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Bibliometric Analysis of Sitting Position with Postural Wellness in the Incidence of Cerebral Palsy

Mahmudah Rahma At Amah[1]✉, Ambita Albaba Zedda[1], Zakiya Mawar Anggriani[1], Aini Fajriatul Ulya[1], Erika Putri Aurelia Efendi[1]

[1]Faculty of Nursing and Health Science, Universitas Muhammadiyah Semarang, Indonesia

✉Corresponding author: **Mahmudah Rahma At Amah**; email: mahrahma2509@gmail.com

Abstract

Background: There is currently no published bibliometric research on sitting position and postural health in cerebral palsy. People with cerebral palsy have difficulty sitting or standing. Improper sitting habits and long duration of sitting can weaken postural and increase the risk of musculoskeletal problems and chronic diseases in children with cerebral palsy. **Objective**: The purpose of searching for publications on sitting positions with sitting position interventions is to support researchers in systematically searching for, reviewing, and analyzing scientific articles. **Method**: The research method was systematically conducted by searching for, reviewing, and analyzing scientific articles. The PRISMA search process used for this publication has a specification range of the last two years (2024 and 2025) and focuses on the fields of Psychology, Health Sciences, Biomedical and Clinical Sciences. **Results**: There were 92,302 articles published on sitting position and postural wellness. After filtering through the inclusion criteria, there were 219 articles. This exploration emphasizes the importance of maintaining correct sitting posture, reducing discomfort, and preventing musculoskeletal-related complications in children with cerebral palsy. **Discussion**: After exploring the complications that can occur from incorrect sitting position in cerebral palsy events, they are asymmetrical posture, orthopedic disorders (hip dislocation or flexion, scoliosis, leg deformities, hip and knee contractures), inability to change position, intellectual disability, and failure of child development. **Conclusion**: Sitting position and postural wellness has expanded across multiple interdisciplinary domains and plays an important role in supporting the management of cerebral palsy. Appropriate sitting posture contributes to improved postural stability, reduced discomfort, and better functional outcomes, particularly among children with neurological impairments. These insights may guide future research and clinical strategies aimed at optimizing postural interventions in individuals with cerebral palsy.

Keywords: bibliometric analysis, body balance, cerebral palsy, postural wellness, sitting posture

INTRODUCTION

Sitting is one of the activities that reflect routine activities in daily life [1]. Sitting is an important form of rest for humans associated with various activities of daily living (ADLs). Sitting requires coordination between the hip, knee, and ankle joints. Children with cerebral palsy (CP) show signs of symptoms that make the sitting position abnormal, such as lower tremors that have adduction and inward rotation movements, necks that lean to

the left because the muscles are less tense, and eyes that look slightly to the right. Children with cerebral palsy exhibit less flexible movements and less than optimal body coordination. He/she has difficulty in maintaining balance, making it difficult to sit or stand in a stable position for a long time. Eye-hand coordination is also poor. In addition, there are impairments in spatial understanding and orientation. His central motor impairment is permanent. When walking, the body tends to tilt forward and sideways with unsteady steps, resulting in falls. In communication, the articulation and pronunciation are less clear, and the intelligence level is below average [2].

In today's modern era, the habit of living with minimal physical activity is almost inevitable for many people. Prolonged sitting, especially with improper body position, can cause various health problems [3]. Changes in living patterns, technological advances, environmental conditions, and the increasing age of the population have resulted in a considerable increase in the duration of time spent sitting [4]. Factors affecting how a person sits include a low level of education resulting in inadequate knowledge, smoking habits, types of recreational activities undertaken, and health conditions such as diabetes mellitus, hypertension, and coronary heart disease. Daily sitting time also plays an important role, especially if it exceeds 6-8 hours, as this may increase the chances of developing some conditions, such as kidney stones [5]. After spending long hours at work with little physical activity, many people then spend time watching television and using social media, which keeps them seated in front of a screen. It is not easy to sit properly in a certain place (e.g. workplace) all the time and sitting for a long time with the wrong posture can cause a series of health problems over time [6]. It is this habit that causes sitting disorders or abnormalities [7].

Sitting position abnormalities are generally caused by improper sitting habits, such as sitting with a hunched posture, sitting on an angle, or an unbalanced position. Poor sitting posture over a long period of time can be a major factor in causing abnormalities in the spinal structure. This habit can cause changes in the spinal curve, such as kyphosis or lordosis, and increase the risk of back pain and musculoskeletal problems [8]. Passive and inappropriate sitting positions can also lead to postural imbalances, especially exacerbating the condition of excessive thoracic kyphosis curves. In addition, an improper sitting position also affects the activity of the back muscles and the stability of the spine, thus risking musculoskeletal disorders [9]. In addition to causing musculoskeletal disorders, inappropriate sitting habits are often part of a low physical activity lifestyle, which is known to increase the risk of various chronic health conditions, such as cardiovascular disease, obesity, type 2 diabetes, colon cancer, osteoporosis and depressive illnesses [10].

Cerebral palsy (CP) is a term recognized as the most common disability that can affect motor function as a result of injury to the developing brain. Cerebral palsy is initially characterized by delayed acquisition of motor milestones and impaired infant motor function that persists throughout the life span [11]. Genetic factors result from spasticity that occurs due to brain damage during infancy, premature birth, or asphyxia at birth [12]. The prevalence of CP in the world is about 1,6 cases per 1.000 live births and has decreased in developed countries (HICs) such as parts of Europe, Australia, and Japan [12]. The motor skills of CP children can be maximized to 90% of the capacity of 2 - 3 years

of age [13]. Children with cerebral palsy tend to spend their time in a variety of sitting positions that can cause sitting disorders or abnormalities due to disruption of muscle function, movement, and coordination [14]. The search for sitting position publications with sitting position interventions supports researchers to systematically search, review, and analyze scientific articles.

METHOD

Study design

The research method used to compile this publication is a bibliometric study. Bibliometrics is a field of science, information, analysis made from articles, journals, and books that produce coverage of quality [15]. The literature sources used are the Dimensions application or can be found at app.dimensions.ai. The publication search process will be described in steps from the Preferred Reporting Items for Systematic Review and Meta Analysis (PRISMA). The PRISMA search process used for this publication has a specification range of the last two years (2024 and 2025) and which focuses on the fields of Psychology, Health Sciences, Biomedical and Clinical Sciences. The research data collection was conducted on April 22, 2025.

Selection and screening

The research process began with the first step, which involved identification using the keywords "Sitting position AND Body balance AND Body goal AND Prevention of bone problems AND Pain prevention AND increasing comfort during sitting". The second step is to filter publications that focus on the fields of Psychology, Health Sciences, Biomedical Sciences, and Clinical Sciences. The time frame used is the last two years (2024 and 2025). The third step is the final step in the process of double-checking to ensure that the literature meets the research criteria. The search results identified 92,302 articles, of which 4,054 were published within the last two years (2024–2025). A total of 88,248 articles were excluded because they fell outside the specified publication period. Ultimately, 219 publications met the inclusion criteria and were included in the analysis (Figure 1).

Data extraction

The software used is VOSviewer version 1.6.20. VOSviewer is one of the software used to create and illustrate bibliometric maps based on the latest trends in network data [16]. The process occurs together through several steps, namely searching for data sources, reading data from the reference manager file, selecting "Fields from which terms will be extracted" by clicking "Title and abstract fields", ensuring the approval check "Ignore structured abstract labels and ignore copyright statements", selecting "Counting method" in the form of Full counting, ensuring the Minimum number of occurrences of an item is 10, Number of terms to be selected is 30, and click "finish".

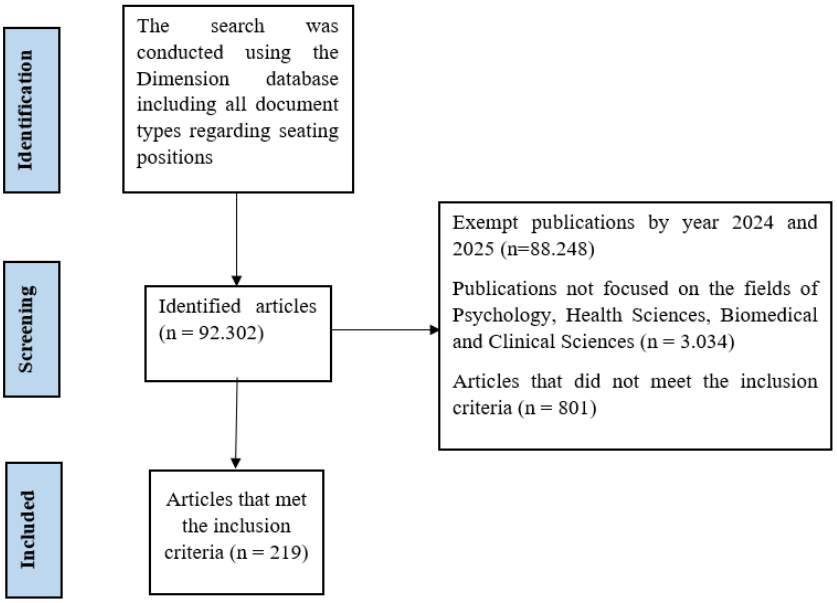

Figure 1. PRISMA Flowchart

RESULTS AND DISCUSSION

Based on bibliometric results using VOS viewer, Figure 2 shows a visualization that sitting position and position wellness have several links to disease, development, management, child, cerebral palsy, patient, group, pain, health, effect or impact, smart city, application, and knowledge.

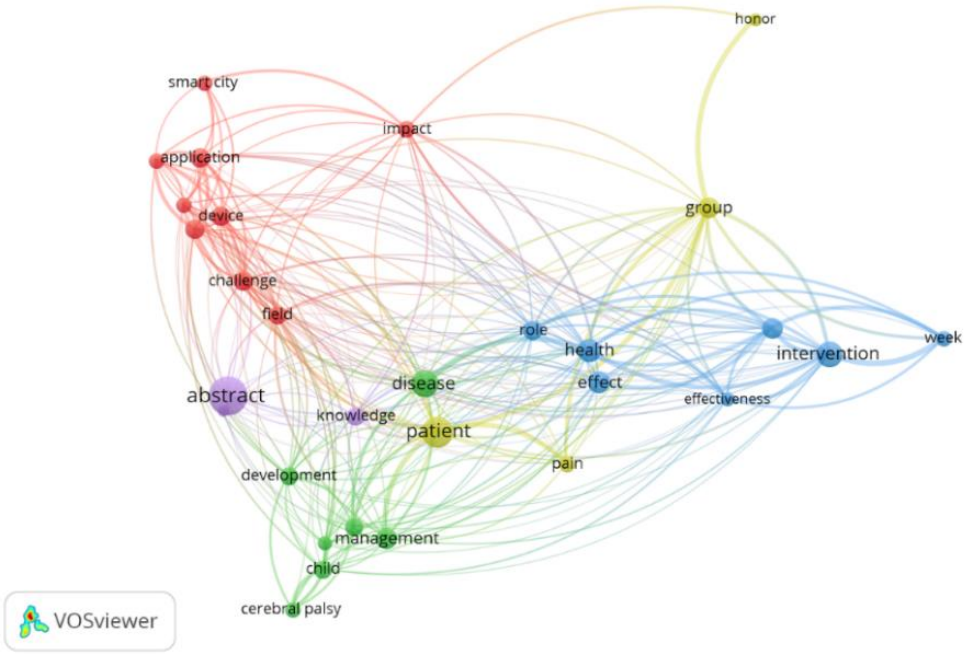

Figure 2. Network visualization of the sitting position (Source: VOS viewer)

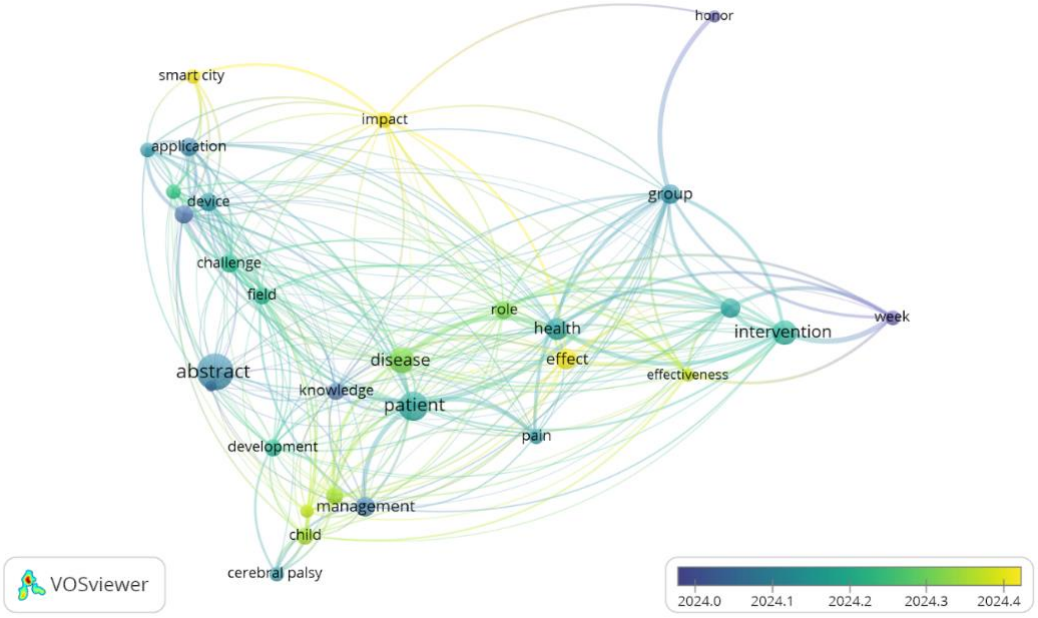

Figure 3. Overlay visualization of the sitting position (Source: VOS viewer)

Based on the bibliometric results using VOS viewer, Figure 3 shows a visualization that the current issues or trends consist of impact or effect, smart city, application, and effectiveness. The overlay visualization will highlight keywords that are on the rise or are the focus of recent research. They are generally marked with brighter or different colors, making it easier to find new trends and research opportunities. Meanwhile, darker topics such as honor, week, group, knowledge, abstract, and health show the lack of attention in research related to sitting position and position wellness.

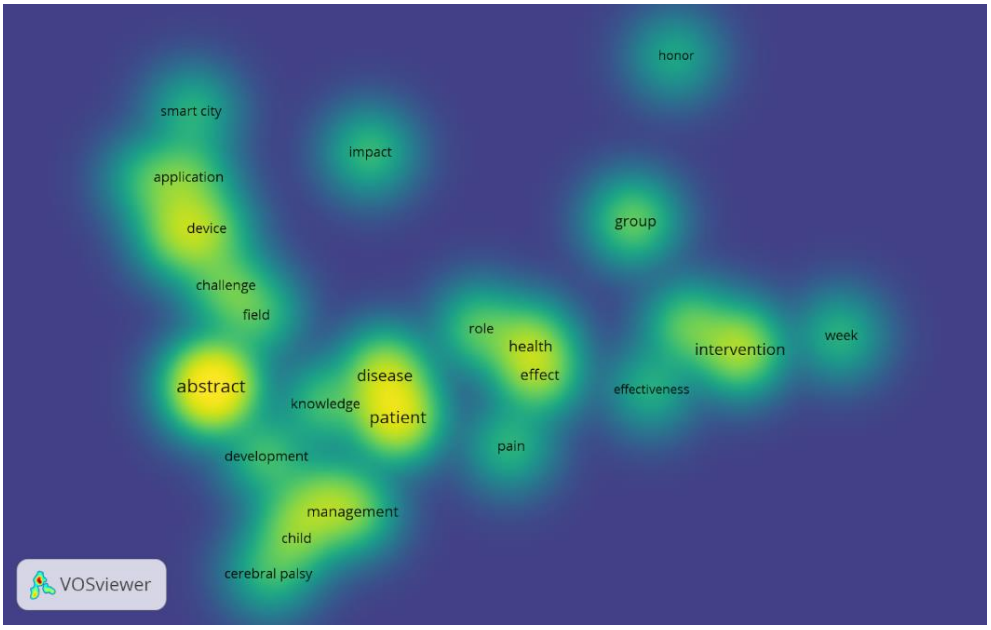

Figure 4. Density visualization of the sitting position (Source: VOS viewer)

Based on the bibliometric results using VOS viewer, Figure 4 shows the density visualization of the sitting position which shows that dark areas such as cerebral palsy, pain, development, effectiveness, impact, and smart city.

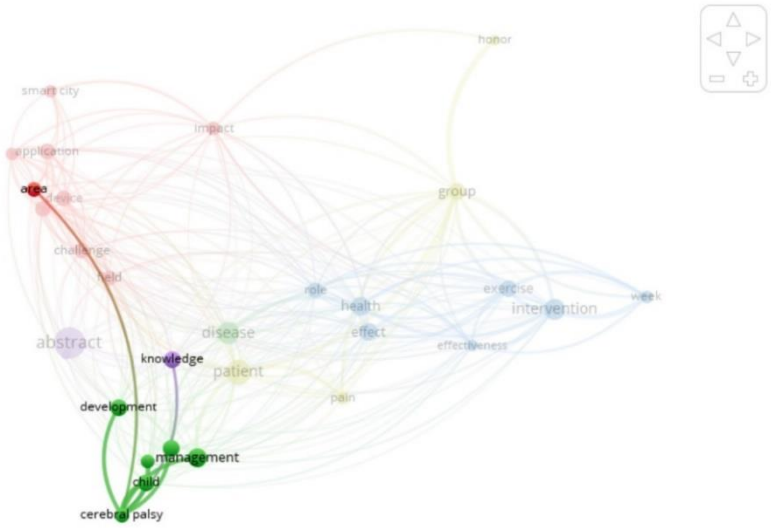

Figure 5. Network visualization of the association of sitting position with cerebral palsy incidence (Source: VOS viewer)

Based on bibliometric results using VOSviewer, it is found that cerebral palsy is closely related to the words child, development, management and knowledge. This relationship shows that the topic of cerebral palsy is often discussed in the context of child development, clinical management, and the importance of knowledge in the treatment process. The association with knowledge reinforces that education and understanding of health workers and families have an important role in the care of children with cerebral palsy including the adjustment of appropriate sitting positions.

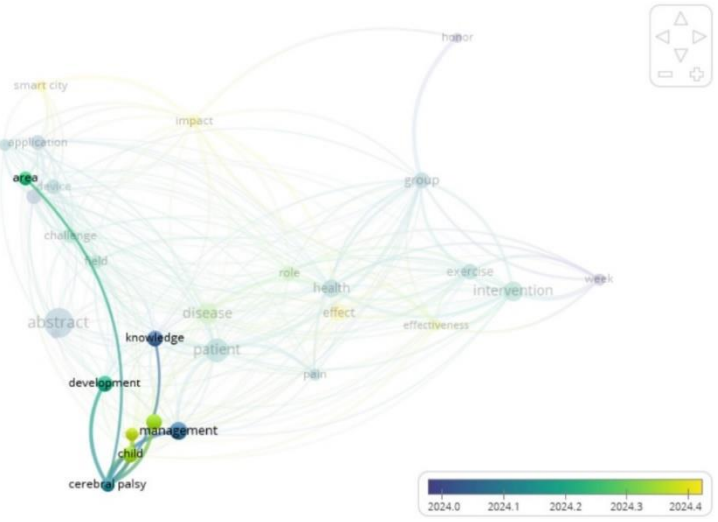

Figure 6. Overlay visualization of the association of sitting position with cerebral palsy incidence (Source: VOS viewer)

Based on bibliometric results using VOSviewer, it is found that cerebral palsy shows a lighter color. So that the search results for cerebral palsy tend to lead to pediatric patients, and are more widely used as a topic of conversation. However, vice versa in the image that shows a darker color, namely management and knowledge, states that it is very rarely used as a topic of conversation.

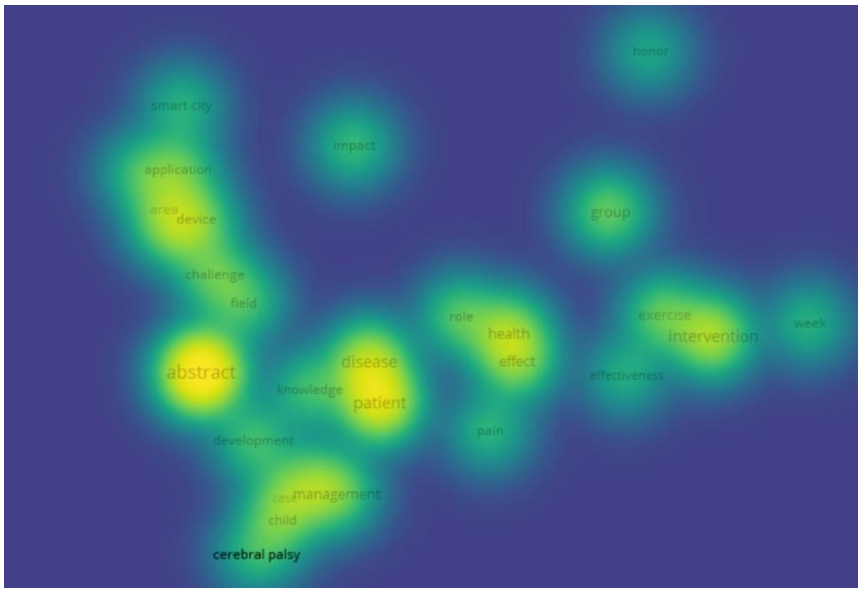

Figure 7. Density visualization of the association of sitting position with cerebral palsy incidence (Source: VOS viewer)

Based on the bibliometric results using VOSviewer, a density visualization that shows the level of novelty in research on sitting positions in children with cerebral palsy, where the darkest areas indicate topics that have not been widely researched or still lack scientific studies.

There were 92,302 articles published on sitting position and postural wellness. After filtering through the inclusion criteria, there were 219 articles. The number of articles published in 2024 was 3,489 articles. While the number of articles published in 2025 was 565 articles. This shows that there is still a trend or interest among researchers in the topic of sitting position. Of the many fields of publication, researchers chose the fields of Psychology, Health Sciences, Biomedical and Clinical Sciences because of evidence-based practice (EBP), which provides an in-depth understanding. The interest of researchers as of April 22, 2025, in the publication of articles in 2024 is about 6.17 times more than in 2025.

Based on 2025, the most published scientific publications on sitting position and cerebral palsy this year are articles from the Pyschology category (45 citations out of 116 articles), followed by Biomedical and Clinical Sciences with the number of articles (41 citations out of 96 articles), Health sciences (42 citations out of 88 articles), the above statistical results show that the number of studies related to sitting position and cerebral palsy is still very limited. further research on sitting position and cerebral palsy in nursing is needed (Figure 1).

The network representation of the keywords found from the research sample. The co-occurrence analysis has revealed that the keywords are divided into 5 different clusters, each cluster is identified with a color. Cluster 1 has the most items (5), followed by cluster 2 (2), cluster 3 has the most items (6), cluster 4 (5), and cluster 5 (1). The most frequently occurring topics in cerebral palsy articles related to sitting position are divided into five colors, cluster 1 (red) contains the keywords application, device, smart city, challenge, and field. Cluster 2 (yellow) group and honor, cluster 3 (blue) intervention, health, role, effect, effectiveness, week. Cluster 4 (green) patient, management, development, child, cerebral palsy, and finally cluster 5 (purple) abstract (Figure 2).

The yellow-colored nodes indicate topics that have been extensively studied, whereas darker-colored nodes represent topics that have received relatively limited research attention (Figure 3). Current research on sitting position is frequently associated with the incidence and management of cerebral palsy in children. A study involving 2,735 children with cerebral palsy reported that many of these children spend prolonged periods sitting or lying down. Such prolonged positioning may lead to postural asymmetry, tissue adaptation, pain, and ultimately musculoskeletal deformities, including skeletal abnormalities [6].

Topics such as *patient, disease, abstract, device, health, effect, intervention,* and *management* are not recommended for further investigation because they have been extensively explored in previous studies. Instead, it is advisable to focus on topics represented by faded colors in the visualization, such as *child, cerebral palsy, pain,* and *knowledge*. These topics indicate relatively limited research coverage and therefore offer promising opportunities for future investigation (Figure 4).

The concept of incorrect sitting position has a relationship with the incidence of cerebral palsy, which can be seen in Figure 5. This is shown from the trend or interest of researchers in the topic of sitting position, which can be seen in Figure 6. Meanwhile, Figure 7 shows a density visualization that shows the level of novelty in research on sitting position in children with cerebral palsy, where the darkest area indicates topics that have not been widely researched or still lack scientific studies.

Sitting posture ability is essential for functional independence and participation in children with cerebral palsy. Improved sitting posture in children with cerebral palsy can improve stability, comfort and motor function. Adjustments can be made to the proper sitting position. This can not only prevent deformities, but also improve their ability in daily activities [17].

Cerebral palsy may affect sitting position in some children. Cerebral palsy (CP) is a set of permanent impairments that affect the development of movement and posture, thus limiting a person's activities. The condition is caused by a non-progressive disorder of brain and fetal development, which usually occurs in newborns or rarely in infants. The incidence rate is about two to three cases per 1,000 live births [18]. In addition to motor impairments, the definition of CP also includes neurobehavioral disorders that are almost

always present in varying degrees of severity. Sensory impairments, intellectual and cognitive disabilities, epilepsy, and behavioral problems often accompany this condition.

As they age, cerebral palsy patients show clinical progression that includes a combination of spasticity, muscle retraction and abnormal movements. The functional and social impact experienced depends on the various impairments and their association with intellectual and cognitive limitations. Complications that can occur from sitting errors in cerebral palsy include asymmetric posture, dislocation or flexion of the pelvis, scoliosis, hip and knee contractures, and inability to change position [19]. Other complications include intellectual disability, orthopedic disorders (hip dislocation and leg deformities), and failure to thrive. Therefore, long-term treatment involving multiple disciplines is essential, starting from childhood to adulthood, to ensure adequate levels of independence, good quality of life, and optimal social integration. Errors in sitting position variations can occur in children with cerebral palsy, so appropriate management or intervention is required.

Management or intervention of sitting position in the event of pediatric cerebral palsy aims to support good posture, especially for the hips and help improve motor function [13]. Some management can be provided such as posture stabilization exercises with or without using assistive devices, performing physiotherapy, and periodic evaluation. The use of foam back pillows has been shown to have various benefits for the lower back and can help with posture stabilization exercises [20]. The use of back support pillows, either made of foam or natural rubber, was shown to significantly reduce back discomfort during sitting for 60 minutes when compared to sitting without support. Among the two pillow types, the natural rubber pillow provided a higher level of satisfaction and was more effective in maintaining lumbar curvature and reducing trunk muscle fatigue over a longer period of time. Although all groups experienced an increase in back discomfort as sitting time increased, the group using the natural rubber cushion showed the smallest increase in discomfort and had significantly lower levels of discomfort compared to both the no support and foam cushion groups. In addition, the use of support pillows also helped reduce fatigue of deep muscles, such as the transversus abdominis and internal oblique muscles, and increased satisfaction during prolonged sitting. These findings indicate that natural rubber support pillows are more effective in reducing discomfort and muscle fatigue during prolonged sitting, although larger-scale studies are still needed to confirm these results. Other condition-specific management includes mobility training, bimanual training, and treadmill training [21]. The results of research with a sample of 315 children with cerebral palsy using hypnotherapy have an influence on posture, so that it is effective in improving sitting position [22]. Hydrotherapy is an aquatic rehabilitation for children with cerebral palsy that can improve gross motor function [23].

An evaluation can be done using a tool called electromyography (EMG). Electromyography is used to assess the frequency of muscles, such as the internal obliques, to integrate muscle responses during sitting. Research shows the discomfort felt in the body, especially after sitting for 30-40 minutes [24]. A six-week trial of a position wellness therapy program can improve independent sitting (Flowers, 2025). Patients with

cerebral palsy, especially children, are encouraged to stand with the support of assistive devices, actively bear weight, and walk to keep familiarizing exercises for the muscles [25]. It is useful to support the active movement of sufferers and change positions, in accordance with the support of individuals, families, and caregivers [26]. This exploration emphasizes the importance of maintaining correct sitting posture, reducing discomfort, and preventing musculoskeletal-related complications in children with cerebral palsy. An effective therapeutic approach can help reduce the rate of further deterioration in the incidence of pediatric cerebral palsy.

CONCLUSION

Establishing the right sitting position is crucial in children with cerebral palsy, where it is useful to support good posture, improve stability, comfort, and motor function, and prevent deformities. It is hoped that future researchers can continue to develop appropriate management and management. Functional improvement in the incidence of cerebral palsy can continue to improve the quality and social integration of children with cerebral palsy.

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DISCLOSURE OF INTERESTS

The author declares that there is no conflict of interest.

REFFERENCES

[1] Aldousari E. Bibliometric analysis confirms expected trends in consumer health information publications. Health Inf Libr J. 2024;41(3):309–323. https://doi.org/10.1111/hir.12399.

[2] Arruda H, Silva ER, Lessa M, Proença D, Bartholo R. VOSviewer and Bibliometrix. J Med Libr Assoc. 2022;110(3):392–395. https://doi.org/10.5195/jmla.2022.1434.

[3] Asano D, Kikuchi N, Yamakawa T, Morioka S. Decline in motor function during COVID-19 pandemic restrictions and its recovery in a child with cerebral palsy: a case report. Children (Basel). 2021;8(6):511. https://doi.org/10.3390/children8060511.

[4] Assis GS, Schlichting T, Rodrigues Mateus B, Gomes Lemos A, dos Santos AN. Physical therapy with hippotherapy compared to physical therapy alone in children with cerebral palsy: a systematic review and meta-analysis. Dev Med Child Neurol. 2022;64(2):156–161. https://doi.org/10.1111/dmcn.15042.

[5] Cai W, Zhao D, Zhang M, Xu Y, Li Z. Improved self-organizing map-based unsupervised learning algorithm for sitting posture recognition system. Sensors (Basel). 2021;21(18):6246. https://doi.org/10.3390/s21186246.

[6] Casey J, Agustsson A, Rosenblad A, Rodby-Bousquet E. Relationship between scoliosis, windswept hips and contractures with pain and asymmetries in sitting and supine in children

with cerebral palsy. Disabil Rehabil. 2022;44(22):6738–6743. https://doi.org/10.1080/09638288.2021.1971308.

[7] Casey J, Rosenblad A, Rodby-Bousquet E. Postural asymmetries, pain, and ability to change position of children with cerebral palsy in sitting and supine: a cross-sectional study. Disabil Rehabil. 2022;44(11):2363–2371. https://doi.org/10.1080/09638288.2020.1834628.

[8] Christovão IS, Chagas PSC, Ferreira LC, Paleg G, Leite HR, Camargos ACR. Goal-oriented collaborative approach with postural management strategies via telehealth for children with non-ambulant cerebral palsy: feasibility randomized clinical trial protocol. Res Dev Disabil. 2024;155:104869. https://doi.org/10.1016/j.ridd.2024.104869.

[9] Damiano DL, Longo E. Early intervention evidence for infants with or at risk for cerebral palsy: an overview of systematic reviews. Dev Med Child Neurol. 2021;63(7):771–784. https://doi.org/10.1111/dmcn.14855.

[10] Dharnipragada R, Bostrom N, Bertogliat M, Denduluri LS, Dhawan S, Ladd B, et al. Sagittal balance in sitting and standing positions: a systematic review of radiographic measures. Heliyon. 2024;10(7):e28545. https://doi.org/10.1016/j.heliyon.2024.e28545.

[11] Faccioli S, Maggi I, Pagliano E, Migliorini C, Michelutti A, Guerra L, et al. Sitting postural management to prevent migration percentage progression in non-ambulatory children with cerebral palsy: randomized controlled trial preliminary data. J Clin Med. 2024;13(11):3129. https://doi.org/10.3390/jcm13113129.

[12] Flowers M. A 6-week modified physical therapy intensive program for a child with cerebral palsy. Pediatr Phys Ther. 2025;37(2). https://doi.org/10.1097/PEP.0000000000001191.

[13] Graham D, Paget SP, Wimalasundera N. Current thinking in the health care management of children with cerebral palsy. Med J Aust. 2019;210(3):129–135. https://doi.org/10.5694/mja2.12106.

[14] Jung KS, Jung JH, In TS, Cho HY. Effects of prolonged sitting with slumped posture on trunk muscular fatigue in adolescents with and without chronic lower back pain. Medicina (Kaunas). 2021;57(1):3. https://doi.org/10.3390/medicina57010003.

[15] Kiebzak WP, Ha SY, Kosztołowicz M, Żurawski A. Forced straightening of the back does not improve body shape. Diagnostics (Basel). 2024;14(3):250. https://doi.org/10.3390/diagnostics14030250.

[16] Maaoui R, Karoui S, Hfaidh M, Mouhli N, Ezzine Z, Ksibi I, et al. Cerebral palsy of the child in rehabilitation environment: epidemiologic and clinical profile and therapeutic modalities. Tunis Med. 2023;101(7):642–647.

[17] McIntyre S, Goldsmith S, Webb A, Ehlinger V, Hollung SJ, McConnell K, et al. Global prevalence of cerebral palsy: a systematic analysis. Dev Med Child Neurol. 2022;64(12):1494–1506. https://doi.org/10.1111/dmcn.15346.

[18] Najafi TA, Abramo A, Kyamakya K, Affanni A. Development of a smart chair sensors system and classification of sitting postures with deep learning algorithms. Sensors (Basel). 2022;22(15):5585. https://doi.org/10.3390/s22155585.

[19] Novak I, Morgan C, Fahey M, Finch-Edmondson M, Galea C, Hines A, et al. State of the evidence traffic lights 2019: systematic review of interventions for preventing and treating

children with cerebral palsy. Curr Neurol Neurosci Rep. 2020;20(2):3. https://doi.org/10.1007/s11910-020-1022-z.

[20] Paleg G, Livingstone R. Evidence-informed clinical perspectives on postural management for hip health in children and adults with non-ambulant cerebral palsy. J Pediatr Rehabil Med. 2022;15(1):39–48. https://doi.org/10.3233/PRM-220002.

[21] Paul S, Nahar A, Bhagawati M, Kunwar AJ. A review on recent advances of cerebral palsy. Oxid Med Cell Longev. 2022;2022:2622310. https://doi.org/10.1155/2022/2622310.

[22] Puntumetakul R, Chatprem T, Saiklang P, Leungbootnak A. The effect of two types of back pillow support on transversus abdominis and internal oblique muscle fatigue, patient satisfaction, and discomfort score during prolonged sitting. Int J Environ Res Public Health. 2023;20(4):3742. https://doi.org/10.3390/ijerph20043742.

[23] Tapia C, Constanzo J, González V, Barría RM. The effectiveness of aquatic therapy based on the Halliwick concept in children with cerebral palsy: a systematic review. Dev Neurorehabil. 2023;26(6–7):371–376. https://doi.org/10.1080/17518423.2023.2259986.

[24] Wen L, Lin X, Li C, Zhao Y, Yu Z, Han X. Sagittal imbalance of the spine is associated with poor sitting posture among primary and secondary school students in China: a cross-sectional study. BMC Musculoskelet Disord. 2022;23(1):1–9. https://doi.org/10.1186/s12891-022-05021-5.

[25] Yamagata H, Nishida N, Izumiyama T, Asahi R, Koike M, Mihara A, et al. A radiographic and physical analysis of factors affecting seat belt position in sitting car seat. Sci Rep. 2022;12(1):1–9. https://doi.org/10.1038/s41598-022-14607-x.

[26] Zeng J, Hao S, Wang Y, Liu Q. Neuromechanism, recovery effect and case study of swimming training intervention in children with cerebral palsy: a case report. Medicine (Baltimore). 2023;102(50):e35223. https://doi.org/10.1097/MD.0000000000035223.