies, healthcare providers can potentially alleviate pain and disability, thereby enhancing collegiate students' academic performance, social functioning, and overall well-being. Additionally, these insights may stimulate further research into manual therapy techniques for headache management, contributing to the advancement of evidence-based interventions in the field of headache medicine. This could lead to improved pain management, reduced disability, and enhanced overall well-being, ultimately benefiting the academic success and quality of life of collegiate populations.

#### Abbreviations

GBD	Global burden of disease
TTH	Tension-type headaches
VAS	Visual Analogue Scale
HDI	Headache Disability Index Questionnaire

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#### Authors' contributions

P.V.: conception, editing, and final approval of the manuscript and accountability for the work. M.A.M.: critical manuscript revision, final manuscript approval, and accountability for the work. Y.R.: conception, writing, and data analysis. The authors read and approved the final manuscript.

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#### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

#### Declarations

##### Ethics approval and consent to participate

The study was approved by the Institutional Ethical Committee.

##### Consent for publication

This study's findings on suboccipital inhibition and soft tissue manipulation for tension-type headaches in collegiate students are pertinent for clinical practice and warrant publication in relevant journals.

##### Competing interests

The authors declare that they have no competing interests.

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