

Encouraging sustainable health in work environments: Maitland technique for cervicogenic headaches

Incentivo à saúde sustentável em ambientes de trabalho: Técnica de Maitland para dores de cabeça cervicogênicas

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ABSTRACT

Background: Cervicogenic headache (CC) affects a large number of workers, causing persistent and debilitating pain in the head, shoulders, and upper back, resulting in high compensation costs. **Objective:** The objective of this study was to determine the effectiveness of the Maitland technique in reducing cervicogenic headaches among industrial technology workers. **Methods:** This was a non-experimental, longitudinal cohort study employing a quantitative approach, involving 26 industrial technology workers. An initial and final evaluation of the clinical presentation of cervicogenic headache was conducted, focusing on pain intensity measured using the visual analogue scale (VAS), cervical disability assessed using the neck disability index (NDI), and the impact of headache pain on daily activities measured using the HIT-6 questionnaire. **Results:** The results revealed a significant decrease in pain intensity, cervical disability, and the impact of headaches, with significant differences observed between the measurements of all variables ($p < 0.05$). **Conclusions:** The Maitland technique, as a mobilization approach, demonstrated positive effects in reducing the clinical presentation of cervicogenic headaches among industrial technology workers. These effects were evident in terms of pain intensity, cervical disability, and the impact of headaches on daily activities.

Keywords: sustainable health, healthy work, neck pain, headache disorders.

RESUMO

Contexto: A cefaléia cervicogênica (CC) afeta grande número de trabalhadores, causando dor persistente e limitante na cabeça, ombros e parte superior das costas; gerando altos custos de compensação. **Objetivo:** determinar o efeito da técnica de Maitland para reduzir dores de cabeça cervicogênicas em trabalhadores de tecnologia industrial; **Métodos:** estudo de coorte longitudinal, não experimental, com abordagem quantitativa em 26 trabalhadores de tecnologia industrial. Foi realizada uma avaliação inicial e final do quadro clínico da cefaléia cervicogênica em relação à intensidade da dor por meio da escala visual analógica (VAS), do índice de incapacidade cervical (NDI) e do impacto da dor da cefaléia nas atividades da vida diária (HIT- 6); **Resultados:** revelaram diminuição da intensidade da dor, incapacidade cervical e impacto da cefaléia e diferenças significativas entre as medidas de todas as variáveis ($p < 0,05$); **Conclusões:** O guia de mobilização de Maitland tem efeitos positivos na redução do quadro clínico de dores de cabeça cervicogênicas em trabalhadores de tecnologia industrial, relacionadas à intensidade da dor, incapacidade cervical e impacto da dor de cabeça nas atividades diárias.

Palavras-chave: saúde sustentável, trabalho saudável, dor no pescoço, distúrbios de dor de cabeça.

INTRODUCTION

According to the World Health Organization (WHO), at least 50% of adults worldwide experience headaches at some point in their lives, with rates reaching up to 66% (WHO, 2016). The age group between 18 and 65 years is the most affected by headaches, without distinction between genders (Pradilla & Muñoz, 2013).. Headache is currently not considered a disease but rather a symptom that can be categorized based on duration, intensity, and frequency of occurrence (Figueroa, et al., 2015). It is one of the most recurrent symptoms in medical consultations (Yuan et al., 2016); and is particularly prevalent in the field of neurology (Pascual, 2019). A spectrum of both benign and malignant conditions is encompassed by headaches (Loreto, 2014).

The most frequent types of headaches are tension-type headaches, accounting for 38% of the total, followed by migraines at 10% (Stovner et al., 2007). Although the etiology of these headaches is unclear, they are associated with non-modifiable risk factors such as age, gender, and genetics, as well as modifiable factors such as sedentary lifestyle, body mass index, and maintaining improper postures (Jiménez, 2021). Thus, the origin of headaches is considered multifactorial (Ocampo & Carrillo, 2018); which complicates their diagnosis and treatment (Fontanillas et al., 2009); impacting both the

clinical and therapeutic approaches and often resulting in high socio-sanitary costs (Wesley et al., 2021).

Among the common types of headaches, cervicogenic headaches (C.H.) are conceptually characterized as head pain resulting from abnormalities in the structures of the neck (nerves, intervertebral discs, joints, muscle insertions) They are typically unilateral and accompanied by symptoms indicative of cervical involvement, causing pain primarily in the occipital region (Núñez & Leirós, 2022) (O'Mullony et al., 2005). This pain is often described as dull or penetrating and can last from hours to days, typically worsening or appearing with neck movements (Antonaci et al., 2006).

The symptoms of C.H. vary from persistent and limiting pain in the nape, extending to the cervical region (O'Mullony et al., 2005). Occasionally, dizziness, vertigo, and instability may be caused by them (Serrano, 2004). These types of headaches are often underestimated and attributed to postural problems, overexertion, or trauma (Cohen & Hooten, 2017) (Velázquez et al., 2013). However, they can be potentially disabling, being globally recognized as a leading cause of disability among workers (Loreto, 2014).

Reports indicate a 60% decrease in work performance due to headaches, a significant increase in absenteeism, a reduction in social commitments, and sometimes the development of depressive states (Parra, 2019). Therefore, C.H. are also considered musculoskeletal disorders (MSDs) of mechanical origin, involving an interaction between differential fatigue, cumulative load, and excessive effort primarily in office workers (Kumar, 2007). When chronic, this condition can lead to temporary or permanent disability, impacting companies in terms of high compensation costs, decreased performance, and productivity (Merlino et al., 2003).

The majority of headaches typically respond favorably to pharmacological and physiotherapeutic treatment (Yuan et al., 2016), but often their resolution is prolonged, becoming a chronic problem that limits individual autonomy and significantly impairs quality of life (Quintero et al., 2016). Therefore, one of the most effective physiotherapeutic treatments for musculoskeletal disorders is manual therapy (Alansari et al., 2021), which aims to restore movement and normalize muscle tone in the affected region (Corum et al., 2021). Among these interventions, Maitland mobilizations have shown effectiveness in reducing pain and improving the functional level of the cervical spine (Zaidi & Ahmed, 2020).

Research conducted by various authors indicates the relevance of manual therapy in the treatment of C.H. According to Núñez et al. (2022), C.H. is observed as a secondary headache resulting from a cervical spine disorder often accompanied by neck pain. Non-invasive treatment techniques are varied, and there is no consensus on which one is the most appropriate, although manual therapy (MT) appears to be one of the options with the highest potential. The authors concluded that manual therapy is effective in treating patients with C.H., as the combined use of MT techniques improved outcomes compared to their separate use.

In the study conducted by Lee, K., & Lee, J. (2017), neck pain was established as a common musculoskeletal disorder in modern society, often causing disabling symptoms. The authors aimed to evaluate joint mobilization and therapeutic exercises applied to the cervical and upper thoracic spine for functional impairment caused by chronic neck pain. The study involved 18 subjects divided into two groups of nine each: group 1 (therapeutic exercises in the cervical and thoracic spine) and group 2 (therapeutic exercises and joint mobilization). The intervention lasted for two weeks, with a frequency of three times per week and 60-minute sessions. The instruments used were the visual analog scale (VAS), neck disability index (NDI), and cervical range of motion. The results showed improvements in both groups in VAS, NDI, and range of motion. Group 2 demonstrated significant improvements in right lateral flexion and right rotation, while upper trapezius tone improved in both groups. The authors concluded that joint mobilization and therapeutic exercises for functional deficits caused by chronic neck pain had a significant effect.

In their study, Lerner et al. (2021) considered the efficacy of manipulation compared to mobilization for the treatment of spinal conditions. They evaluated the effectiveness of manipulation compared to pragmatically selected mobilization for patients with cervicogenic headaches. The study included 45 patients with cervicogenic headaches randomly assigned to receive manipulation or pragmatically selected mobilization. They were assessed at baseline, the second visit, discharge, and one-month follow-up using the following instruments: neck disability index (NDI), numeric pain rating scale (NPRS), headache impact test (HIT-6), global rating of change (GRC), and patient acceptable symptom state (PASS). The results indicated no statistically significant differences for NDI, NPRS, or HIT-6, nor significant differences between groups for GRC and PASS. The authors concluded that manipulation had similar effects on disability, pain, GRC, and cervical range of motion as mobilization when pragmatically applied to patients with cervicogenic headaches.

Shabbir et al., (2021) considered neck pain as a common problem characterized by the presence of trigger points, local and referred pain. They decided to evaluate the effect of Maitland mobilization in patients with chronic myofascial neck pain. The study included thirty participants aged between 25 and 50, divided into two groups: the first group received Maitland mobilizations, and the second control group received conventional physiotherapy. The treatment was administered for eight weeks, and the participants were evaluated using the visual analog scale (VAS), neck disability index (NDI), and

cervical range of motion (ROM) before and after the intervention. The results showed significant differences in favor of the mobilization group in all variables compared to the conventional physiotherapy group. The authors concluded that the application of Maitland techniques in mobilization grades I-IV was effective in reducing neck pain, improving functionality, and increasing the range of motion of the cervical spine. Considering this context, the objective of the present study is to determine the effect of the Maitland technique in reducing cervicogenic headaches in industrial technology workers.

METHODS

The following research was conducted as a non-experimental, longitudinal cohort study with a quantitative approach. The study took place at T-Control Company, located in Quito, Ecuador, and involved a population of 60 participants, encompassing the total workforce of the company. The age range of the participants was 20 to 55 years, comprising both males and females. The entire population that met the inclusion and exclusion criteria was included in the study. Inclusion criteria encompassed workers with cervicogenic headaches, experiencing unilateral or bilateral pain in the suboccipital region, and demonstrating restriction or hypomobility in the suboccipital spine. Additionally, workers without radiological abnormalities were considered. Exclusion criteria consisted of individuals with recent traumas, neurological pathologies, spinal deformities or malformations, radicular symptoms, prior cervical surgery, recent cervical fractures, osteoporosis, dizziness or vertigo, open or recent wounds in the cervical area, ongoing clinical or rehabilitation treatment at the time of the intervention, elderly individuals, and pregnant women. Consequently, a census sample of 26 workers (10 females and 16 males) was selected, as they fulfilled all the criteria for participation in the present study.

Data Collection Instrument:

The population was assessed using the following diagnostic methods:

The Visual Analog Scale (VAS) was employed, which involved participants rating pain intensity on a numerical scale ranging from 0 to 10. The scale's endpoints represented the absence of pain (0) and the perception of extremely severe pain (10). Participants indicated their current pain level by marking the corresponding point on the scale. The VAS was chosen due to its high reliability and its extensive utilization in neck pain studies. It offers ease of interpretation, exhibiting strong test-retest reliability ($r=0.94$ to 0.71) and validity ($r=0.62$ to 0.91) (Ubillos et al., 2019) (Herrero et al., 2018)

The Headache Impact Test (HIT-6) consisted of 6 questions gauging the frequency of headache occurrence during specific activities. Participants responded on a 5-point scale, where never (6 points), rarely (8 points), sometimes (10 points), very often (11 points), and always (13 points) were the available options. Final scores were computed by multiplying the number of responses by the corresponding score and summing them. Scores below 49 indicated minimal or no impact on individuals' lives, while scores between 50 and 55 suggested some impact, scores between 56 and 59 denoted significant impact, and scores exceeding 60 represented very severe impact. The administration of the HIT-6 took approximately 5 minutes, and the test exhibited strong test-retest reliability ($CCI=0.77-0.80$) with a Cronbach's α of $0.83-0.90$ (Martin et al., 2004).

The Neck Disability Index (NDI) was employed as an evaluation scale for participants with neck pain, providing reliable outcomes. The NDI encompassed various items addressing functionality (e.g., personal care, reading, concentration) and impairments (e.g., neck pain, headache). Each item was scored on a scale of 0 to 5, indicating escalating levels of limitation. The Spanish version of the NDI demonstrated good internal consistency, yielding a Cronbach's α of 0.94 for the total scale and 0.91 for the functional and emotional subscales. Furthermore, the test-retest reliability exhibited a coefficient of 0.76 (Andrade et al., 2008). The interpretation of NDI scores allowed for the classification of disability levels as follows (García et al., 2021):

0-4: No disability.

5-14: Mild disability.

15-24: Moderate disability.

25-34: Severe disability.

Over 34: Complete disability.

Maitland technique

The Maitland technique was utilized for this study, which was conducted to investigate its effectiveness in the management of cervicogenic headaches among workers in the T-Control company. The technique was developed by Australian physiotherapist Geoffrey Douglas Maitland and involves the application of passive movements to the affected

joint, thereby enhancing tissue extensibility and increasing range of motion (ROM), resulting in pain relief in the treated area (Saunders et al., 2005). The Maitland technique allows for the performance of different grades of articular movements, which include Grade 1, Grade 2, Grade 3, and Grade 4.

Applied techniques

The application of the Maitland technique was performed in two main ways: passive accessory intervertebral movements (PAIVM) and articular mobilization. During the PAIVM procedure, the workers were instructed to assume a prone position while the physiotherapist positioned their hands crossed at the forehead level. The physiotherapist's thumbs were then positioned at the spinous processes of the subcranial region, and rhythmic posteroanterior movements were applied from the third cervical vertebra to the first cervical vertebra. Central posteroanterior movements were performed, and any painful regions reported by the workers were given additional attention. Furthermore, the worker's head was rotated 30°-40° in the ipsilateral direction to identify any pain originating from the first and second cervical vertebrae, and unilateral PA movements could be applied accordingly (Reid et al., 2012).

For articular mobilization, the workers assumed a supine position with their head positioned outside the table. The physiotherapist placed their right forearm under the worker's head, with the elbow positioned behind the ear. The physiotherapist's index finger was then positioned posteroanteriorly to the targeted vertebra, and a gentle sliding motion was applied to the right while performing a left lateral flexion, bringing the worker's head to the desired level. This technique could also be performed bilaterally (Reid et al., 2012).

Intervention phases

The intervention phase lasted for 6 weeks, with a frequency of 3 times per week (Monday, Wednesday, and Friday) and a duration of 20 minutes per session. The intervention was divided into several phases. During the initial phase (week 1), assessments were conducted using the Visual Analogue Scale (VAS), Neck Disability Index (NDI), and Headache Impact Test (HIT-6) to determine eligibility and resolve any uncertainties regarding the intervention plan. Subsequently, the intervention progressed through Phase I (week 2), Phase II (week 3), Phase III (week 4), and Phase IV (week 5), with each phase focusing on different aspects of pain relief, mobility improvement, and joint range of motion. The final phase (week 6) involved repeating the initial assessments to evaluate the effectiveness of the intervention.

The data collected during the study were processed using Word, Excel, and SPSS V29.0. The content validation coefficient (CVC) was calculated to ensure the proper application of the Maitland mobilization guide. Statistical analyses were conducted using the Student's t-test for related samples or the Wilcoxon signed-rank test, depending on the distribution of the data. The significance level was set at 95% ($p < 0.05$). Ethical considerations were addressed by obtaining approval from the Human Research Ethics Committee of the Faculty of Health Sciences at the Technical University of Ambato (UTA) under the code 030-CEISH-UTA-2023. Informed consent was obtained from the participants, and they were provided with detailed information about the study procedures, objectives, potential benefits, and possible consequences of participation.

RESULTS

A decrease in pain intensity was observed in the sub cranial area after the application of the Maitland manipulation guide, as demonstrated by the differences between the initial and final results. The presence of moderate to severe pain decreased from 38% to 23%, while intense pain decreased from 62% to 4%. Consequently, a reduction in pain intensity was achieved, with 23% of the population reporting no pain, 73% experiencing mild to moderate pain, and only 4% experiencing moderate to severe pain. The application of Maitland manipulations in the sub cranial area yielded significant reductions in pain intensity as indicated by the comparative results (Table 1).

Table 1. Initial and final assessment of pain intensity (VAS) in cervicogenic headache among industrial technology workers.

VAS Scores	Pain Intensity	Initial		Final	
		Fr	%	Fr	%
0	No presence of pain	0	0	6	23
1 to 3	Mild to moderate pain	0	0	19	73
4 to 6	Moderate to severe pain	10	38	1	4
7 to 9	Very intense pain	16	62	0	0
10	Extremely strong pain	0	0	0	0
Total		26	100	26	100

Score: 0 indicates no pain; 1-3 indicates mild to moderate pain; 4-6 indicates moderate to severe pain; 7-9 indicates very intense pain; 10 indicates extremely strong pain.

The differences between the initial and final results in the cervical disability index after the application of Maitland manipulation guidelines in the sub cranial area demonstrated a decrease in functional limitation. This resulted in a transition from 88% of the population experiencing moderate functional limitation to 12% experiencing intense functional limitation, to 100% of the population experiencing minimal functional limitation, which did not require treatment other than postural advice and exercises. Therefore, the comparative results between measurements reveal a considerable decrease in the functional limitation experienced by the employees of T-Control Company following the application of Maitland manipulations in the sub cranial area (Table 2).

Table 2. Neck Disability Index and limitation (NDI) in industrial technology workers, initial assessment and final assessment.

Scores	NDI Disability and limitation	Initial		Final	
		Fr	%	Fr	%
0 to 20	Minimal functional limitation (no treatment will be required except postural advice and exercises)	0	0	26	100
20 to 40	Moderate functional limitation (requires conservative treatment)	23	88	0	0
40 to 60	Intense functional limitation (will require in-depth study)	3	12	0	0
60 to 80	Disability (requires intervention)	0	0	0	0
> 80	Maximum functional limitation (bedridden or exaggerates its symptoms)	0	0	0	0
Total		26	100	26	100

The differences between the initial and final results in the impact of headache after the application of Maitland manipulation guide in the subcranial area were a significant decrease in its impact on their lives. This resulted in a transition from 35% experiencing a significant impact and 65% experiencing some impact in their lives to 100% of the population experiencing no or little impact in their lives. Thus, the comparative results between measurements demonstrate a significant reduction in the impact of headache on the daily activities of the workers at T-Control Company following the application of Maitland manipulations in the sub cranial area (Table 3).

Table 3. Impact of cervical pain on daily activities (HIT-6) in industrial technology workers, initial and final assessment.

HIT - 6 Score	Impact on daily activities	Initial		Final	
		Fr	%	Fr	%
< 49	No or little impact on their life	0	0	26	100
50 a 55	Certain impact on their life	17	65	0	0
56 a 59	Significant impact on their life	9	35	0	0
> 60	Severe impact on their life	0	0	0	0
Total		26	100	26	100

After the application of the Maitland manipulation guide for cervicogenic headache in the employees of T-Control Company, significant differences were observed in pain intensity, cervical disability index (NDI), and headache impact scale - HIT-6, as confirmed by the Wilcoxon Signed-Rank test for related samples. The probability obtained for all three tests was ($p < 0.000$), indicating strong statistical significance. These statistical values demonstrated a significance level lower than the predetermined alpha level ($p < 0.05$). Consequently, the research hypothesis was accepted, and the null hypothesis was rejected, providing evidence of significant differences between the measures related to pain intensity, disability, and headache impact among the employees of T-Control Company after the implementation of the Maitland exercise guide (M1 \neq M2) (Table 4).

Table 4. Wilcoxon Signed-Rank Test for Hypothesis verification

	Intensity of Pain Initial - Final	Final Neck Disability Index Initial - Final	Final Headache Impact Scale Initial - Final
Z	-4,549 ^b	-2,000 ^b	-4,636 ^b
Asymptotic Sig.	,000	,046	,000

DISCUSSION

Cervicogenic headache is one of the most recurrent symptoms in clinical practice, causing persistent and debilitating pain in the head, shoulders, and upper back. Although pharmacological treatment and physiotherapy often lead to pain relief, it can sometimes become disabling and result in high costs for compensation and treatment of affected workers. Due to the failure of conventional treatments to address recurrences, manual therapy has been employed as an adjunctive therapy in recent years. Therefore, the following study was conducted to investigate the intensity of pain experienced by employees of T-Control Company. It was found that the workers presented moderate to severe pain in 38% of cases and intense pain in 68% of cases, as opposed to the results obtained by Guevara & Sánchez (2022) in a group of workers with chronic musculoskeletal disorders, which showed mild pain intensities in 9.4% of cases, moderate pain in 54.7% of cases, and intense pain in 35.9% of cases. These findings demonstrate higher pain intensities compared to the study conducted by Garcia et al. (2021), where the mean pain levels were reported as mild for both men and women using data display screens.

Regarding disability associated with headache and neck pain, it was observed that 88% of the workers presented moderate functional limitations, indicating the need for conservative treatment, while intense functional limitations were observed in 12% of cases, suggesting the need for further in-depth study of their condition. This suggests the presence of multiple factors that have contributed to moderate and high levels of disability among the workers of T-Control Company. In terms of the impact of headache on the workers' lives, it was found that 65% experienced some impact, while 35% experienced a significant impact. Although there is limited evidence available, these findings are similar to those reported by Moraes et al. (2012), where 40% of healthcare workers reported minimal interference with their daily activities, 13% experienced significant interference, and only 1% were unable to perform their tasks.

The effectiveness of manual therapy in the treatment and resolution of musculoskeletal disorders has been supported by scientific evidence, as it allows for the restoration of movement to the affected segment and the normalization of muscle tone in the affected region. Among the most recognized interventions are Maitland mobilizations, which have been shown to effectively reduce pain and improve the functional level of the cervical spine.

When comparing the pain intensity measures before and after the program, a considerable clinical difference was observed, with a decrease in the percentage of workers experiencing moderate to severe pain to 4%, those with mild to moderate pain to 73%, and those with no pain to 23%. A decrease in the level of cervical disability was also observed, with minimal functional limitation achieved by all workers. Furthermore, after the program, it was observed that all workers reported either no impact or minimal impact on their lives due to headache pain. Statistically significant differences were observed in the study between the measures before and after the program, with $p < 0.000$ for the Visual Analog Scale (VAS), $p < 0.000$ for the Neck Disability Index (NDI), and $p < 0.000$ for the HIT-6 scale. These results align with the findings of Shabbir et al. (2021) in a comparative study of Maitland versus a placebo group, where the VAS yielded a value of $p < 0.008$ and the NDI had a value of $p < 0.030$ after 8 weeks of treatment. Similarly, when comparing Maitland and Mulligan techniques for neck pain, Alasari et al. (2021) found significant differences between the measures for both techniques ($p < 0.05$) (28). In Hassan et al.'s (2020) study comparing Maitland and Kaltenborn for the management of cervical radiculopathy, significant differences were found for both groups after the application of the techniques ($p < 0.05$), and the oscillatory mobilizations of Maitland were more significant than the sustained stretching of Kaltenborn ($p < 0.05$). It can be concluded that Maitland manipulations decrease pain intensity, cervical disability, and headache impact in the workers of T-Control Company.

CONCLUSIONS

The clinical presentation of cervicogenic headache in industrial technology workers revealed very intense headaches and neck pain, moderate functional limitation, and intense functional limitation during their activities. Additionally, they experienced a certain degree of impact on their lives associated with cervicogenic headache, affecting their physical, psychological, and occupational domains. Thus, there was a clear need to develop and implement an intervention that effectively mitigates this clinical condition and maintains its effect over time.

The scientific evidence from this research has demonstrated that the Maitland manual therapy technique is effective in relieving pain, reducing functional disability, and minimizing the impact of headaches on daily activities. Therefore, this technique should be considered an excellent alternative when deciding on the management of cervicogenic headaches.

Regarding the Maitland manipulation guide for the subcranial region, which was one of the objectives, it was designed and applied to workers who met the inclusion and exclusion criteria. After review and validation by three experts with experience in occupational disorders, the guide obtained a content validation coefficient of 96% overall and for each

item, reflecting excellent ratings and agreement among the experts. This allowed for the application of the guide.

The comparison between measures of pain intensity, cervical disability index, and headache impact demonstrated improvements in the condition. There was a significant decrease in the levels of moderate to severe pain to mild or no pain in the majority of workers, with statistically significant differences. Similarly, a significant decrease in cervical functional limitation was observed, with all workers achieving minimal functional limitation. Statistically significant differences were obtained between the measures. In terms of headache impact, the workers reported either no or minimal impact on their lives due to headaches, with statistically significant differences between measures. In conclusion, the Maitland technique has positive effects in reducing the clinical presentation of cervicogenic headaches in the 26 industrial technology workers, as evidenced by improvements in pain intensity, cervical disability, and headache impact on daily activities.

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