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The impact of suboccipital muscle inhibition on postural stability in young individuals

Wpływ inhibicji mięśni podpotylicznych na stabilność posturalną u młodych osób

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Abstract
Introduction. Postural stability is the result of cooperation between the musculoskeletal and nervous systems. The stability of standing posture ensures the spatial arrangement of the body, where the center of gravity falls within the center of the support base. FHT (Forward Head Posture) increases the extension in the occipito-cervical joint and upper cervical spine, deepening the flexion of the lower cervical segment, causing improper contraction of the suboccipital muscles. Disorders in the tone of the suboccipital muscles may affect the balance.
Objective. The research hypothesis was made that a single 4-minute suboccipital muscle inhibition procedure influences the change in postural stability values with open and closed eyes in individuals with cranio vertebral angle (CVA) within the normal range and below.
Materials and Methods. Healthy participants (10 women and 8 men) with an age of 22.7 ± 0.58. The participants took part in the study. They were classified into research groups based on the CVA angle assessment. Postural stability analysis used the Koordynacja stabilometric platform. Measurements were taken with open and closed eyes, before and immediately after suboccipital muscle inhibition.
Results. The suboccipital muscle inhibition was observed to affect anterior-posterior (A-P) displacements in group A (CVA < 50) p-value = 0.0168, with no significant impact in group
B (CVA ≥ 50), p-value = 0.3695.
Conclusion. A single 4-minute suboccipital muscle inhibition procedure does not significantly influence postural stability parameters in the examined groups, except for A-P displacements with open eyes in the CVA < 50 group.

Keywords
suboccipital muscle, postural stability

Streszczenie
Wprowadzenie Stabilność posturalna jest wynikiem współpracy między układem mięśniowo-szkieletowym a nerwowym. Stabilność postawy stojącej zapewnia przestrzenny układ ciała, gdzie środek ciężkości mieści się w obrębie środka bazy podparcia. Postawa z przodozgięciem głowy (FHT) zwiększa wyprost w stawie potyliczno-szyjnym i górnym odcinku kręgosłupa szyjnego, pogłębiając zgięcie dolnego segmentu szyjnego, co powoduje nieprawidłowe skurcze mięśni podpotylicznych. Zaburzenia w tonusie mięśni podpotylicznych mogą wpływać na równowagę. Cel. Hipoteza badawcza zakładała, że pojedyncza, 4-minutowa procedura inhibicji mięśni podpotylicznych wpływa na zmianę wartości stabilności posturalnej z otwartymi i zamkniętymi oczami u osób z kątem kraniowertebralnym (CVA) w zakresie normy i poniżej. Materiały i metody. Badanie przeprowadzono na grupie zdrowych uczestników, w skład której wchodziło 10 kobiet i 8 mężczyzn, średnio w wieku 22,7 ± 0,58 lat. Uczestnicy zostali podzieleni na grupy badawcze na podstawie oceny kąta kraniowertebralnego (CVA). Analiza stabilności posturalnej wykorzystywała platformę stabilometryczną firmy Koordynacja. Pomiary były przeprowadzane z otwartymi i zamkniętymi oczami, przed i bezpośrednio po inhibicji mięśni podpotylicznych. Wyniki. Zaobserwowano, że inhibicja mięśni podpotylicznych wpływa na przemieszczenia przednio-tylne (A-P) w grupie A (CVA < 50) z wartością p = 0,0168, bez znaczącego wpływu w grupie B (CVA ≥ 50), wartość p = 0,3695. Wnioski. Pojedyncza, 4-minutowa procedura inhibicji mięśni podpotylicznych nie wpływa znacząco na parametry stabilności posturalnej w badanych grupach, z wyjątkiem przemieszczeń A-P z otwartymi oczami w grupie CVA < 50.

Słowa kluczowe
mięsień podpotyliczny, stabilność posturalna

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Introduction

The popularity of touchscreen technology and various engaging applications is constantly rising. At present, the youth is particularly prone to musculoskeletal complaints due to prolonged smartphone use. The State of Mobile 2023 report indicates an average daily phone usage of 5 hours globally, a 3% increase compared to 2022 [1]. The most common issue associated with prolonged smartphone use is Forward Head Posture (FHP) [2]. FHP involves excessive extension of the upper cervical spine (C_1–C_3) and flexion of the lower cervical spine (C_4–C_7), related to the shortening of muscles such as the rectus capitis, neck extensor muscles (suboccipital, semispinalis, and splenius), sternocleidomastoid, and levator scapulae [3]. Changes in muscle length due to postural alterations impact the binding between actin and myosin filaments, causing changes in muscle force [4]. Several studies have noted that patients with FHP exhibit significant atrophy of the suboccipital muscles, including fat infiltration [5]. Uthaikhup et al. [6] suggested a connection between suboccipital muscle structure and symptoms such as the lack of proprioceptive nociceptive inhibition in the dorsal horn of the spinal cord, potentially leading to postural imbalance. Adipose tissue may result in inaccurate feedback, leading to the loss of essential information related to muscle position and tension transmitted to the central nervous system [5]. The correct head positioning is defined as a situation where the gravity line passes through the external auditory canal, cervical spine, and acromion process in the sagittal plane [7]. Sensomotor control of a stable upright position relies on afferent information from the vestibular, visual, and proprioceptive systems [8]. The cervical spine plays a crucial role in providing proprioceptive stimuli, reflected in the abundance of cervical mechanoreceptors and their central and reflex connections to the vestibular, visual, and central nervous systems. Neck muscles have a higher muscle spindle density than other body muscles; the rectus capitis posterior minor has 36 spindles per gram, the rectus capitis posterior major has 30.5 spindles per gram, while the gluteus maximus has only 0.8 spindles per gram [9]. Dysfunction in the vestibular, visual, and proprioceptive systems can result in balance disorders [10-12]. Suboccipital muscle inhibition (SMI) is widely used in manual therapy, targeting the myofascial region [13-15]. We hypothesized that a single suboccipital muscle inhibition procedure would influence head posture correction by altering suboccipital muscle length and nociceptive response, thereby affecting postural stability values [16].

Materials and methods

Study Participants: Healthy individuals, 10 women and 8 men, aged 20-25 years old (22.7 ± 0.58). No gender-based division was made; participants were assigned to research groups based on the CVA angle assessment. The study was conducted after obtaining approval from the UMP Poznan Bioethics Committee (KB-88/23) and written consent from participants.

Inclusion Criteria: Healthy individuals. Exclusion Criteria: Spinal diseases, balance disorders, neurological deficits, lack of consent to participate in the study.

CVA Angle Assessment: Participants' CVA angles were assessed using photogrammetry and assigned to the FHP group ($n = 10$) when CVA angle was $< 50°$ or the normal CVA group ($n = 8$) when CVA $\geq 50°$ [17]. CVA angle is defined as the angle between a line passing through the seventh spinous process (C_7) and the tragus of the ear, and a line parallel to the C_7 vertebra [18]. CVA angle was assessed using 2D photogrammetry and Max Traq software with serial number: 534D-584D. The participant assumed a standing position, upper limbs along the trunk, and lower limbs spaced hip-width apart [19]. The examiner marked the seventh spinous process (C_7) and tragus of the ear. A photo was taken 1.5 m away from the participant, and the CVA was obtained using the program's tools.

The Postural Stability Assessment: Postural stability analysis utilized the Koordynacja stabilometric platform. Postural stability was measured with open and closed eyes, before and immediately after therapy. The study was conducted in a standing position; participants stood barefoot on the stabilometric platform, upper limbs along the trunk. Before starting the measurement, the participant was instructed to stand as still as possible for 30 seconds with open eyes. After the first measurement, a second attempt was made with closed eyes.

Suboccipital Muscle Inhibition: During suboccipital muscle inhibition (SMI), the participant lay supine on a therapeutic table, and the therapist placed the second and third fingers of both hands, flexed at the metacarpophalangeal joints to 90°, between the occipital bone and the participant's atlas [20]. Constant pressure was applied without causing pain. The intervention duration was 4 minutes, conducted by the same therapist for each participant.

Statistical analysis was performed using R ver. 4.2.2 software [21].

Results

At the beginning of the statistical analysis, the normal distribution of data for group A (CVA < 50) and group B (CVA ≥ 50) was confirmed. A normal distribution was observed. The Student's t-test was then applied to compare postural stability values before and after suboccipital muscle inhibition with open and closed eyes for anterior-posterior, medio-lateral displacements, and surface area. Results were also presented in box plots. The significance level was set at 0.05.

In the first step, an analysis was conducted for postural stability values with open eyes. Statistical significance was observed in group A with a p-value of 0.0168 for anterior-posterior deviations (A-P) after inhibiting suboccipital muscles (Figure 1). In group B, no statistical significance was noted with a p-value of 0.3695 (Figure 2).

Next, the impact of inhibiting postural muscles on medial-lateral (M-L) deviations in postural stability was examined. In both groups A and B, no statistical significance was observed (p-values of 0.3205 and 0.3609, respectively) (Figures 3 and 4).

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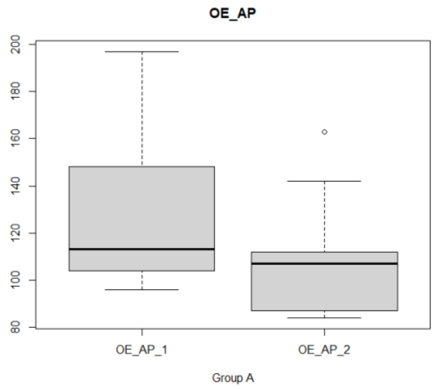

Figure 1. Effect of suboccipital muscle inhibition in group A on A-P excursions of postural stability with eyes open (OE_AP_1 – open eyes anterior-posterior before inhibition; OE_AP_2 – open eyes anterior-posterior after inhibition).

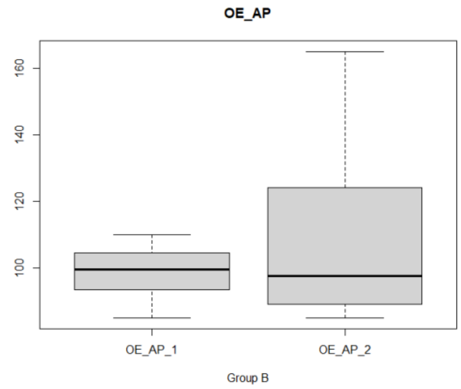

Figure 2. Effect of suboccipital muscle inhibition in group B on A-P excursions of postural stability with eyes open (OE_AP_1 – open eyes anterior-posterior before inhibition; OE_AP_2 – open eyes anterior-posterior after inhibition)

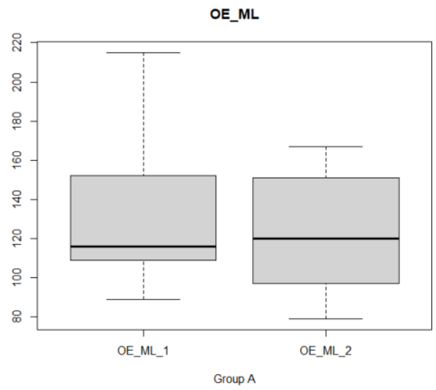

Figure 3. Effect of suboccipital muscle inhibition in group A on M-L excursions of postural stability with eyes open (OE_ML_1 – open eyes mediale-laterale before inhibition; OE_ML_2 – open eyes mediale-laterale after inhibition)

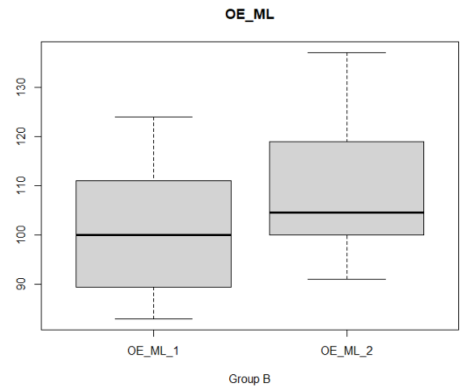

Figure 4. Effect of suboccipital muscle inhibition in group B on M-L excursions of postural stability with eyes open (OE_ML_1 – open eyes mediale-laterale before inhibition; OE_ML_2 – open eyes mediale-laterale after inhibition)

Subsequently, a statistical analysis for surface area was performed. Neither group A (p-value = 0.2153, Figure 5) nor group B (p-value = 0.4609, Figure 6) showed statistical significance.

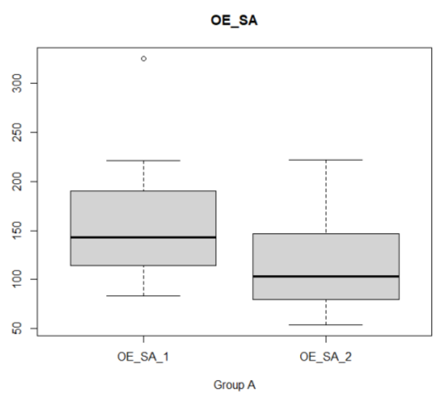

Figure 5. Effect of suboccipital muscle inhibition in group A on area at open eyes (OE_SA_1 – open eyes surface area before inhibition; OE_SA_2 – open eyes surface area after inhibition)

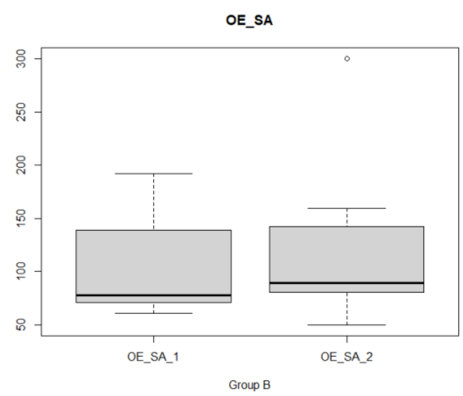

Figure 6. Effect of suboccipital muscle inhibition in group B on area at open eyes (OE_SA_1 – open eyes surface area before inhibition; OE_SA_2 – open eyes surface area after inhibition)

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The next step involved examining the influence of inhibition on postural stability values with closed eyes. Both group A and group B did not exhibit statistical significance for anterior-posterior deviations (A-P) with closed eyes (p-values of 0.3739 and 0.2044, respectively) (Figures 7 and 8).

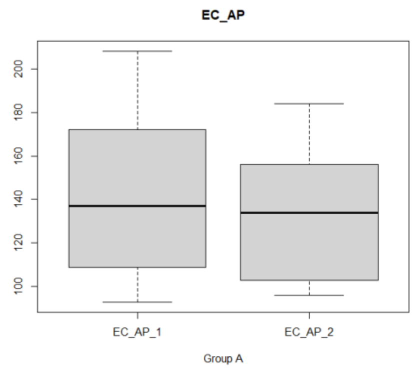

Figure 7. Effect of suboccipital muscle inhibition in group A on A-P excursions of postural stability with eyes closed (EC_AP_1 – eyes closed anterior-posterior before inhibition; CE_AP_2 – eyes closed anterior-posterior after inhibition)

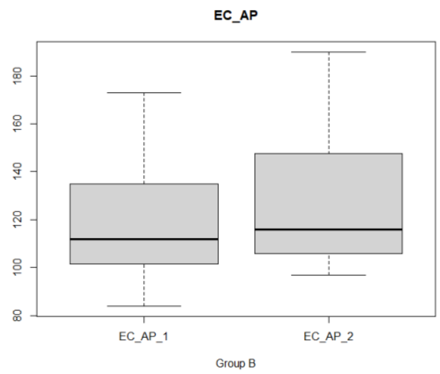

Figure 8. Effect of suboccipital muscle inhibition in group B on A-P excursions of postural stability with eyes closed (EC_AP_1 – eyes closed anterior-posterior before inhibition; CE_AP_2 – eyes closed anterior-posterior after inhibition)

For medial-lateral deviations (M-L) with closed eyes, neither group A (p-value = 0.6958, Figure 9) nor group B (p-value = 0.3444, Figure 10) showed statistical significance.

Finally, regarding surface area, both group A (p-value = 0.5341, Figure 11) and group B (p-value = 0.9529, Figure 12) did not exhibit statistical significance after inhibition.

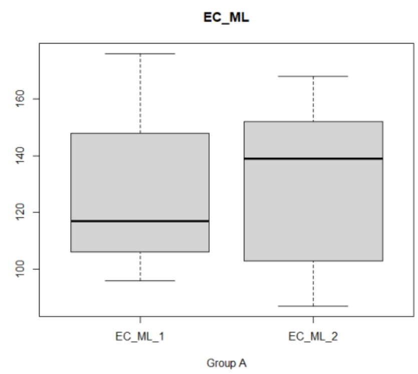

Figure 9. Effect of suboccipital muscle inhibition in group A on M-L excursions of postural stability with eyes closed (CE_ML_1 – eyes closed mediale-laterale before inhibition; CE_ML_2 – eyes closed mediale-laterale after inhibition)

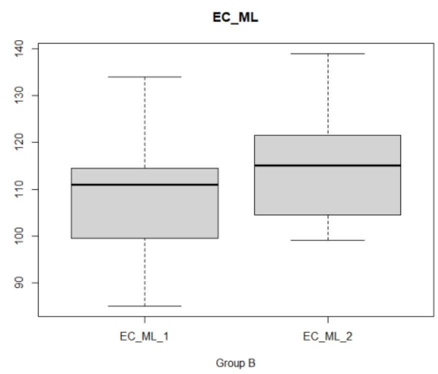

Figure 10. Effect of suboccipital muscle inhibition in group B on M-L excursions of postural stability with eyes closed CE_ML_1 – eyes closed mediale-laterale before inhibition; CE_ML_2 – eyes closed mediale-laterale after inhibition)

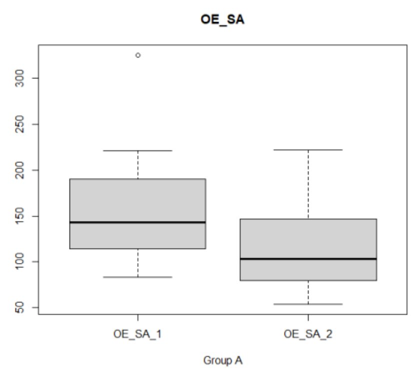

Figure 11. The impact of inhibiting suboccipital muscles in group A on surface area with closed eyes (CE_SA_1 – eyes closed surface area before inhibition; CE_SA_2 – eyes closed surface area after inhibition)

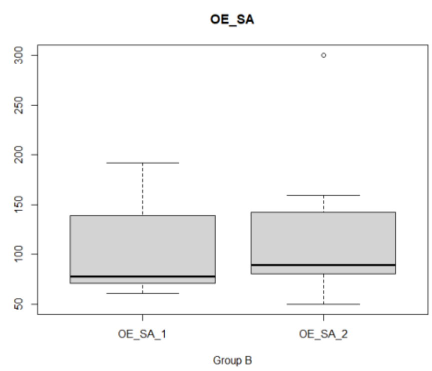

Figure 12. The impact of inhibiting suboccipital muscles in group B on surface area with closed eyes (CE_SA_1 – eyes closed surface area before inhibition; CE_SA_2 – eyes closed surface area after inhibition)

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The next step of the statistical analysis involved comparing postural stability values between groups A and B. Statistical significance was only observed with open eyes for anterior-posterior deviations (A-P) before inhibiting suboccipital muscles (p-value = 0.0321) (Table 1, Figure 13).

Table 1. P-values when comparing group A with group B (OE – open eyes; EC - eyes closed; AP_1 – anterior-posterior before inhibition; AP_2 – anterior-posterior after inhibition; ML_1 – medial-lateral before inhibition; ML_2 – medial-lateral after inhibition; SA_1 – surface area before inhibition; SA_2 – surface area after inhibition)

	A vs B					
	AP_1	AP_2	ML_1	ML_2	SA_1	SA_2
OE	0.0321	0.9795	0.06142	0.3771	0.07217	0.8738
EC	0.2505	0.7795	0.09492	0.1886	0.1443	0.06982

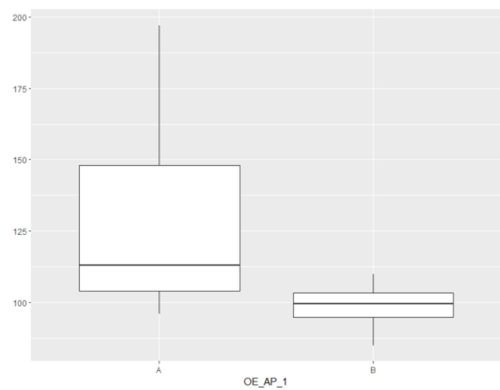

Figure 13. Comparison between group A and B before inhibiting suboccipital muscles

Discussion

The proprioceptive role of suboccipital muscles is crucial for posture and balance.[22]. Studies by Lee et al. observed differences in balance control between Forward Head Posture (FHP) and control groups without FHP [18]. The intervention time for Suboccipital Muscle Inhibition (SMI) varies, but it generally ranges from 2.5 to 5 minutes [13]. Hallgren and co-authors observed an increase in hip and knee joint range of motion after 2 minutes of intervention [23], Lee et al. reported a reduction in headache and improvement in neck function after 3 minutes of intervention [18]. Antolinos-Campillo et al. showed an increase in hip ROM after 5 minutes of intervention [5], and Azam et al. reported that an 8-minute intervention improved gait function in children with cerebral palsy [24]. Mecagni et al. suggested that there was a correlation between an increase in ankle joint range of motion after SMI and improved balance ability [25]. The SMI technique had a positive effect on elbow extension in patients with cervical spine injury [20]. According to Heredia Rizo et al. [20],
the SMI technique seemed to have an immediate effect on relaxing the suboccipital muscles, improving the alignment of the craniocervical axis. A manual technique that releases tension at the occipital level will affect peripheral tension, according to tensegrity theory [26]. This theory proposes a structural concept of the body that explains how the release of fascial tension in one part can involve the entire structure. Musculofascial techniques performed in the suboccipital area can have a distant effect on the locomotor system [23]. Treatments applied to the head area can reduce stress hormones and heart rate variability [27-29].

Conclusions

A single 4-minute inhibition of suboccipital muscles has no significant impact on postural stability parameters in the studied groups, except for anterior-posterior deviations with open eyes in the group with a CVA angle < 50. Further research with a larger sample size, considering gender distribution, and extending the duration of suboccipital muscle inhibition is needed.

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Piśmiennictwo/ References

1. https:datareportal.com/raports/digital-2023-poland (08.01.2024).
2. Sung YH. Suboccipital Muscles, Forward Head Posture, and Cervicogenic Dizziness. Medicina (Kaunas). 2022;5(12):179.

doi.org/10.56984/8ZG2EF8369

3. Kang JH, Park RY, Lee SJ, Kim JY. The effect of the forward head posture on postural balance in a long time computer based worker. Ann Rehabil Med. 2015;36(1):98-104.
4. Cho SH, Kim SH, Park DJ. The comparison of the immediate effects of application of the suboccipital muscle inhibition and self-myofascial release techniques in the suboccipital region on short hamstring. J Phys Ther Sci. 2015;195-7.
5. Kang HS, Kwon HW, Kim DG, Park KR, Hahm SC, Park JH. Effects of the Suboccipital Muscle Inhibition Technique on the Range of Motion of the Ankle Joint and Balance According to Its Application Duration: a randomized controlled trial. Healthcare (Basel). 2021;29;9(6):646.
6. Uthaikhup S, Assapun J, Kothan S. Structural changes of the cervical muscles in elder women with cervicogenic headache. Musculoskelet. Sci. Pract. 2017; 29;1-6.
7. Arjona Retamal JJ, Fernández Seijo A, Torres Cintas JD. A. Effects of Instrumental, Manipulative and Soft Tissue Approaches for the Suboccipital Region in Subjects with Chronic Mechanical Neck Pain. Int J Environ Res Public Health. 2021;16;18.
8. Carini F, Mazzola M, Fici C. Posture and posturology, anatomical and physiological profiles: overview and current state of art. Acta Biomed. 2017;11-16.
9. Kang H.-S, Kwon H.-W, Kim D. Effects of the Suboccipital Muscle Inhibition Technique on the Range of Motion of the Ankle Joint and Balance According to Its Application Duration. Healthcare. 2021; 9,646.
10. Bae Y, Park Y. Head Posture and Postural Balance in Community-Dwelling Older Adults Who Use Dentures. Medicina. 2020, 56, 529.
11. Jeong ED, Kim CY, Kim SM, Lee SJ. Short-term effects of the suboccipital muscle inhibition technique and cranio-cervical flexion exercise on hamstring flexibility, cranio-vertebral angle, and range of motion of the cervical spine in subjects with neck pain. Musculoskelet Rehabil. 2018;1025-1034.
12. Devaraja K. Approach to cervicogenic dizziness. Eur. Arch. Otorhinolaryngol. 2018; 27, 2421–2433.
13. Ma Y, Tang W, Gong DZ, Li XY. The morphology, biomechanics, and physiological function of the suboccipital myodural connections. Sci Rep. 2021;13;11.
14. Antolinos-Campillo PJ, Oliva-Pascual V. Short-term changes in median nerve neural tension after a suboccipital muscle inhibition technique in subjects with cervical whiplash.. Physiotherapy. 2014;100(3):249-55.
15. Pinloche L, Souvignet S, Germain M. The short-term effect of a myofascial protocol versus light touch applied to the cervical spine towards the prevention of balance disorders in the elderly. Chiropr Man Therap. 2022;31;30(1):33
16. Bernal-Utrera, Anarte-Lazo, Gonzalez-Gerez JJ. Effect of Combined Manual Therapy and Therapeutic Exercise Protocols on the Postural Stability of Patients with Non-Specific Chronic Neck Pain. J Clin Med. 2021;24;11.
17. Salahzadeh Z, Maroufi N, Ahmadi A, Behtash H, Razmjoo A, Gohari M, Parnianpour M. Assessment of forward head posture. Musculoskeletal Rehabil. 2014;27: 131–139.
18. Lee JH. Effects of forward head posture on static and dynamic balance control. J Phys. 2016 Jan;28(1):274-7
19. Joon-Hee Lee,.Effects of forward head posture on static and dynamic balance control. 2016;28;274-277
20. Antolinos-Campillo A.P., Oliva-Pascual-Vaca Á. Short-term changes in median nerve neural tension after a suboccipital muscle inhibition technique in subjects with cervical whiplash., Physiotherapy. 2014;249-255.
21. Development Core Team. A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna. Austria. 2020. Available at: http://www.r-project.org (Accessed: 20 November 2023).
22. Song X, Gong J, Yu SB, et al. The relationship between compensatory hyperplasia of the myodural bridge complex and reduced compliance of the various structures within the cranio-cervical junction. Anat Rec. 2023;306(2):401–8.
23. Hallgren RC, Rowan JJ. Implied evidence of the functional role of the rectus capitis posterior muscles. Osteopath Assoc. 2020;120:395–403.
24. Azam AM. Efficacy of suboccipital muscles decompression techniques in restoring functional walking capacity in hemiplegic cerebral palsy children. Pediatr. 2017:4, 1132.
25. Lee HR, Shim JH. Effects of high-frequency diathermy integrated into suboccipital release on tenderness and neck mobility and disability in people with chronic tension-type headache. Phys. Ther. 2017:24, 37–47.
26. Plaut S. Scoping review and interpretation of myofascial pain/fibromyalgia syndrome: An attempt to assemble a medical puzzle. PLoS One. 2022;16;17.
27. Wójcik M, Siatkowski I. The efect of cranial techniques on the heart rate variability response to psychological stress test in frefghter cadets. Scientifc Reports. 2023;13:7780.
28. Wójcik M, Bordoni B, Siatkowski I, Żekanowska E. Behav. Sci. The Effect of Craniosacral Therapy on Blood Levels of Stress Hormones in Male Firefighter Cadets: A Randomized Clinical Trial. 2023;13:914.

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