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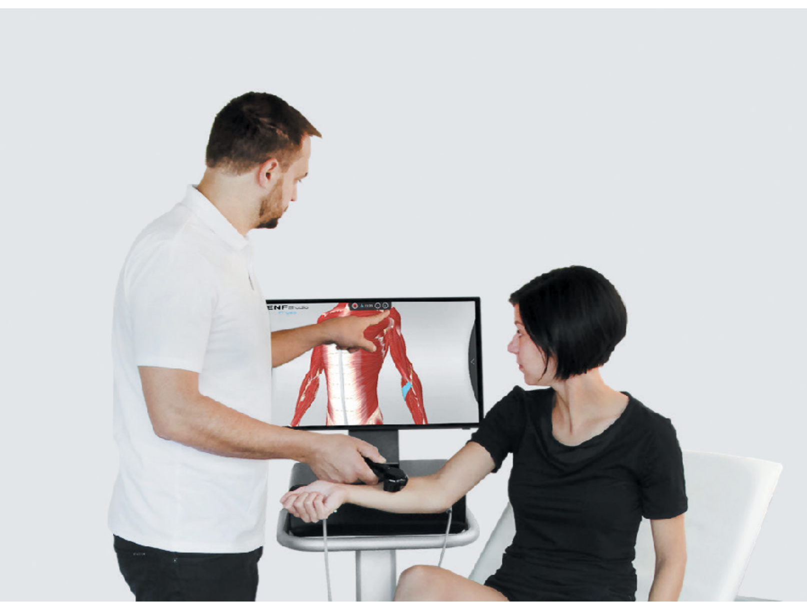

BIOMAGNETOTERAPIA W WYROBACH MEDYCZNYCH „ORT BUTTERFLY”

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REGULARNA BIOSTYMULACJA MAGNETYCZNA!

Ogromny potencjał Natury w zwalczaniu smogu energetycznego i autooksydacji, będącej główną przyczyną wszystkich chorób cywilizacyjnych! **Najstarsza Terapia Świata** wspomagająca każdą formę leczenia! Uważa się do dziś, że bez niej nie da się wyleczyć żadnej choroby do końca! **Naturalna Terapia Magnetyczna** Twoje Zdrowie, Twoja Uroda, Odporność i Sprawność do późnej starości! **Wypróbuj** – gdy zawiodły już inne terapie!

Biomagnetoterapia inicjuje ożywienie komórkowe, oczyszcza i „odmładza” krew, podnosząc witalność całego organizmu, który uruchamia intuicyjne procesy obronne, znosząc dyskomfort powodowany bólem, urazem lub stresem, bez konieczności ostrej dawki leków chemicznych...

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Natężenie sztucznych pól elektromagnetycznych zwiększyło się 100 tys. razy! Naturalne pole magnetyczne Ziemi zmniejszyło swą moc o połowę!

Jestem osobistym królikiem doświadczalnym! I żyję – realizując 25 lat wciąż nowe i śmielsze pomysły w wykorzystaniu tej **boskiej energii** naturalnych magnesów! Dzięki nim pokonuję dziś niezliczone przeszkody i przeciwności losu z nieznaną mi przedtem energią i determinacją! To moja pasja! I przeznaczenie!

Najnowsza opinia klienta:

Komentarz ten jest moim osobistym świadectwem zadowolenia z produktów biomagnetycznych „Ort Butterfly”, których używam od 20. lat! Zastanawiam się, zwłaszcza nad fenomenem poduszki (określenie nie jest przypadkowe) zwyczajnie; nie wyobrażam sobie snu i wypoczynku bez magnetycznej „Ort Butterfly” – pod głową! Jej ergonomiczny, przyjazny dla głowy i szyi kształt sprawia, że wysypiam się „po królewsku”. Zabieram ją również ze sobą w bliższe i dalsze podróże! Czyż gdyby była to zwyczajna poduszka, fundowałbym sobie dodatkowy bagaż? Wychwalam więc ją od zarania, polecam i rekomenduję, bo jest tego warta! Bez niej nie wyobrażam sobie prawdziwie relaksacyjnego snu i błogiego, kojącego wyczpoczynku! Dziękuję, że ją Pani stworzyła!

J. Szw. Działdowo (maj 2020)

PS *Poduszki „Ort Butterfly” to prawdziwe arcydziełka robione z wyczuciem i sercem... jak rzeźby Michała Anioła... Polecam wszystkim!*

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Effects of upper cervical HVLA manipulation on static and dynamic balance parameters in healthy adults – a systematic literature review

Wpływ manipulacji HVLA górnych kręgów szyjnych na parametry równowagi statycznej i dynamicznej u zdrowych dorosłych – systematyczny przegląd literatury

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Abstract
Background. Balance is a complex concept that applies not only to tasks with a reduced base of support, but also to everyday activities that require us to maintain a fixed position. Just as the concept itself is broad, the mechanisms for maintaining balance are complex and rely on information received from many regions of the body and organs.
Objective. The aim of this systematic literature review is to analyse whether HVLA manipulation of a blocked C0-C1 segment can affect static and dynamic balance parameters in healthy adults.
Methods. Based on the available literature, accessed via PubMed, Google Scholar, Scopus, EBSCO databases, a detailed search of the electronic literature was performed for 2010–2023. Eligible studies were chosen according to inclusion and exclusion criteria, using keywords: static balance, dynamic balance, manipulation, HVLA. Out of 114 manuscripts, 82 were short-listed for the preliminary review process. Twenty experimental studies were selected for final analysis.
Results. Out of the 20 publications analysed, 14 examined the effect of HVLA manipulation on balance parameters. In most cases, the study groups consisted of people with no dysfunction or complaints and/or people with neck pain. The most commonly studied parameter was static balance in standing: 17 of 20 publications. For the cervical spine, 50% of the studies found a significant improvement in the parameters studied in the immediate assessment, while in the delayed assessment there were as many significant positive results as there were results with no effect on balance. In the analysis of a subset of trials that examined only asymptomatic patients, partial or significant positive effects were observed in both immediate and delayed assessment.
Conclusions. We were not able to identify studies that would provide a clear answer to the research question. Based on the publications included in the review, it can be assumed that HVLA manipulation in the cervical region has the potential to affect balance in healthy adults, but the number of available studies is too small to draw firm conclusions. Further research in this area is therefore warranted.

Keywords
static balance, dynamic balance, manipulation, HVLA, podoscope

Streszczenie
Wprowadzenie. Równowaga to skomplikowane pojęcie, które dotyczy nie tylko zadań z ograniczoną bazą wsparcia, ale także codziennych czynności wymagających od nas utrzymania stałej pozycji. Tak, jak szerokie jest samo pojęcie, mechanizmy utrzymania równowagi są również złożone i opierają się na informacjach odbieranych z wielu obszarów ciała i narządów.
Cel. Celem tego systematycznego przeglądu literatury jest analiza, czy manipulacja HVLA zablokowanego segmentu C0-C1 może wpływać na parametry równowagi statycznej i dynamicznej u zdrowych dorosłych.
Metody. Na podstawie dostępnej literatury, uzyskanej za pomocą baz danych PubMed, Google Scholar, Scopus, EBSCO, przeprowadzono szczegółowe wyszukiwanie literatury elektronicznej w latach 2010–2023. Odpowiednie badania zostały wybrane według kryteriów włączenia i wykluczenia, używając słów kluczowych: równowaga statyczna, równowaga dynamiczna, manipulacja, HVLA. Spośród 114 prac 82 zostały wybrane do wstępnego procesu recenzji. Dwadzieścia badań eksperymentalnych zostało wybranych do ostatecznej analizy.
Wyniki. Spośród 20 przeanalizowanych publikacji 14 badania dotyczyło wpływu manipulacji HVLA na parametry równowagi. W większości przypadków grupy badane składały się z osób bez dysfunkcji ani zastrzeżeń i/lub osób z bólem szyi. Najczęściej badanym parametrem była równowaga statyczna w pozycji stojącej: 17 z 20 publikacji. Dla kręgosłupa szyjnego 50% badań wykazało znaczącą poprawę w badanych parametrach w ocenie natychmiastowej, podczas gdy w ocenie odroczonej liczba znacząco pozytywnych wyników była taka sama jak liczba wyników bez wpływu na równowagę. W analizie podzbioru badań obejmujących tylko pacjentów bezobjawowych zaobserwowano częściowe lub znaczące pozytywne efekty zarówno w ocenie natychmiastowej, jak i odroczonej.
Wnioski. Nie byliśmy w stanie zidentyfikować badań, które dostarczyłyby jednoznacznej odpowiedzi na pytanie badawcze. Na podstawie publikacji uwzględnionych w przeglądzie można przypuszczać, że manipulacja HVLA w regionie szyjnym ma potencjał wpływania na równowagę u zdrowych dorosłych, jednak liczba dostępnych badań jest zbyt mała, aby wyciągnąć ostateczne wnioski. Dalsze badania w tym zakresie są zatem uzasadnione.

Słowa kluczowe
równowaga statyczna, równowaga dynamiczna, manipulacja, HVLA, podoskop

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Introduction

Balance is a complex process that involves the interaction of many organs with a complex physiology and anatomy. The main tasks of the balance system include providing up-to-date information about the body's position in space, reacting quickly to prevent falling, and controlling eye movements to maintain a constant view of the surrounding space [1]. Balance disorders can be caused by a number of dysfunctions, including neurological conditions, nervous system injuries, disorders of the soft tissues adjacent to neural structures or muscular imbalances. Some causes are reversible, others are not. There are a number of tests that can be used to check a patient's balance. However, they are more or less subjective. Objective balance assessments can be made with the use of equipment such as the pedobarograph, which produces stabilograms. By detecting and monitoring pressure points and the position of the centre of gravity projection, it is possible to observe sway and asymmetries that may be indicative of balance disorders.

Balance involves many parts of the body and relies on different mechanisms, e.g. reflex pathways of lower limb muscles [2]. The head and neck play a key role in the process, due to a significant number of proprioceptors responsible for the execution of coordinated, corrective and targeted movements [3].

The interdependencies described above raise the question of whether interventions in the neck region can have a measurable effect on balance parameters.

HVLA (high velocity, low amplitude) manipulation

According to one recent definition, manipulation is the separation of opposing articular surfaces of a synovial joint, caused by a force applied perpendicularly to those articular surfaces that results in cavitation within the synovial fluid of that joint [4]. HVLA manipulation is characterised by high speed and low amplitude of the thrust applied by the therapist. This method follows specific principles to ensure that the treatment is as targeted and controlled as possible. The effectiveness of HVLA manipulation is thought to be rooted in neurophysiological mechanisms [5, 29].On this basis, it has been demonstrated that this type of intervention can produce an increase in the pain threshold, among other effects, and therefore manipulation techniques can be effective in the treatment of some cases of chronic pain [6]. The intervention affects not only mechanical parameters, like range of motion [7], but also other systems. Studies have also shown positive effects on grip strength or lowering blood pressure [8]. By affecting the autonomic nervous system, HVLA manipulations can also induce changes in heart rate variability and skin conductance [9].

Objective

The aim of this systematic literature review is to analyse whether HVLA manipulation of a blocked C0-C1 segment can affect static and dynamic balance parameters in healthy adults.

Material and methods

Based on the available literature, accessed via PubMed, Google Scholar, Scopus, EBSCO databases, a detailed search of the electronic literature was performed for 2010–2023. Eligible studies were chosen according to inclusion and exclusion criteria, using keywords: static balance, dynamic balance, manipulation, HVLA, podoscope. Out of 114 manuscripts, 82 were short-listed for the preliminary review process. Twenty experimental studies were selected for final analysis.

The selected manuscripts represented different types of publications: randomised trials, randomised double-blinded trials, cross-sectional studies, clinical experiments, pilot studies. The selection process was based on the PICO model and inclusion and exclusion criteria.

Inclusion criteria:
- intervention: HVLA spinal manipulation
- factors studied: balance parameters
- measurement method: podoscope, stabilometric force platform
- study duration: immediate and/or delayed effect

Exclusion criteria:
- type of publication: case study
- study group: age under 18 years, limited communication with the patient, conditions like balance disorders, neurological conditions

Results

The 20 experimental studies included in the final analysis are presented in Table 1. The information provided in the Table includes the studied body part, whether and what intervention was undertaken, the studied effect: immediate and/or delayed, as well as the parameters studied and tests performed to assess them.

Of the 20 studies selected for this review, 14 examined the effect of spinal manipulation. The remainder were designed to assess the effects of different aspects of the cervical spine on postural parameters. The publications included in the review varied in terms of the target populations. The largest proportion (45%) included groups of people not affected by disease, dysfunction or any complaints associated with the subject of the study.

The second most common category were people with pain in the cervical spine (30%). The remaining studies investigated people with lower back pain (15%) and asymmetries or restrictions in cervical spine mobility (10%) (Fig. 1).

All trials that included some form of intervention chose HVLA manipulation. Only one trial additionally compared it with LVVA manipulation. In terms of the frequency of the intervention, only one trial repeated the manipulation several times. For the other publications, the intervention was performed only once in each participant.

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Table 1. Systematic analysis of 20 literature items, regarding HVLA manipulation of a blocked C0-C1 segment and its effect on static and dynamic balance parameters in healthy adults

Authors	Body part	Intervention	Experimental group	Control group	Studied parameter	Immediate effect	Delayed effect	Test
Quek et al., 2013	pper cervical spine	-----	Patients with asymmetry in cervical flexion-rotation test; n = 34; mean age approx. 66 years; neck pain	Patients without asymmetry; n = 20; neck pain	Postural balance in standing (CoP), gait speed	Compensations aimed at improving postural functions	-----	Force platform
Jørgensen et al., 2011	Cervical spine	-----	Cleaners with neck pain; n = 85	Cleaners without neck pain; n = 109	Postural balance in standing (CoP sway, fast and slow component)	Participants with neck pain were more likely to fail the unilateral stance test and had more problems when standing with eyes closed	-----	Force platform; maintaining unilateral stance for 30s, standing in the Romberg position with eyes open and closed
Cheng et al., 2015	Cervical spine	-----	Patients with neck pain; n = 20; age approx. 25 years	Asymptomatic patients; n = 20; age approx. 22 years	Postural balance in standing (CoP sway), EMG of cervical and lumbar muscles	Greater body sway in those with pain in quiet standing; greater sway in both groups after neck flexor fatigue in quiet standing	-----	Force platform; quiet standing and standing with backward perturbations before and after neck flexor fatigue
Saadat et al., 2018	Cervical spine	-----	Patients with neck pain; n = 22	Patients without neck pain; n = 22	Postural stability in standing (TSI, APSI, MLSI, trunk deviation)	Significant differences in APSI, MLSI and TSI between groups, greater trunk deviation in pain group	-----	Force platform; standing with eyes open and closed
Gómez et al., 2020	Upper cervical spine (C1-C2)	HVLA manipulation	Patients with neck pain receiving HVLA; n = 22; age 18-60 years	Patients with neck pain receiving placebo; n = 22; age 18-60 years	Postural balance in standing (CoP)	Improvement in only some of the postural parameters	At day 7 and 15 follow-up; improvement in each parameter in the experimental group	Force platform; standing with eyes closed
Romero del Rey et al., 2022	Upper cervical spine (C1-C2)	HVLA manipulation	Patients with neck pain, receiving manipulation at C1-C2; n = 93	Patients with neck pain, receiving manipulation at C3-C4/C7-T1/T5-T6; n = 93	Postural stability in standing	Largest improvement in parameters in the experimental group (C1-C2)	No data available	Force platform
Grassi Dde et al., 2011	Sacroiliac joint	HVLA manipulation	Healthy individuals; n = 20	-----	Postural balance in standing (peak pressure, contact area)	Reduction in peak pressure; correlation between the side of joint restriction and the foot with greater contact area; no further correlations	At day 7 follow-up; reduction in peak pressure; no further correlations	Baropodometric platform
Farazdaghi et al., 2018	Sacroiliac joint	HVLA manipulation	Patients with lower back pain, receiving HVLA manipulation; n = 16, age 20-50 years	Patients with lower back pain, receiving sham manipulation; n = 16; age 20-50 years	Postural balance in standing	No significant differences in postural control	-----	Force platform; 3x30s, eyes open

Authors	Body part	Intervention	Experimental group	Control group	Studied parameter	Immediate effect	Delayed effect	Test
Fagundes Loss et al., 2020	Lumbar spine	HVLA manipulation	Patients with lower back pain, receiving HVLA manipulation; n = 12	Patients with lower back pain, receiving sham manipulation; n = 12	Postural balance in standing	No significant differences in postural parameters	-----	Force platform; 3x30s, eyes open
Goertz et al., 2015	Lumbar spine	HVLA/ LVVA manipulation	Patients with lower back pain, receiving HVLA manipulation; n = 74 Patients with lower back pain, receiving LVVA manipulation; n = 74	Patients with lower back pain, receiving sham manipulation; n = 73	Balance in standing and response to sudden load	Significant difference only in medial-to-lateral parameter in LVVA group	2 weeks follow-up; no significant differences in parameters	Force platform; quiet standing and sudden load (perturbation of balance)
Ditcharles et al., 2017	Thoracic spine	HVLA manipulation	Healthy individuals, receiving HVLA manipulation; n = 11	Healthy individuals, receiving sham manipulation; n = 11	Postural balance in standing, gait initiation	Negative effects on anticipatory postural adjustments (APA) and speed performance during gait initiation	-----	Force platform; quiet standing + 10x gait initiation
Fisher et al., 2015	Cervical spine	HVLA manipulation	Patients with neck pain, receiving HVLA manipulation; n = 10	-----	Postural balance in standing	No significant differences in parameters	5 min and 10 min after the procedure; no significant differences in parameters	Force platform
Delafontaine et al., 2022	Cervical spine	-----	Healthy individuals wearing cervical bandage/foam collar/ Philadelphia orthosis/no neck device; n = 15	-----	Gait initiation with different types of neck stabilisation	No significant differences in postural control and stability, but with alterations in motor performance, e.g. step length	-----	Force platform; quiet standing + gait initiation + walking 5 m x10 for each of the 4 test conditions
Hamaoui, Alamini-Rodrigues, 2017	Cervical spine	-----	Healthy women wearing cervical bandage/foam collar/ Philadelphia orthosis/no neck device; n = 16	-----	Dynamic balance during sit-to-stand transition	Correlation of restriction of cervical spine mobility with impairment of motor and postural functions	-----	Force platform; 6 trails of the sit-to-stand task at maximum speed for each of the 4 test conditions
Behrens et al., 2023	Cervical spine	HVLA manipulation	Healthy individuals, receiving HVLA manipulation; n = 15	Healthy individuals, receiving sham manipulation; n = 15	Static and dynamic balance in standing	Slight improvement in parameters with small differences between groups	1 week follow-up; Slight improvement in parameters with small differences between groups	Force platform; limits of stability test (sway in eight directions) with and without counting backwards by threes; single leg stance test with and without counting backwards by threes

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Authors	Body part	Intervention	Experimental group	Control group	Studied parameter	Immediate effect	Delayed effect	Test
Drayer, Kauwe, 2013	Cervical spine	HVLA manipulation	Healthy individuals, receiving HVLA/sham manipulation at 2 different visits; n = 34	-----	Static balance, proprioception	Significant differences in individual parameters, without clear impact on balance	-----	SMART NeuroCom Balance Master Sensory Organization Test; Laser Cervical Proprioceptive test
McKay, 2018	Cervical spine	HVLA manipulation	Patients with C0-C3 fixation, receiving HVLA manipulation; n = 20 Patients with C4-C7 fixation, receiving HVLA manipulation; n = 20 Patients with fixations in both the upper and lower cervical spine, receiving HVLA manipulation; n = 20	Patients with fixation at any level of the cervical spine; n = 20	Static and dynamic balance	Significant improvement in dynamic balance after lower cervical spine manipulation	-----	Force platform; Quiet standing with eyes open and closed; fixed platform and platform with a foam pad
Nolan, 2010	Upper cervical spine	HVLA manipulation	Individuals receiving HVLA manipulation	Individuals receiving placebo	Postural balance in standing	Significant improvement, also in relation to the control group	-----	BIODEX system
Uchiyama et al., 2019	Cervical spine	HVLA manipulation	Healthy individuals, receiving HVLA manipulation	Healthy individuals, receiving sham manipulation	Dynamic balance	Reduction of postural sway in the experimental group	-----	Force platform; single leg stance on a foam pad
Lopez et al., 2011	Cervical spine	HVLA manipulation 1x per week for 7 weeks	Healthy elderly patients, receiving treatment; n = 20	Healthy elderly patients not receiving treatment; n = 20	Postural balance in standing	-----	Improved postural control after a series of treatments	Force platform; standing with eyes open/closed/modified Romberg test

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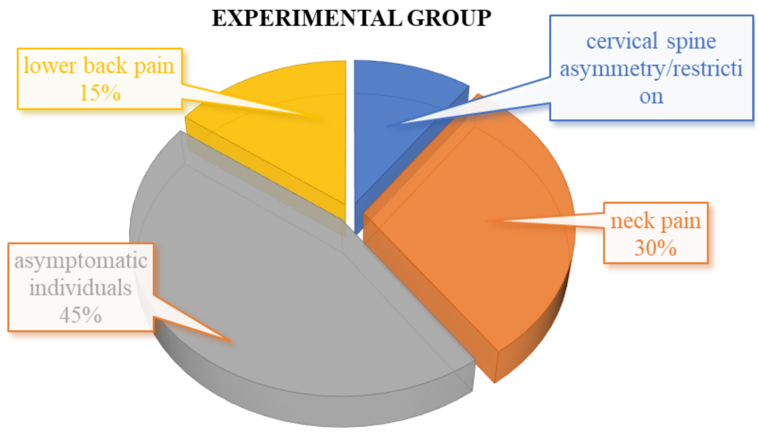

Fig. 1. Percentage distribution of experimental group categories in the analysed publications

In each of the trials analysed, the researchers assessed postural and motor control parameters using stabilometric force platforms, though representing different systems. The parameters assessed in the selected studies were mainly static balance during standing, and in some cases additionally dynamic balance in perturbed standing. Only two publications examined balance parameters during gait (Fig. 2). In the trials assessing changes in parameters during standing, participants were asked to perform different tasks: quiet standing with eyes open, quiet standing with eyes closed, the Romberg test, and, for more dynamic conditions, standing with perturbation, single leg stance, the limits of stability test (leaning out of balance) and the sit-to-stand test (Fig. 3). In the assessment of gait, no additional tasks were used.

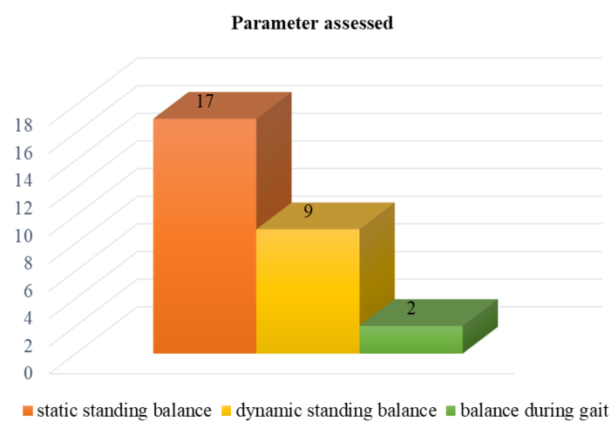

Fig. 2. Number of publications assessing each type of balance

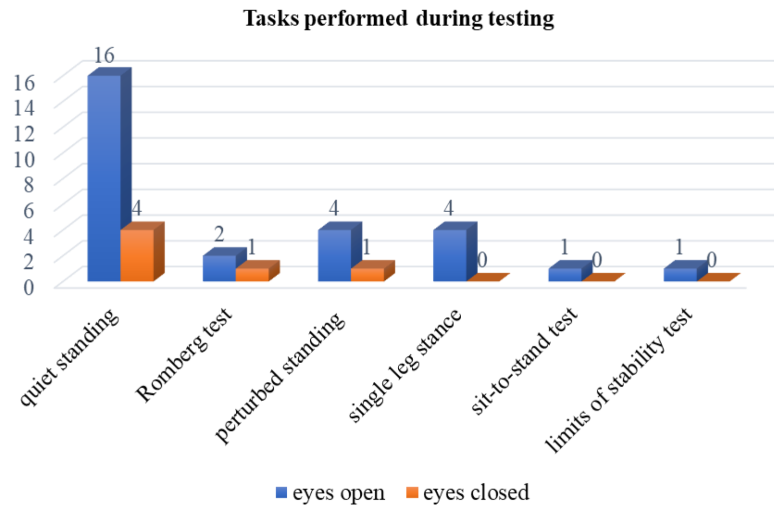

Fig. 3. Frequency of the respective additional tasks in parameter assessment

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The majority of studies took into account only current readings or the immediate effect of the intervention. Delayed effects were additionally assessed by six research teams, and only one team made the assessment at the end of a series of treatments, i.e. several weeks after the commencement of the procedures (Fig. 4).

Those of the reviewed studies that investigated the effect of altered cervical spine conditions on postural parameters, irrespective of the type of test and task, all found that cervical spine conditions affected postural stability.

Studies that used HVLA manipulation reported a range of different outcomes in terms of balance. When considering all the spinal regions included in the review, the results obtained were very mixed: partial improvement, significant improvement, no effect or worsening of parameters in the immediate post-intervention assessment (Fig. 5).

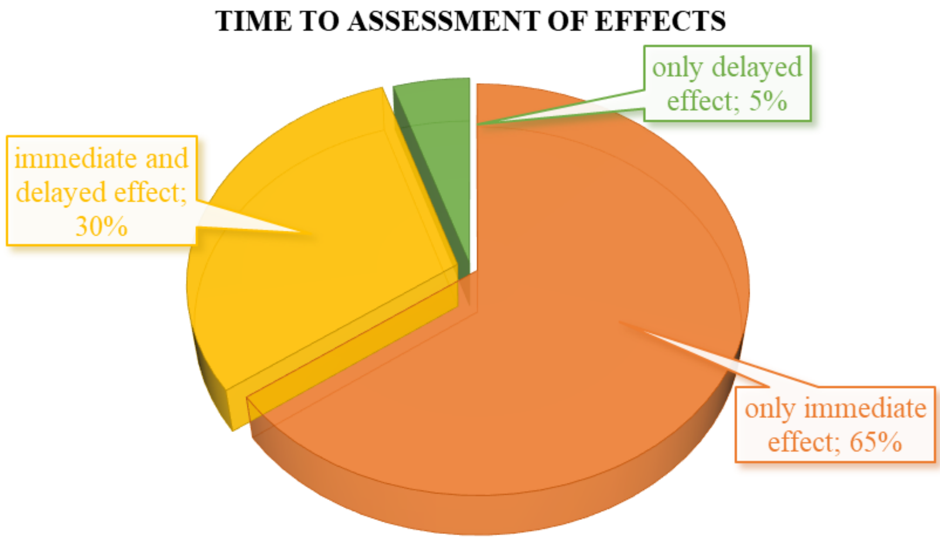

Fig. 4. Percentage distribution of time to assessment of effects

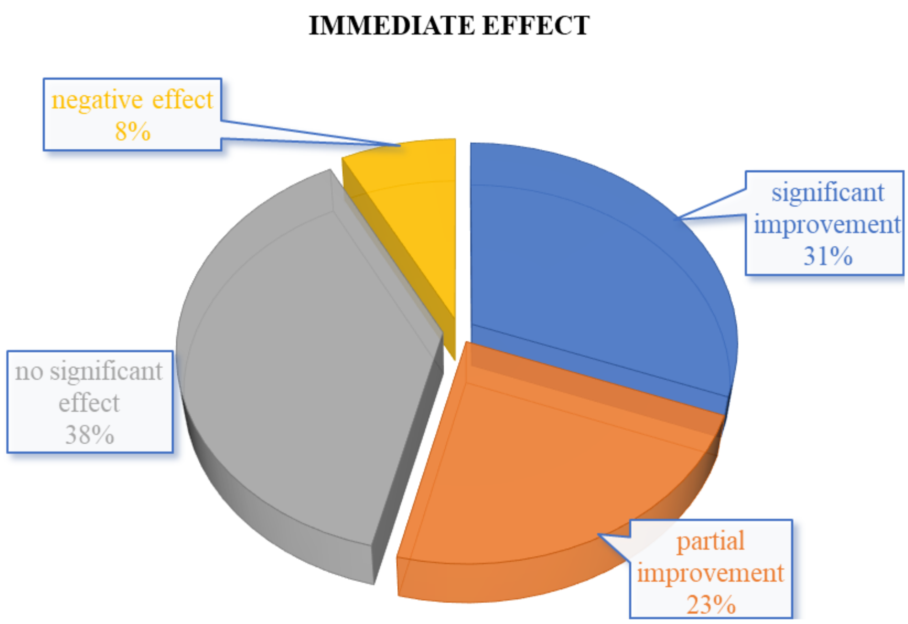

Fig. 5. Percentage distribution of each type of immediate effect of HVLA manipulation in all the spinal regions under study

However, if only the cervical spine taken into account, the distribution differs from the above, as shown in Fig. 6. Here, the positive effects of manipulation prevail.

In terms of delayed effects, the results observed in the cervical spine are very similar to those observed across all spinal regions overall – improvement was observed as often as no effect (Fig.7). In only one of the trials were the delayed effects found to be better than the immediate effects. For the most part, the effects were the same or similar.

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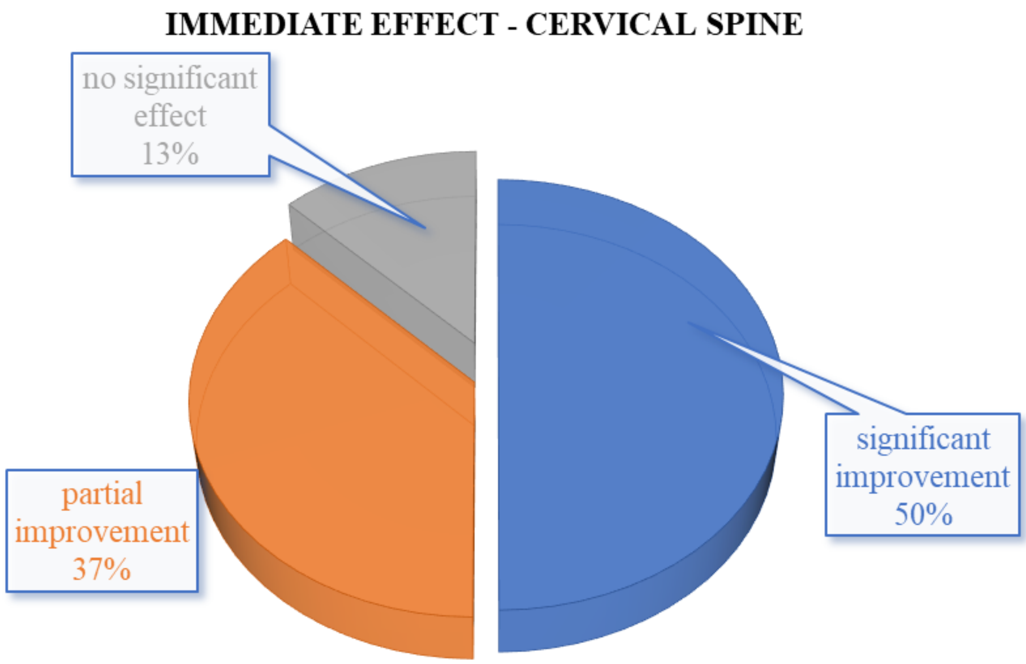

Fig. 6. Percentage distribution of immediate effects after cervical spine manipulation

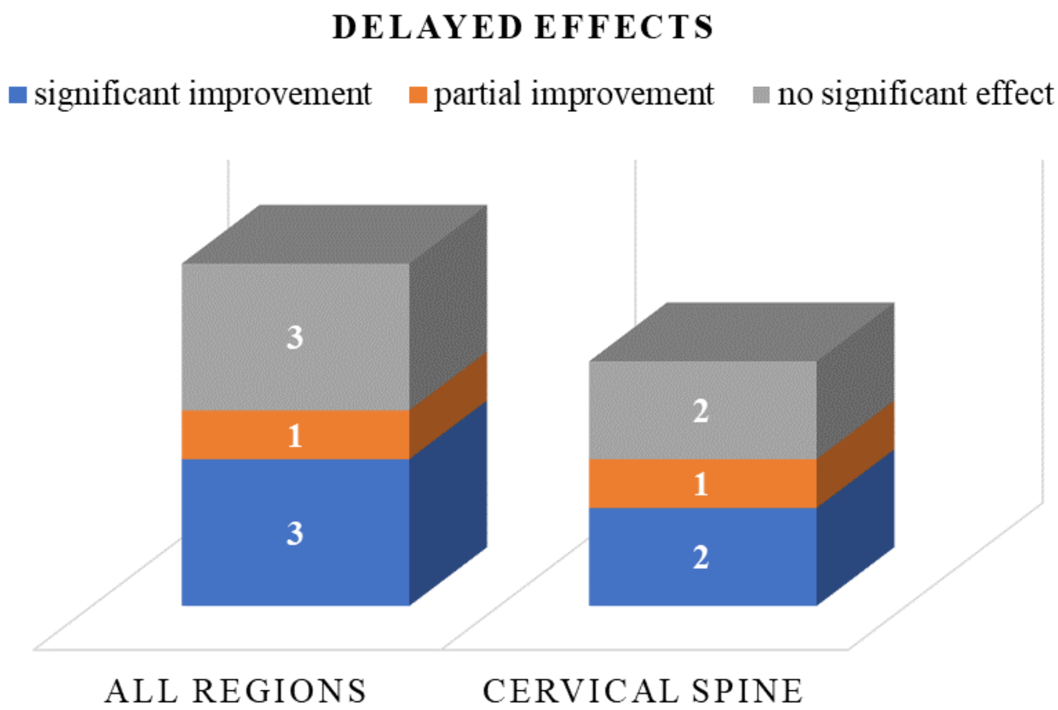

Fig. 7. Quantitative distribution of each type of delayed effect for all spinal regions under study and for the cervical spine

When analysing the outcomes in asymptomatic patients, there is a slight majority of positive effects across all regions of the spine included in the analysis. Trials focusing on the cervical spine, on the other hand, did not report negative effects or no effect – in all cases, there was at least a partial improvement (Fig. 8).

In the case of asymptomatic individuals, few studies assessed treatment outcomes over time. Those that did showed an even distribution of results for both all spinal regions and the cervical spine, with the difference that all recorded results for the cervical spine showed a smaller or larger but positive effect of manipulation (Fig.9).

To obtain a more complete picture, correlation studies would be needed. However, the sample was too small for a more sophisticated statistical analysis.

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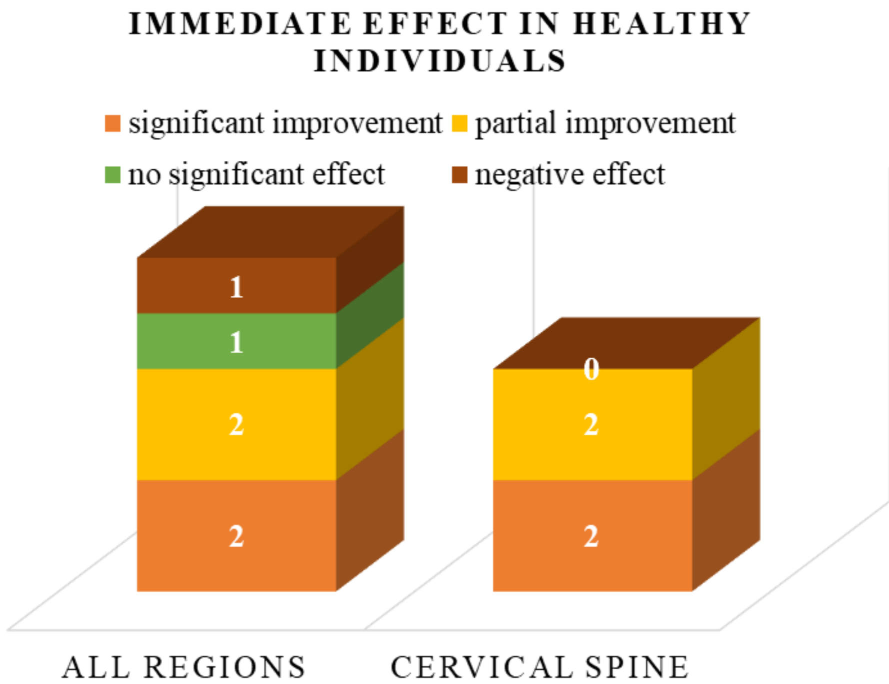

Fig. 8. Quantitative distribution of each type of immediate effect in healthy (asymptomatic) individuals for all spinal regions and for the cervical spine

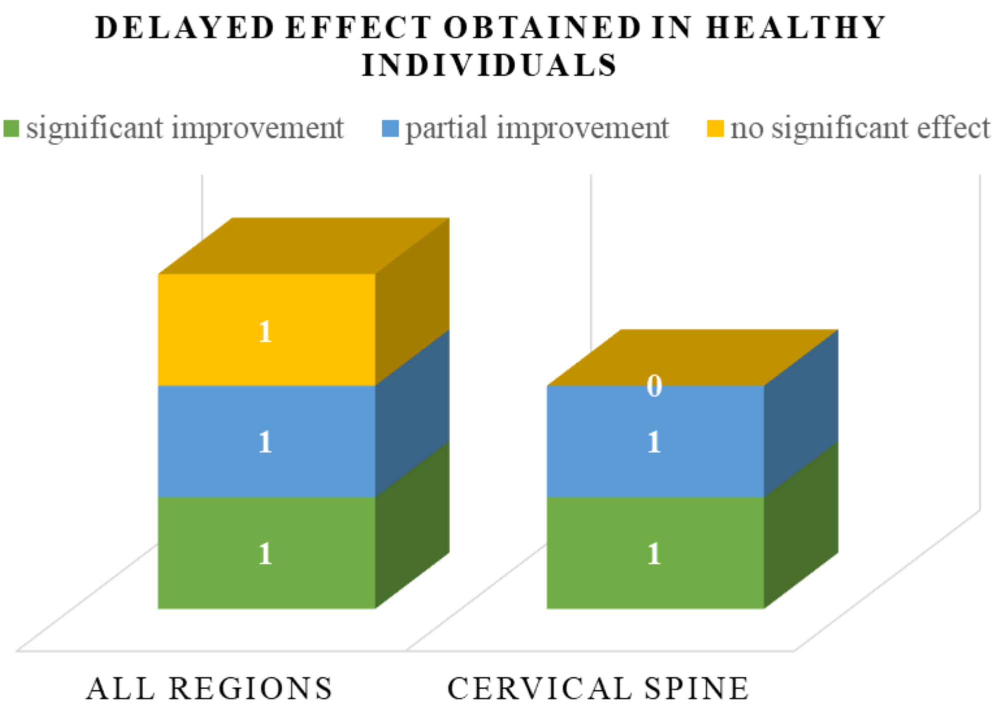

Fig. 9. Quantitative distribution of each type of delayed effect obtained in healthy (asymptomatic) individuals for all spinal regions and for the cervical spine

Discussion

Many studies have attempted to demonstrate the relationship between the cervical spine and balance parameters. One such study was authored by Quek et al. (Quek et al., 2013), who investigated the effect of cervical asymmetry in people with neck pain on postural control measured using a force platform [10]. The study showed that individuals with a confirmed asymmetry developed compensatory mechanisms to maintain postural stability on a level similar to those without such asymmetry. This emphasises the link between the cervical spine and static balance.

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Similar conclusions were reached by Jørgensen et al. (Jørgensen et al., 2011), in a study of workers with high postural demands, with and without neck pain, who were tested in a series of balance tests using a force platform [11]. The study found significantly higher rates of impaired postural balance in people with neck pain. These conclusions are also supported by the findings in Sadaat et al. (Sadaat et al., 2018) and Cheng et al. (Cheng et al., 2015) [12, 13].

The effect of upper cervical HVLA manipulation on standing postural parameters was investigated by Gómez et al. (Gómez et al., 2020) in a population of patients with non-specific neck pain. The participants were divided into two groups of equal size, with the experimental group receiving a genuine HVLA manipulation and the control group receiving a sham intervention. Each participant was assessed four times: before the intervention, immediately after, and on days 7 and 15 after the intervention. Postural data were captured using the NAMROL PODOPRINT force platform. The participants were asked to be as still as possible with eyes closed and relaxed jaw, without occlusal contact. The study found significant changes in postural parameters in the experimental group after HVLA manipulation was applied. In contrast to the control group, in the experimental group the velocity of the centre of pressure displacement was significantly lower at the immediate assessment, and continued to decrease progressively at the two subsequent follow-up assessments, reaching a reduction of up to 42.18%. Significant improvements in postural control are also confirmed by the decreases in the path length and the surface area described by the displacement of the centre of pressure. The study also suggests that the greatest effect was only seen on day 15, with little change observed immediately after the intervention [14].

Similar observations were made by Romero del Rey et al. (Romero del Rey et al., 2022), who investigated the effect of manipulation on balance parameters in patients with chronic neck pain. In their study, C1-C2 manipulation was compared with manipulation at the mid cervical spine, cervicothoracic joint and thoracic spine. Significant positive effects were obtained in the upper cervical manipulation group [2].

Grassi Dde et al. found a correlation between the side of joint restriction and the foot with greater contact area (Grassi Dde et al., 2011), but nevertheless the results of the studies described above are in stark contrast to other studies that found no significant differences or no effect at all using different types of manipulation in different parts of the body (Grassi Dde et al., 2011)(Farazdaghi et al., 2018)(Fagundes Loss et al., 2020)(Goertz et al., 2015) [15, 16, 17, 18]. Ditcharles et al. even found a negative effect of the thoracic HVLA manipulation on postural parameters (Ditcharles et al., 2017) [19]. The above findings also conflict with another study – Fisher and her team found no significant differences in postural parameters after applying HVLA manipulation to the cervical region (Fisher et al., 2015). The difference in results may possibly be attributable to differences in the protocol, such as the lack of a specific spinal segment, or the reassessment of parameters after as little as 5 and 10 minutes, with no further follow-up [20].

In terms of dynamic balance, in addition to Ditcharles (Ditcharles et al., 2017), it was investigated by Delafontaine et al. (Delafontaine et al., 2022), whose experiment included two test conditions with two different cervical collars, a placebo condition with a simple tubular bandage and a control condition with no additional restraint [21]. The study participants were free of cervical spine dysfunction. The experiment was designed to test whether an alteration in cervical spine mobility would affect force platform recordings during gait. The study showed that the restriction of cervical spine mobility, which can be induced by wearing a cervical orthosis with a high or low rigidity, may have a negative effect on motor performance and postural organisation of gait initiation, but does not alter the mechanisms of postural control and balance. Nevertheless, the authors noted the risk of negative effects of cervical spine immobilisation on motor performance in the elderly or those with pre-existing neurological deficits.

Similar conclusions were reached by Hamaoui and Alamini-Rodrigues (Hamaoui, Alamini-Rodrigues, 2017), although they used a ‘sit-to-stand’ test in their analysis [22]. The study group consisted of asymptomatic young women with no history of cervical spine or balance disorders. They were asked to perform the task on a force platform while wearing three different neck collars that progressively restricted the mobility of the cervical spine. In that study, too, motor performance was impaired with the gradual loss of cervical spine mobility.

Only a handful of studies came close to answering the research question at hand. The trials involved asymptomatic adults who had no medical conditions that could affect the results. Two studies investigated the immediate effects of cervical spine manipulation. Unfortunately, their results did not allow clear conclusions to be drawn about the outcome of the treatment (Behrens et al., 2023) (Drayer, Kauwe, 2013) [23, 24]. Another trial examined the difference between interventions in the upper and lower cervical spine, and found that both led to significant improvements in balance, with lower cervical spine manipulation producing better results (McKay, 2018) [3]. The effectiveness of upper cervical manipulation was also confirmed by Nolan (Nolan, 2010) [25]. Healthy adults were also studied by Uchiyama, who tested unilateral stance and similarly observed positive effects on postural stability (Uchiyama et al., 2019) [26]. Positive effects have been additionally reported in elderly patients over 65 years of age (Lopez et al., 2011) [27].

Conclusions

The search and analysis of the currently available literature did not identify any studies that would provide a clear answer to the research question. Based on the publications included in the review, it can be assumed that HVLA manipulation in the cervical spine has the potential to affect balance in healthy participants. However, the effectiveness of the intervention specifically in the C0-C1 segment has not yet been demonstrated. There are several available studies with a similar design, but the number is

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too small to answer the research question unequivocally. There is a need for further trials, with a format closer to the hypothesis and larger populations, as well as further research and development work to maximise the effectiveness of HVLA therapy, which the author is doing.

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