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Ocena czynników wpływających na skuteczność terapii integracji sensorycznej u dzieci w wieku przedszkolnym i wczesnoszkolnym

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The effect of HVLA manipulation on static and dynamic postural parameters – a case study of a patient with a blocked atlanto-occipital transition

Wpływ manipulacji HVLA na statyczne i dynamiczne parametry posturalne – studium przypadku pacjenta z zablokowanym stawem szczytowo-potylicznym

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Abstract

Objective. The study aimed to assess the effects of high velocity low amplitude (HVLA) manipulations on force distribution, pressures, and balance in individuals with atlanto-occipital blockage, focusing on post-treatment improvements.

Research methods. Diagnostic tests (cervical spine compression, Spurling, de Kleyn) and pedobarography (using an EPS/R2 mat and BIOMECH STUDIO software) assessed functionality and postural parameters pre and post HVLA therapy.

Results. Initial diagnosis showed significant disturbances in force distribution, balance, and gait. Post-HVLA therapy improvements included:

1. Balanced forefoot load during standing, with a decrease in heel load percentage.
2. Improved global body pressure distribution, with a notable decrease in left-side body pressure.
3. Enhanced anteroposterior and lateral body oscillation ranges, with a reduced ratio of extreme deflection distances to deflection surface and a decreased average speed of displacements.
4. Normalization of the right foot abduction angle, with no significant change in the left foot's visitation angle.
5. Slight improvements in foot vault index (AI) and average foot pressure during gait, with minimal changes in maximum foot pressure during gait.

Conclusions. HVLA manipulation significantly improves static balance parameters but shows minimal improvement in gait parameters. This indicates a complex relationship between atlanto-occipital blockage and postural disorders, suggesting the need for further research to explore the association between postural defects and atlanto-occipital transition blockage, as well as the impact of these blockages on postural changes.

Keywords

atlanto-occipital blockage, HVLA manipulation, postural disorders, balance improvement, pedobarography

Streszczenie

Cel. Celem badania było ocena wpływu manipulacji HVLA (wysoka prędkość, niska amplituda) na rozkład sił, ciśnienie i równowagę u osób z blokadą stawu szczytowo-potylicznego, ze szczególnym uwzględnieniem popraw po terapii.

Metody badawcze. Funkcjonalność i parametry posturalne przed i po terapii HVLA oceniano za pomocą testów diagnostycznych (kompresja kręgosłupa szyjnego, test Spurlinga, de Kleyna) oraz pedobarografii (używając maty EPS/R2 i oprogramowania BIOMECH STUDIO).

Wyniki. Wstępna diagnoza wykazała znaczące zaburzenia w rozkładzie sił, równowadze i chodzie. Poprawy po terapii HVLA obejmowały:

1. Zrównoważone obciążenie przedniej części stopy podczas stania, z obniżeniem procentowego udziału obciążenia pięty.
2. Poprawa globalnego rozkładu ciśnienia ciała, z wyraźnym zmniejszeniem ciśnienia po stronie lewej ciała.
3. Zwiększenie zakresów oscylacji ciała w płaszczyźnie przednio-tylnej i bocznej, z obniżeniem stosunku odległości między skrajnymi odchyleniami do powierzchni odchylenia oraz zmniejszeniem średniej prędkości przemieszczeń.
4. Normalizacja kąta abdukcji prawej stopy, bez znaczącej zmiany kąta odwiedzenia lewej stopy.
5. Niewielkie poprawy w indeksie sklepienia stopy (AI) oraz średnim ciśnieniu stopy podczas chodu, z minimalnymi zmianami w maksymalnym ciśnieniu stopy podczas chodu.

Wnioski. Manipulacja HVLA znacząco poprawia parametry równowagi statycznej, ale wykazuje minimalne poprawy w parametrach chodu. Wskazuje to na złożoną relację między blokadą stawu szczytowo-potylicznego a zaburzeniami posturalnymi, sugerując potrzebę dalszych badań w celu zbadania związku między wadami postawy a blokadą przejścia szczytowo-potylicznego oraz wpływu tych blokad na zmiany posturalne.

Słowa kluczowe

blokada stawu szczytowo-potylicznego, manipulacja HVLA, zaburzenia posturalne, poprawa równowagi, pedobarografia

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Introduction

The atlanto-occipital transition is defined as the C0-C1 joint, which is the junction between the skull and the first cervical vertebra. Flexion and extension movements mainly occur in this segment. Rotation is also possible, but to a very limited extent, due in part to the flat structure of the articular processes [1]. The angle of inclination of the articular surfaces in the sagittal plane is 20-78°, while in the transverse plane it is 70-96° [2]. Considering the cervical segment as a whole, the range of flexion is 80-90°, extension is 70°, lateral flexion is 20-45° and rotation is up to 90° [3]. However, in the C0-C1 segment alone, the flexion-extension range of movement is 15-20°, while lateral flexion and rotation are significantly limited or absent [1, 4].

Body balance is defined as the dynamic maintenance of the body to prevent a fall. According to another definition, it is the maintenance of the vertical projection of the centre of gravity (C.O.M.) on the foot support surface. In addition to the centre of gravity, there is also a centre of pressure (C.O.P.) - the point of application of the resultant ground reaction force. It is independent of the centre of gravity [5, 6]. Maintaining balance is a complex task that depends on many factors. Three systems are involved in its coordination: visual, proprioceptive and peripheral vestibular systems [7]. In this process, the centre of pressure oscillates between the sides of the centre of gravity so as to keep it as constant as possible between the feet [8].

The first joint of the spine is often subject to overload. This is fostered by frequent and prolonged assumption of static body positions or head positioning in protraction or retraction, which are usually fostered by occupational activities such as office work. Injuries to the cervical spine such as whiplash injury also predispose to segmental disorders. Other causes can be muscular imbalances, prolonged emotional tension [9] or dysfunctions of the stomatognathic system [10]. As a result of such perturbations, recurrent, paroxysmal headaches and upper cervical pain, dizziness and balance disorders may occur [11]. Blockage of the atlanto-occipital transition may consequently affect both static and dynamic postural patterns, which will be reflected in a global disturbance of the distribution of foot pressures on the ground. The link between different areas of the human body and balance has been studied in the past. Among others, a link between the angle of thoracic kyphosis and lumbar lordosis on the distribution of ground reaction force pressures or the anteroposterior distribution of pressures has been discovered [12]. A significant correlation of these parameters with temporomandibular joint dysfunctions was also shown. Imbalance has also been confirmed in situations with limitations in upper cervical mobility [13]. Inspection of postural parameters, an adequate history and a physical examination provide the opportunity for an in-depth analysis of postural dysfunctions that may be associated with blockage of the atlanto-occipital transition. Evaluation of these measurements also allows a better evaluation of the effects of the therapeutic method used.

It is important to assess postural patterns during standing and gait, which allows the evaluation of global postural, biomechanical parameters, assessment of balance, differential foot pressures and gait parameters. The pedobarographic examination allows a sensitive and reliable assessment of the patient during standing, when parameters such as anteroposterior pressure distribution, balance and foot structure are analysed: rotation, vaulting. During gait. In gait, pressure changes during foot rolling are evaluated.

Objective

The aim of this study was to comparatively analyse the distribution of forces and pressures and balance in a person with an atlanto-occipital transition blockage, based on the initial diagnosis and realised after the application of short lever manipulations (HVLA- high velocity low amplitude).

Research methods and tools

The patient was a 21-year-old man, a manual worker, who presented to the practice because of restricted mobility of the cervical spine and discomfort during gait. He underwent three diagnostic tests: the cervical compression test (Fig. 1.), the Spurling test (Fig. 2.) and the de Kleyn test (Fig. 3.).

Figure 1. Cervical compression test. Source: own study

Figure 2. Spurling test. Source: own study

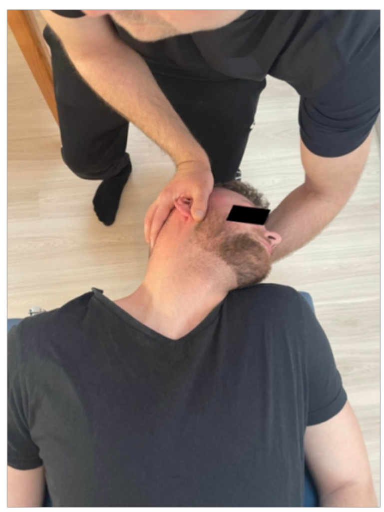

Figure 3. The de Kleyn test. Source: own study

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A negative result was obtained in all of them. Palpation tenderness, stiffness at the atlanto-occipital transition and the location of the blockage were assessed by evaluating the mobility of the segment [14] (Figure 4.).

Figure 4. Assessment of the mobility of the C0-C1 segment. Source: own elaboration

The presence of a blocked atlanto-occipital transition on the left side was confirmed. Measurements were then taken using a pedobarograph.
The measuring tool used in the study was the Pedobarograph EPS R2 (Fig. 5.). This is a device in which 2096 pressure sensors with an area of 1 cm^2 are distributed over a 48x48 cm area. The read-out pressure range is 30-400 kPa and the acquisition frequency is 100 Hz. The software used is BIOMECH Studio.

Figure 5. EPS R2 pedobarograph used in the study. Source: PODOLOGIA.PL

Pedobarography is a method that allows examination during standing (so-called static examination) and during gait (so-called dynamic examination). During standing, pressure distribution is assessed anteroposteriorly, balance and foot structure: rotation, vaulting. In gait, pressure changes during foot rolling are evaluated. At this point, it is important to remember that the values of pressure forces during this process have two peaks – at the moment of heel contact with the ground and during impact. The maximum values thus reach about 120% of body weight, while in the phase between peaks the values drop to about 80% of body weight [15]. In addition to the pressure forces in gait, the foot typology in dynamics, the pressure distribution of the individual parts of the feet in dynamics and the statistics of the individual steps, i.e. the step time, average and maximum pressure of the individual step and the foot surface area outlined during the step, are also assessed.
A static test was performed first, in which the subject stood still on the device for 20 seconds. This was followed by a dynamic test, in which the subject's task was to walk through the pedobarograph until data were obtained from 10 steps for each foot (Fig. 6.).

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Figure 6. Pedobarographic examination during gait. Source: PODOLOGIA.PL

In the next stage of the study, HVLA manipulation was performed for the C0-C1 segment on the left side in the patient's supine position [16] (Fig. 7.). After the intervention, orthostatic pressure was waited to equalise, after which measurements were repeated.

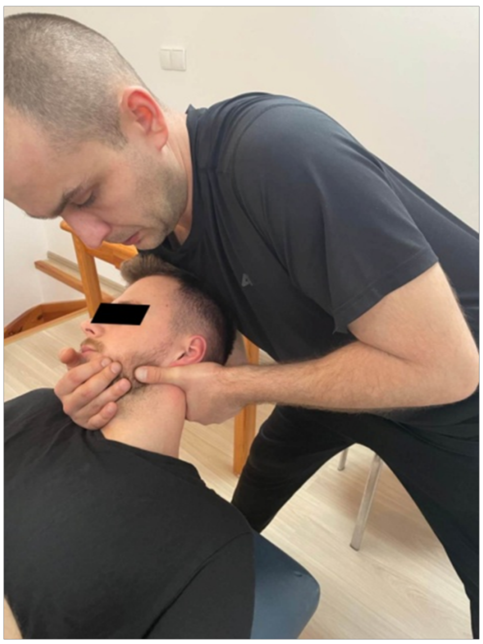

Figure 7. HVLA manipulation on a blocked C0-C1 segment

HVLA (High Velocity, Low Amplitude) manipulation is a high velocity, low amplitude technique. It is applied to a patient in the supine position. The selected segment is positioned in a coupled motion, performing flexion, lateral flexion and rotation to the opposite side. Once the tissue slack is selected in the position obtained, a pulse is applied.

A double check of the stabilographic parameters was performed to allow analysis of the distribution of foot pressures in a subject with a blocked atlanto-occipital transition and the changes in foot pressure distribution before and after therapy with HVLA manipulation. Body balance was analysed when showing a blocked atlanto-occipital transition and changes occurring after therapy with the HVLA technique. Asymmetries in foot alignment, foot typology and biomechanical abnormalities in the subject were assessed, as well as the effect of the manipulation on the alignment of the feet in relation to the ground and on foot vault parameters, tarsal and toe alignment.

Results

A comparative analysis of the distribution of pressure on the subject's feet was carried out. As reference values, anterior-posterior pressure values of 60% for the forefoot, 40% for the rearfoot and lateral pressure values of 48% for the left side, 52% for the right side were used [15, 17, 18]. In the subject, prior to manipulation, forefoot pressure values of 48% were recorded for the front of the foot, 52% for the rear of the foot, 61.8% for the left side and 38.2% for the right side. After the manipulation, the forefoot pressure decreased to 38.4% and the rearfoot pressure increased to 61.6%. For lateral pressure, the value for the left side decreased to 54.6%, for the right side it increased to 45.4% (Fig.8.-10.).

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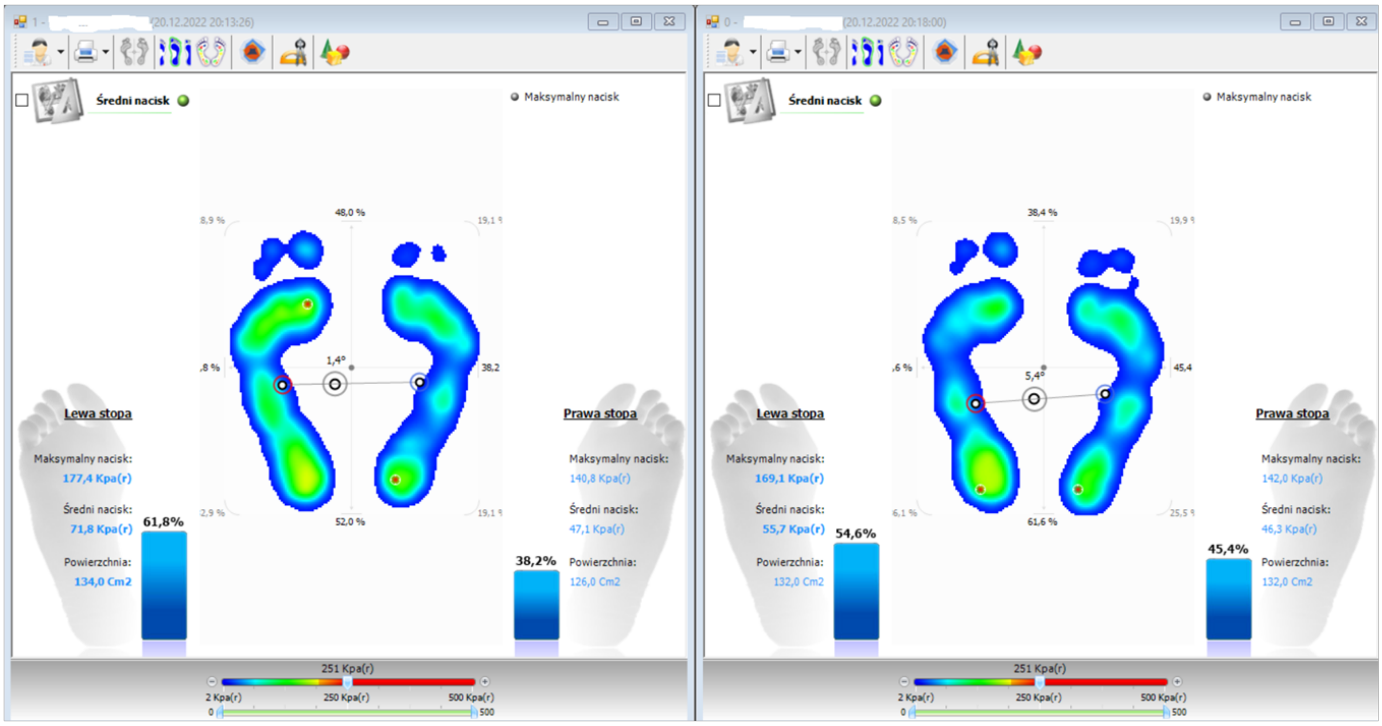

Figure 8. Results of the foot pressure distribution study before and after treatment. Source: BIOMECH Studio

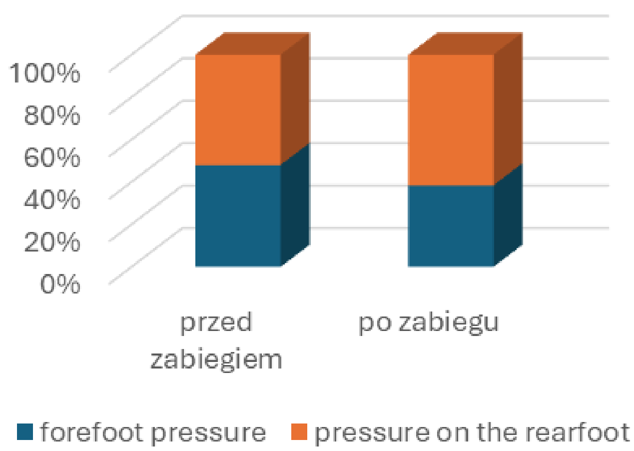

Figure 9. Percentage distribution of anteroposterior foot pressure distribution before and after surgery

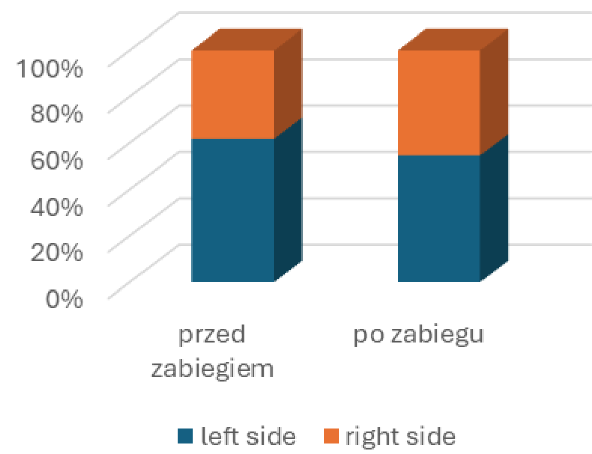

Figure 10. Percentage distribution of lateral foot pressure distribution before and after surgery

A comparative analysis of body balance was then performed. For this purpose, data were collected on the behaviour of the centre of pressure during the static test. Before therapy, the averaged C.O.P. position entered in the coordinate system was X: 1.7 mm, Y: −1.7 mm. The oscillations of the C.O.P. forward reached approximately 4 mm, backward 2.5 mm, right 5.8 mm, left 4.4 mm. The average speed of these displacements was calculated to be 5.5 mm/s (0.0055 m/s). The ratio of the distance between the extreme C.O.P. outcrops to the outcrop surface (LSF) was 2.2 (Fig. 11.) (Table 1.). After manipulation, the averaged C.O.P. position was X: 1 mm, Y: −3.3 mm. Forward oscillations decreased to approximately 2.5 mm, backward to 1.5 mm, right to 2.3 mm and left to 3.5 mm. The mean oscillation velocity decreased to 3.4 mm/s (0.0034 m/s) and LSF decreased to 1.8 (Fig. 12.) (Table 1.). The reference values for anteroposterior oscillations in individuals under 30 years of age are 19 mm and for medial-lateral oscillations are 7-9 mm [19-22].

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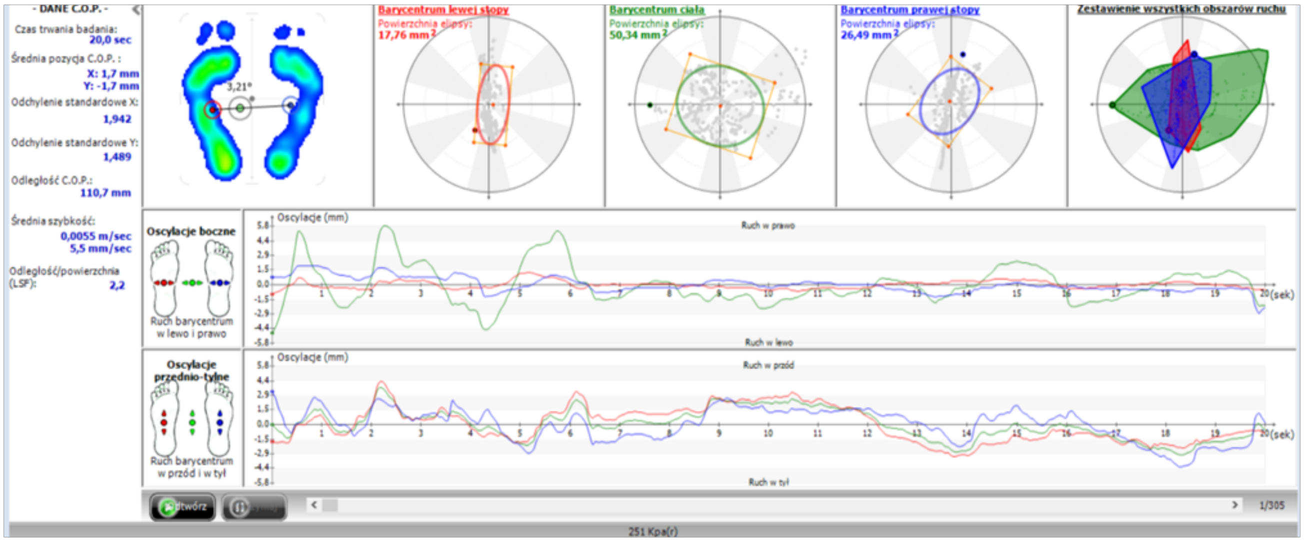

Figure 11. Results of C.O.P. displacement measurements before therapy. Source: BIOMECH Studio

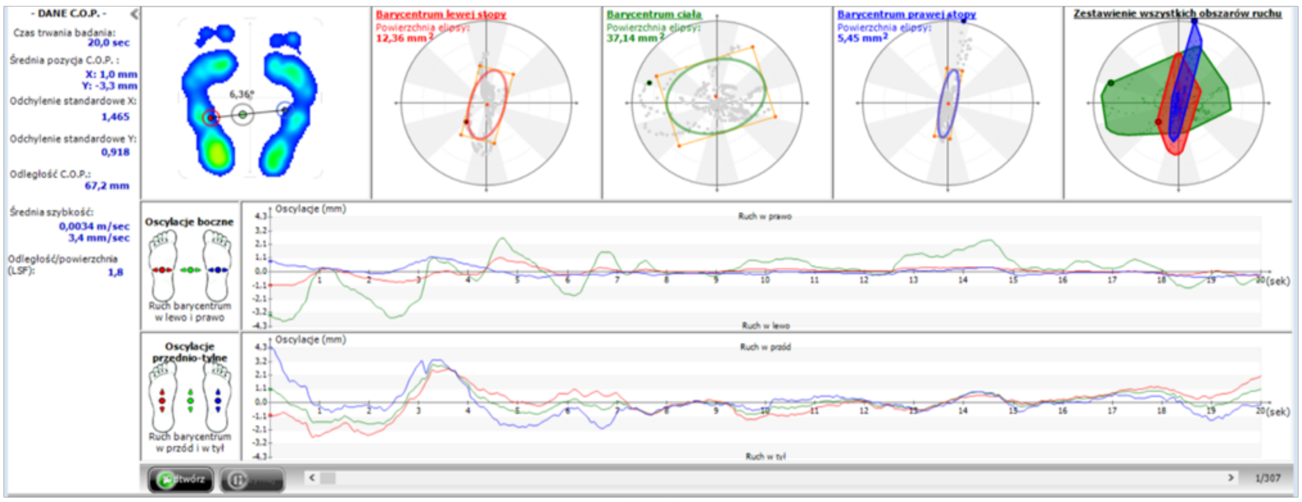

Figure 12. Results of C.O.P. displacement measurements after treatment. Source: BIOMECH Studio

Table 1. Comparison of C.O.P. displacement parameters before and after surgery

	Before therapy	After therapy
X-axis coordinate	1.7 mm	1 mm
Y-axis coordinate	−1.7 mm	−3.3 mm
Forward oscillation	4 mm	2.5 mm
Oscillations backwards	2.5 mm	1.5 mm
Oscillations to the right	5.8 mm	2.3 mm
Oscillations to the left	4.4 mm	3.5 mm
Oscillation speed	5.5 mm/s	3.4 mm/s
LSF relationship	2.2	1.8

During the static examination, the feet's relationship to the ground, i.e. foot abduction, was also assessed. According to the reference values, it should be 7-10° [23]. Before manipulation, the left foot's visitation was 5.9° and the right foot's visitation was 11.7°. After the intervention, the left foot's visitation remained unchanged and the right foot's decreased to 8.5° (Fig. 13.) (Table 2.).

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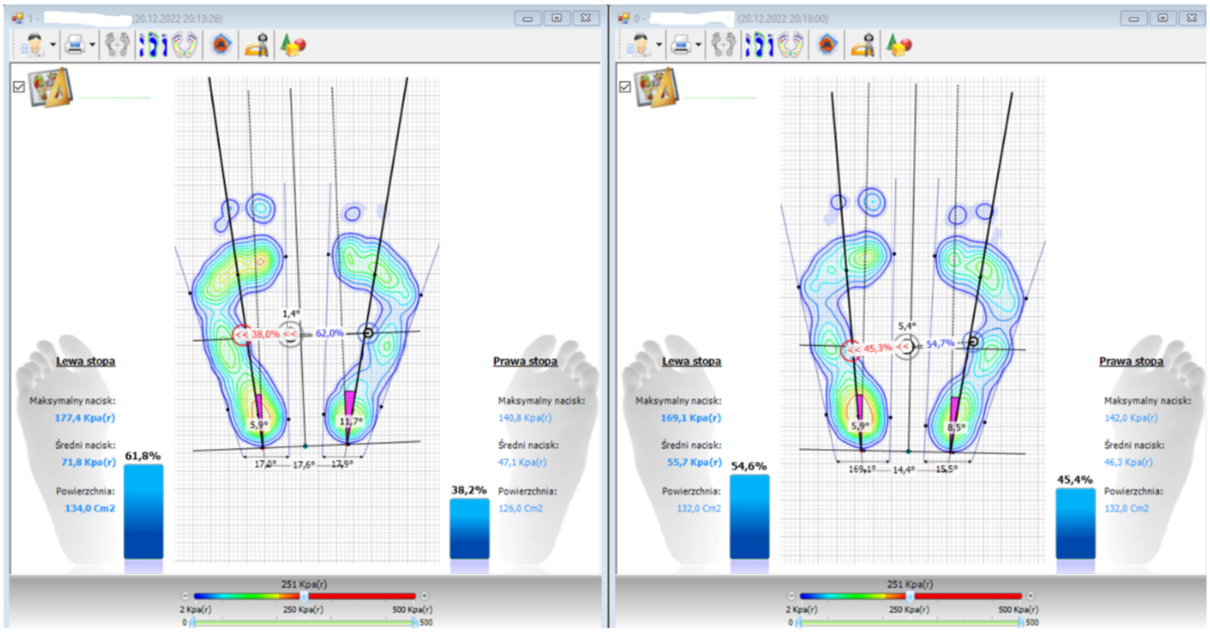

Figure 13. Results of foot-foot relationship assessment before and after therapy. Source: BIOMECH Studio

Table. 2. Right and left foot visitation values before and after therapy

	Before therapy	After therapy
Right foot	11.7°	8.5°
Left foot	5.9°	5.9°

The Arch Index (AI), an indicator of foot vaulting, was also evaluated. Reference values were set at 21-28%, where a score of less than 21% indicates a reduced or absent lateral compartment and a score of more than 28% indicates a flat foot [15, 24-27]. The subject's AI for the left foot before surgery was 27.34%, dropping to 27.09% after manipulation. In the right foot, on the other hand, it decreased from 26.18% to 26.10% (Figs. 14. and 15.).

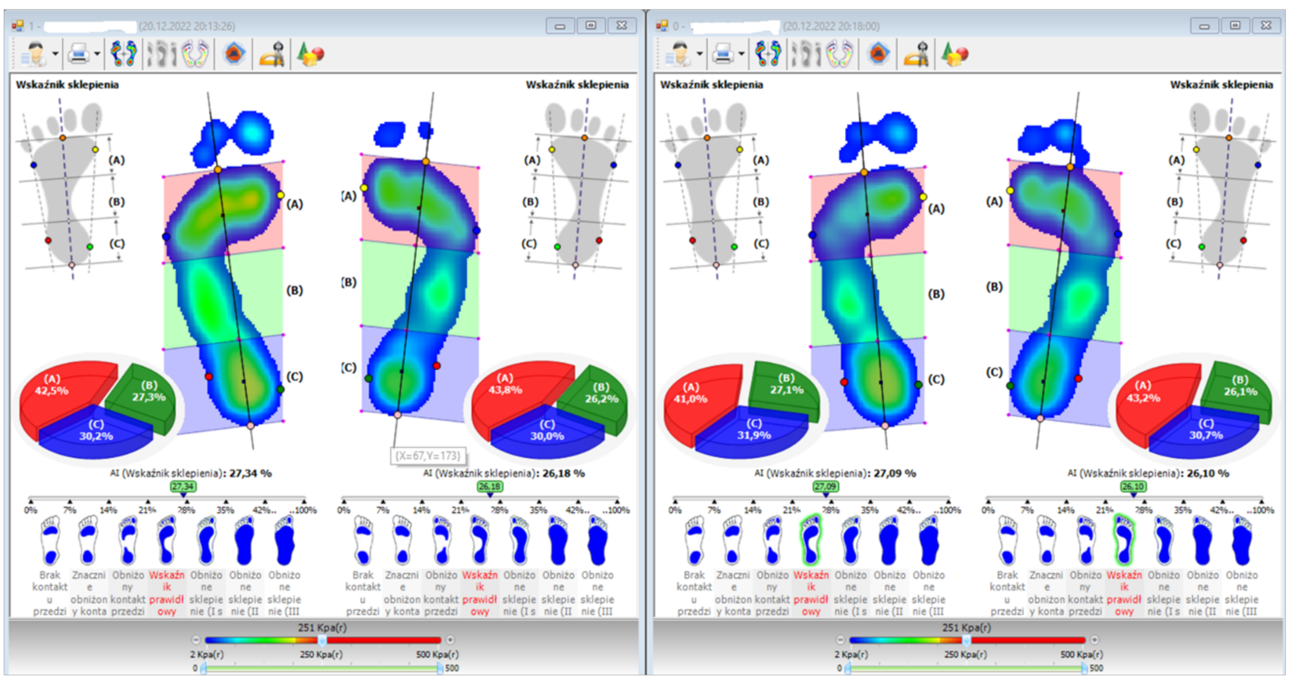

Figure 14. AI assessment before and after therapy. Source: BIOMECH Studio

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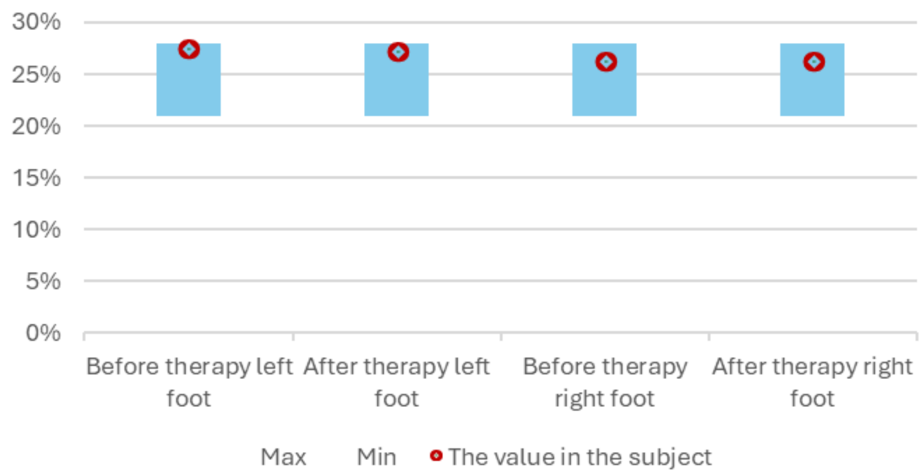

Figure 15. AI values before and after therapy

This was followed by an evaluation of the distribution of foot pressure forces on the ground during gait. By analysing the above values collected and averaged from 10 consecutive steps of each foot, a left foot rolling time of 992.5 ms was obtained, which increased to 1097.5 ms after manipulation. For the right foot, it was initially 886.7 ms, after which it increased to 990 ms. The mean foot pressure before manipulation was 83.6 kPa for the left foot and 86.6 kPa for the right foot. After manipulation, both values increased – for the left foot to 84.8 kPa, for the right to 87 kPa. The maximum pressure was originally 145.9 kPa for the left foot, 142 kPa for the right foot, and after the intervention it equalised for both feet to a value of 143.9 kPa. The load area of the right foot was initially 138 cm^2, after which it decreased to 136 cm^2, while the area of the left foot from 136 cm^2 increased to 137.3 cm^2 (Fig. 16.) and (Fig. 17.) (Table 3.).

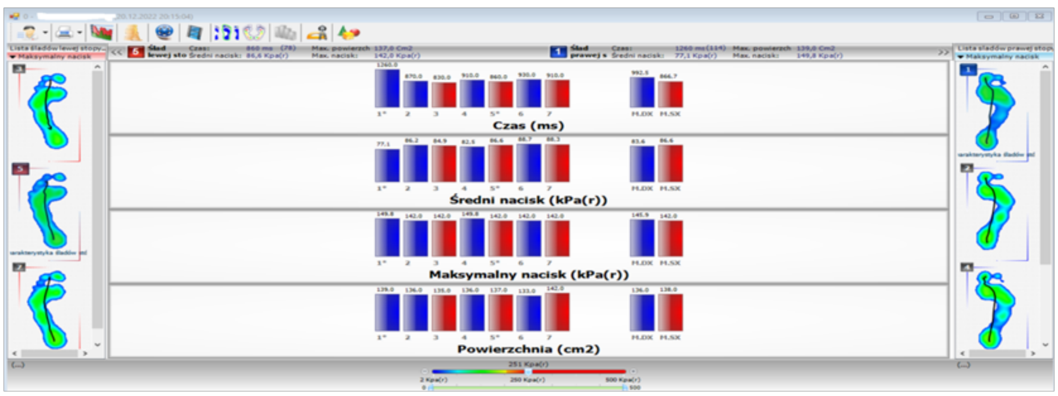

Figure 16. Assessment of the distribution of the foot on the ground during gait before surgery. Source: BIOMECH Studio

Figure 17. Assessment of the distribution of foot pressure forces on the ground during gait after surgery. Source:

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Table 3. Distribution values of ground pressure forces before and after therapy

	Before therapy	After therapy	
Left foot	Transfusion time	992.5 ms	1097.5 ms
	Average pressure	83.6 kPa	84.8 kPa
	Maximum pressure	145.9 kPa	143.9 kPa
	Space	136 cm^2	137.3 cm^2
Right foot	Transfusion time	886.7 ms	990 ms
	Average pressure	86.6 kPa	87 kPa
	Maximum pressure	142 kPa	143.9 kPa
	Space	138 cm^2	136 cm^2

Discussion

From the results presented above, it can be observed that the distribution of forces on the forefoot and rearfoot before the intervention was somewhat disturbed in the subject - the majority of the pressure was on the rearfoot (pressure values increased after manipulation). A similar disturbance was demonstrated by Souza et al. in their study [28], where they confirmed a majority of forefoot loading in subjects with temporomandibular joint dysfunction compared to healthy subjects. Therefore, it is worth verifying the exacerbation of the distribution disorder created in this study by checking other areas of the body, such as the orofacial region. Looking at the lateral pressure distribution, on the other hand, it is possible to see the positive effect of the therapy - here, too, the subject showed an inversion with respect to the reference distribution of forces, but after manipulation this difference decreased, so that the values came closer to the reference ones, although the subject still shows more pressure on the left foot. These results are somewhat in contrast to a study in which the effect of neck taping was tested [29]. There, a positive effect of the neck intervention was obtained in the anteroposterior distribution of forces, while no change was observed in the lateral distribution. However, significant changes occurred in overall static balance, suggesting a link between the neck area and balance parameters. Similarly, improvements in overall balance were obtained in the study by Bernal-Utrera et al [30], although patients with chronic neck pain were studied and the intervention used cervical spine mobilisations or exercises.

Positive effects of the intervention were also observed for body balance parameters. A reduction in the magnitude of C.O.P. oscillations was observed – forward excursions were reduced by 37.5%, backward by 40%, right by 60.3% and left by 20.5%. This brings them within the range of reference values where, prior to manipulation, these standards were exceeded. There was also a 38.2% decrease in the velocity of the described oscillations and the ratio of the distance between the extreme C.O.P. deflections to the deflection area (LSF) - a decrease of 18.2%. All these changes point directly to the subject's stabilisation in the standing position and, therefore, an improvement in balance. Similar results were obtained in two studies [31,32], where they also tested the effect of HVLA manipulation in the upper cervical region. In contrast, Fisher et al. [33] obtained the opposite results, also using a single manipulation.

In the case of foot-foot relationship, i.e. foot visitation, changes were only noticeable in the right foot – initially the amount of visitation exceeded the norm, but after the manipulation the value fell to the range of reference values – a decrease of 27.4%. The visitation in the left foot both before and after the manipulation remained below reference values. No studies were found that reliably examined the association of foot visitation with upper cervical locking and balance. It is therefore difficult to assess the significance of changes in this area.

There were no significant changes in the AI data. Both before and after therapy, the values were within the normal range, although they were close to the upper limit, which could suggest a tendency to lower the foot vault. After treatment, the values decreased, to a small extent – for the left foot by 0.8 per cent, for the right foot by 0.3 per cent. It is worth mentioning that the examination performed suggests the presence of instability of the lateral compartment of the foot in the subject. This defect may directly translate into no change in AI. However, it requires further observation and diagnosis. A study by Pourhoseingholi et al [34] suggests that the foot vault index is significantly lower in children with flat feet. The possible stiffness of the foot arch due to the existing defect and the type of vaulting would also need to be taken into account, a study that may be consistent with the results of Cen et al. [35], which showed a greater load on the rearfoot in those with a stiff foot arch. This would be another possibility to explain the imbalance in anteroposterior distribution in the subject. Although our own study did not show significant differences after neck intervention, there are studies that support the association of differences in foot arches with posture, including in the upper body [36].

The dynamic test showed an increase in foot roll time for both sides after manipulation, with a 10.6% increase in the left foot and an 11.6% increase in the right foot. The same can be observed for the mean contact force, but to a much lesser extent – in the left foot the increase was 1.4 per cent and in the right foot 0.5 per cent. Still, the parameter did not level off. The maximum pressure generated, on the other hand, leveled off to the same value – in the left foot it decreased by 1.4% and in

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the right foot it increased by 1.3%. It is noteworthy that both static and maximal gait pressure were initially greater for the left side and both parameters became balanced. This may suggest an actual link with blockage in the atlanto-occipital segment just on the left side. Similarly, as noted by Haag [37] in his study, we can observe that short stepping times are sometimes associated with abnormalities of the foot arches. Our own research indicated that it was possible to increase stride time by performing manipulations, although the disproportion between left and right foot stride time remained present. Earlier parameter values may indicate a tendency to overload the left lower limb, which may also be supported by a longer time to roll the foot on this side. The contact area of the foot during gait did not show significant changes; this may be related to the foot defect mentioned above.

Summarising the study and the above analysis, it can be concluded that the HVLA manipulation significantly influenced the lateral pressure distribution in the static test and balanced the maximum foot pressure during gait. The C.O.P. oscillation length shortened, indicating an improvement in body balance in the static assessment. The angle of foot abduction also improved, which in turn may be related to improved balance and distribution of body side pressures. The AI index did not change in either static or dynamic examination, which is dictated by a probable foot defect. No equalisation of mean foot pressure during gait was observed. Similar conclusions were drawn by Delafontaine et al. [38], who observed no significant differences in balance parameters during a gait test with the simultaneous use of different types of neck bracing. However, additional, more detailed holistic diagnostics should be performed to check for factors other than foot defects that could potentially interfere with the effects of therapy. As mentioned earlier, parameters are affected by temporomandibular joint dysfunction or previous injuries, such as lower limb injuries, which may be associated with overloading of one limb and a disturbed gait pattern. However, the priority of the appearance of the perturbation should be assessed: in the limbs and posture or in the cervical spine. For this purpose, further studies and longer follow-up of the effects of therapy are needed.

Conclusions

The pedobarographic examination allows the assessment of global postural patterns and can therefore be used to evaluate the effects of techniques such as HVLA manipulation on posture. The data obtained during the test may suggest an effect of blocking the apex-occipital transition on the values of balance parameters in statics and dynamics. From the analysis of the readings obtained, it can be concluded that HVLA manipulation on the blocked atlanto-occipital segment can significantly improve static balance parameters. However, no improvement was obtained during gait analysis. A study on a clinical group is needed to evaluate the effects obtained in the above study.

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Piśmiennictwo/ References

1. Clark J. G., Abdullah K. G., Mroz T. E., Steinmetz M. P., Biomechancs of the Craniovertebral Junction, Biomechanics in Applications; 9 Sep 2011
2. Jaumard N. V., Welch W. C., Winkelstein B. A., Spinal facet joint biomechanics and mechanotransduction in Normal, Injury and Degenerative Conditions, Journal of Biomechanical Engineering; Jul 2011; 133(7)
3. Suga Y., Shigematsu H., Tanaka M., Okuda A., Kawasaki S., Yamamoto Y., Ikeriji M., Asai H., Fukushima H., Tanaka Y., Factors associated with the increased risk of atlantoaxial osteoarthritis: a retrospective study, European Spine Journal; 2022 Dec; 31 (12): 3418-3425
4. Kapandji A. I., Functional anatomy, Volume 3, Spine and head, Elsevier Urban & Partner; Wrocław 2014; 200-202
5. Paszko - Patej G., Terlikowski R., Kulak W., Sienkiewicz D., Okurowska - Zawada B., Factors influencing the process of shaping a child's equilibrium and the possibility of its objective assessment, Neurologia Dziecięca; 2011; 20; 41: 121-127
6. Veloso C., da Silveira A. F., Garcia M. V., Romero C. A. P., Osteopathic Manipulation Treatment onpostural balance: a systematic review, Manual Therapy, Posturology & Rehabilitation Journal, 2016
7. Held-Ziółkowska M., Static and dynamic equilibrium of the body. Part 1: sensory organisation and biomechanics of the balance system, Otorhinolaryngology Magazine; 2006, 18: 39-46
8. Ivanenko Y., Gurfinkel V. S., Human Postural Control, Frontiers in Neuroscience; 2018; 12: 171
9. Adamczewski T., Puzder A., Gworys K., Pietrzak B., Figas G., Zawadzka - Fabijan A., Gasztych J., Saryusz - Wolska A., Lis - Studniarska D., Innovative model of diagnostic and therapeutic proceedings and prevention in people with functional disorders of the cervical and cervical-thoracic spine, Medical University of Lodz Publishing House; 29 Sep 2021
10. Banks K. et al. 2012. manual therapy according to Maitland. Edited by Śliwiński Z. Elsevier Urban & Partner, Wrocław, pp. 178-210, 211-237.
11. Staheli LT, Chew DE, Corbett M. The longitudinal arch. J Bone Joint Surg 1987;69A(3):426-8.

doi.org/10.56984/8ZG2EF8t5I

12. Żurawski A, Śliwiński Z, Suliga E, Śliwiński G, Wypych Ż, Kiebzak W, Effect of Thoracic Kyphosis and Lumbar Lordosis on the Distribution of Ground Reaction on the Feet, Orthop Res Rev 2022; 14: 187-197
13. Zafar H., Integrated jaw and neck function in man. Studies of mandibular and head-neck movements during jaw opening - closing tasks, Swedish Dental Journal; 2000; (143): 1-41
14. Tixa S., Atlas of palpation anatomy, Warsaw, PZWL, 2022, p. 14.
15. Cavanagh P. R., Rodgers M. M., Iiboshi A., Pressure Distribution Under Symptom-Free Feet during Barefoot Standing, Foot & Ankle; Apr 1987; 7(5): 262- 276
16. Tixa S., Ebenegger B., Atlas of osteopathic joint techniques. Volume 3. cervical, thoracic and lumbar spine and ribs, PZWL, 2021
17. Swartz E. E., Floyd R. T., Cendoma M., Cervical Spine Functional Anatomy and the Biomechanics of Injury Due to Compressive Loading, Journal of Athletic Training; Jul-Sep 2005; 40 (3): 155-161
18. Perry J.: " Gait Analysis: Normal and Pathological Function". Slack Inc 1992
19. Degani A. M., Leonard Ch. T., Danna-Dos-Santos A., The effects of early stages of aging on postural sway: a multiple domain balance assessment Rusing aforce platform, Journal of Biomechanics; Nov 2017; 64: 8-15
20. Pomarino D., Pomarino A., Plantar Static Pressure Distribution in Healthy Individuals: Percentiles for the Evaluation of Forefoot Landing, Foot & Ankle Specialist; Aug 2014; 7(4): 293-297
21. Santos T. S., Oliveira K. K. B., Martins L. V., Vidal A. P. C., Effects of manual therapy on body posture: systematic review and meta-analysis, Gait & Posture; Jul 2022; 280-294
22. Bonnet C. T., Cherraf S., Szaffarczyk S., Rougier P. R., The contribution of body weight distribution and center of pressure location in the control of mediolateral stance; Journal of Biomechanics; May 2014; 47(7): 1603-1608
23. Patti A., Bianco A., Şahin N., Sekulic D., Paoli A., Iovane A., Messina G., Gagey P. M., Palma A., Postural control and balance in a cohort of healthy people living in Europe, Medicine (Baltimore); Dec 2018; 97(2): e13835
24. Hogan MT, Staheli LT. Arch height and lower limb pain: an adult civilian study. Foot Ankle Int 2002;23(1):43-7
25. Garcia-Rodriguez A, Martin-Jimenez F, Carnero-Varo M, GomezGracia E, Gomez-Aracena J, Fernandez-Crehuet J. Flexible flat feet in children: a real problem? Pediatrics 1999;103:e84.
26. Gilmour JC, Burns Y. The measurement of the Medial Longitudinal Arch in children. Foot Ankle Int 2001;22(6):493-8
27. Forriol F, Pascual J. Footprint analysis between three and seventeen years of age. Foot Ankle Int 1990;11(2):101-4.
28. Souza JA, Pasinato F, Corrêa EC, da Silva AM. Global body posture and plantar pressure distribution in individuals with and without temporomandibular disorder: a preliminary study. J Manipulative Physiol Ther. 2014 Jul-Aug;37(6):407-14
29. Lee BH, Lee HR, Kim KM, Lee JH, Kim KY. Effects of spiral taping applied to the neck and ankle on the body balance index. J Phys Ther Sci. 2015 Jan;27(1):79-82
30. Bernal-Utrera C., Anarte-Lazo E., Gonzalez-Gerez J. J., Saaverda-Hernandez M., De-La-Barrera-Aranda E., Serrera-Figallo M. A., Gonzales-Martin M., Rodriguez-Blanco C., Effect of Combined Manual Therapy and Therapeutic Exercise Protocols on the Postural Stability of Patients with Non-Specific Chronic Neck Pain. A Secondary Analysis of Randomized Controlled Trail, Journal of Clinical Medicine; 2022; 11 (1): 84
31. Gómez F., Escribá P., Oliva-Pascual-Vaca J., Méndez-Sánchez R., Silvia Puente-González A., Immediate and Short-Term Effects of Upper Cervical High-Velocity, Low-Amplitude Manipulation on Standing Postural Control and Cervical Mobility in Chronic Nonspecific Neck Pain: A Randomised Controlled Trial, Journal of Clinical Medicine; 10 Aug 2020
32. Romero del Rey R., Saavedra Hernández M., Rodriguez Blanco C., Palomegue del Cerro L., Alarcón Rodriguez R., Short-term effects of spinal thrust joint manipulation on postural sway in patients with chronic mechanical neck pain: a randomized controlled trial, Disability and Rehabilitation; 30 Jul 2020; 1227-1233
33. Fisher A. R., Bacon C. J., Mannion J. V. H., The effect of cervical spine manipulation on postural sway in patients with nonspecific neck pain, Journal of Manipulative and Physiological Therapeutics; Jan 2015; 38(1):65-73
34. Pourhoseingholi E., Pourhoseingholi M. A. Comprasion of Arch Index of Flat foot and health foot in pre-school children. Thrita. 2013;2(3): 15-18
35. Cen X, Xu D, Baker JS, Gu Y. Association of Arch Stiffness with Plantar Impulse Distribution during Walking, Running, and Gait Termination. Int J Environ Res Public Health. 2020 Mar 21;17(6):2090
36. Wozniacka R, et al. The association between high-arched feet, plantar pressure distribution and body posture in young women, Scientific Reports; 2019 Nov 20;9(1):17187.
37. Haag, Mackenzie J., 'The effect of arch height on variances in gait phases: A kinematic analysis'. Honors Program Theses. 2019. 382.
38. Delafontaine A., Vialleron T., Diakhaté D. G., Fourcade P., Yiou E., Effects of experimentally induced cervical spine mobility alteration on the postural organisation of gait initiation, Scientific Reports; 12(1):6055, Apr 2022

doi.org/10.56984/8ZG2EF8t5I