fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 4/2023 (23) KWARTALNIK ISSN 1642-0136

Integracja Sensoryczna układu przedsionkowego, jako jeden z elementów kompleksowej rehabilitacji dziecka z uszkodzonym słuchem

Sensory Integration of the Vestibular System as one of the elements of comprehensive rehabilitation of a child with impaired hearing

Fizjoterapeutyczna diagnostyka funkcjonalna w ginekologii

Physiotherapeutic assessment in gynecology


3 Kongres Rehabilitacja Polska
Pabianice, 8–9 grudnia 2023
Organizatorzy:
Polskie Towarzystwo Fizjoterapii i Polskie Towarzystwo Rehabilitacji
P.T.Reh.
www.3kongres.pl

NOWOŚĆ W OFERCIE

ASTAR.

Tecaris

SKUTECZNA I BEZPIECZNA TERAPIA PRĄDEM O CZĘSTOTLIWOŚCI RADIOWEJ

Urządzenie przeznaczone do przeprowadzania profesjonalnych zabiegów prądem o częstotliwości radiowej (terapia TECAR).

Dowiedz się więcej
terapiatecar.astar.pl

Aparat umożliwia pracę z elektrodami rezystancyjnymi (o średnicy 25, 40, 55 lub 70 mm), pojemnościowymi (o średnicy 25, 40, 55 lub 70 mm) oraz z elektrodą typu IASTM do terapii tkanek miękkich

Tecaris generuje sinusoidalny prąd zmienny o częstotliwościach 300, 500, 750 lub 1000 kHz, dostarczanego do tkanek pacjenta za pomocą uniwersalnego aplikatora kątowego lub prostego.

Prąd o częstotliwości radiowej wywołuje efekty w głębszych warstwach tkanek, czyli kościach, ścięgnach lub więzadłach.
Umożliwia to leczenie zwłóknień i zwyrodnień tkanek w przewlekłych stanach chorobowych.

Terapia wpływa przede wszystkim na tkanki powierzchowne, czyli mięśnie (rozluźnienie) i układ limfatyczny, przyspieszając regenerację komórek.

ul. Świt 33
43-382 Bielsko-Biała

t +48 33 829 24 40
astarmed@astar.eu

POLSKI PRODUKT WYBIERASZ I WSPIERASZ

wsparcie merytoryczne
www.fizjotechnologia.com

www.astar.pl

MEDICAL
INNOVATION

PhysioAssist

Unikalna technologia Simeox

Łatwy w użyciu, prosty w obsłudze

Zalety Simeox

Mobilizacja i drenaż głęboko zalegającego śluzu

Sygnał Simeox rozprzestrzenia się do najbardziej dystalnych odcinków drzewa oskrzelowego, tam gdzie jest on najtrudniejszy do usunięcia.

Zmniejsza ryzyko zapadnięcia się oskrzeli

Simeox nie generuje ciągłego przepływu. Bardzo krótkie impulsy ujemnego ciśnienia naprzemiennie z ciśnieniem atmosferycznym pomiędzy nimi zmniejszają do minimum zapadnięcie się oskrzeli.

Nie wymaga wysiłku

Pacjent wykonuje swobodne wdechy i wydechy nie wymagające dodatkowego wysiłku.

Uczucie oddychania „pełną piersią"

Simeox pomaga pacjentowi wydychać powietrze, pozwalając mu lepiej „opróżnić" płuca. Uczucie „świeżego" powietrza, które dostaje się do płuc przy kolejnym wdechu, daje pacjentowi prawdziwe, lepsze samopoczucie.

MEDICAL
INNOVATION

PhysioAssist

fizjoterapia polska
nr 4/2023 (23)

Two-dimensional analysis of gait parameters in schizophrenia – an observational study

Dwuwymiarowa analiza parametrów chodu w schizofrenii – badanie obserwacyjne

Kancherla Sireesha[1(A,B,C,D,E,F)], D. Malarvizhi[2(A,B,C,D,E)]

[1]Postgraduate student, SRM College of Physiotherapy, SRM Institute of Science and Technology, Faculty of Medical and Health Sciences, Kancheepuram District, Kattankulathur, Chennai, Tamil Nadu, India
[2]SRM College of Physiotherapy, SRM Institute of Science and Technology, Faculty of Medical and Health Sciences, Kancheepuram District, Kattankulathur, Chennai, Tamil Nadu, India

Abstract

Background. Gait analysis is a systematic study of human locomotion that involves evaluating body motions, body mechanics, and muscle activity Objective. To analyze spatiotemporal and kinematics variables in schizophrenia. Methodology. Non-Experimental study, convenient sampling, sample size was 15. Both men and women with 18 to 45 years of age were included in the study. Procedure. subjects were selected based on inclusion and exclusion criteria for analyzing the kinematic and spatio temporal parameters of gait in schizophrenia. Outcome measures. Spatiotemporal and kinematics variables were assessed by using 2D gait analysis with software from Auptimo technologies. Results. Gait analysis of schizophrenia shows significant increase in ankle plantar flexion $p < 0.05$, significant increase in knee flexion $p < 0.05$, and significant increase in hip flexion $p < 0.05$ shows in lateral view and in anterior view significant increase in knee abduction/ adduction $p < 0.05$, and in posterior view significant increase in contralateral pelvic drop $p < 0.05$, and significant increase in rear foot angle eversion $p < 0.05$. In spatiotemporal parameters of schizophrenia shows non significant changes in cadence $p > 0.05$, and shows significant changes in right and lest stance time, right and left swing, and gait cycle time $p < 0.05$. Conclusion. This study concluded that schizophrenia shows marked kinematic changes in ankle, knee and hip joint, in anterior view knee abduction and adduction shows notable changes, and in posterior view, significant changes in pelvic drop and rear foot angle, and spatio temporal parameters no apparent changes noted in cadence, and significant increases in stance phase time, swing phase time and gait cycle time.

Keywords

schizophrenia, lower limb, pelvic drop, rear foot angle, knee adduction/abduction, spatiotemporal, gait analysis, 2-dimensional

Streszczenie

Analiza chodu to systematyczne badanie ludzkiego ruchu polegające na ocenie ruchów ciała, mechaniki ciała oraz aktywności mięśniowej. Cel. Analiza zmiennych przestrzenno-czasowych i kinematycznych w schizofrenii. Metodologia. Badanie nieeksperymentalne, wybór próby według wygody, rozmiar próbki wynosił 15 osób. W badaniu uwzględniono zarówno mężczyzn, jak i kobiety w wieku od 18 do 45 lat. Procedura. Uczestnicy zostali wybrani na podstawie kryteriów włączenia i wyłączenia w celu analizy kinematycznych i przestrzenno-czasowych parametrów chodu w schizofrenii. Mierniki wyników. Zmienne przestrzenno-czasowe i kinematyczne oceniano przy użyciu 2D analizy chodu z oprogramowaniem od Auptimo technologies. Wyniki. Analiza chodu w schizofrenii wykazała istotny wzrost zgięcia stopy w kierunku podeszwy ($p < 0,05$), istotny wzrost zgięcia kolana ($p < 0,05$) oraz istotny wzrost zgięcia biodra ($p < 0,05$) w widoku bocznym. W widoku przednim zaobserwowano istotny wzrost abdukcji/addukcji kolana ($p < 0,05$), a w widoku tylnym istotny wzrost opadania przeciwnego biodra ($p < 0,05$) oraz istotny wzrost kąta eversji tylnej części stopy ($p < 0,05$). W parametrach przestrzenno-czasowych schizofrenii nie zaobserwowano istotnych zmian w kadencji ($p > 0,05$), ale zaobserwowano istotne zmiany w czasie podparcia prawej i lewej nogi, w fazie machania prawą i lewą nogą oraz w czasie cyklu chodu ($p < 0,05$). Wnioski. Badanie to wykazało, że schizofrenia charakteryzuje się wyraźnymi zmianami kinematycznymi w stawie skokowym, kolanowym i biodrowym. W widoku przednim abdukcja i addukcja kolana wykazują zauważalne zmiany, a w widoku tylnym istotne zmiany w opadaniu biodra i kącie tylnej części stopy. W parametrach przestrzenno-czasowych nie zanotowano wyraźnych zmian w kadencji, ale zaobserwowano istotne wzrosty w czasie fazy podparcia, czasie fazy machania i czasie całego cyklu chodu.

Słowa kluczowe

schizofrenia, kończyna dolna, opadanie miednicy, kąt tylnej części stopy, addukcja/abdukcja kolana, przestrzenno-czasowy, analiza chodu, 2-wymiarowy

doi.org/10.56984/8ZG20A37C

Introduction

According to WHO, Schizophrenia is delineated as a mental health disorder which causes people to interpret reality unusually through altered emotions, thinking, and behavior. The syndrome incorporates an irregular pattern of symptomatic proportions such as delusions, hallucinations, disorganized speech, atypical motor behavior, and negative symptoms. Schizophrenia is a complex neuropsychiatric syndrome characterized by a range of psychophysiological and cognitive deficiencies. Neurological soft signs (NSS) offer a secondary and progressively important perspective on the illness, implying noticeable flaws in sensory integration (SI), motor coordination (MC), and progression of movements [1].

The prevalence of schizophrenia is 3 for every 1000 people in India and is more common in men. It also relatively increases to 7.2/1000 in early adult life and becomes chronic. Thara et al. state that despite the impact of schizophrenia, most affected men are seen to be functioning in employment, and women in marital functioning [2]. The impact of schizophrenia varies; nowadays, it is emerging in a few people in South London. A comprehensive global review determined that schizophrenia accounts for 1.1% of the total disability-adjusted life years globally and 2.8% of the years lived with disability globally. The prevalence of anxiety associated with schizophrenia ranges between 30% and 45% [3].

Atypical functional associations between the motor cortex and the cerebellum during the execution of a motor task have been shown in schizophrenia. Abnormalities in the corpus callosum structure are also evident due to the presence of neurological soft signs [4]. Motor deficiencies are common and debilitating symptoms in schizophrenia. Disrupted motor execution is consistently associated with schizophrenia, attributed to a lower laterality quotient during simple motor tasks. The level of disability corresponds with the degree of mental illness and antipsychotic treatment. Motor deformities, such as altered postural control, postural instability, gait, and balance deficiencies, have emerged as key characteristics in schizophrenia, playing a significant role in the pathology of the disease.

Gait in schizophrenia is marked as a key deficiency in schizophrenic bradykinesia, which was a disorganized modulation in stride length, and regulation in cadence remains unaltered [1]. This is due to a detriment in supraspinal control in gait, which changes the role of lower-level central activities and is responsible for the variations in spatial and temporal parameters. Ataxic gait was found to be markedly more persistent in schizophrenic patients with eyes open and also shows a notable increase with age in schizophrenia, which relates mostly to the aged population [6]. This is along with a preceding report of alcohol misuse, including the disorder of the visuo-cerebellar circuit. Deficiencies in posture swaying in schizophrenia appeared in various situations, such as opening and closing of eyes. These demanding circumstances might be due to a damaged combined structure of vision along with equilibrium actions [7].

The Gait ON motion analysis program (Auptimo Technologies LLP, India) allows a clinician to trustily and promptly diagnose while also allowing detailed observation and control of an intervention/treatment in an objective manner. To establish spatiotemporal gait parameters and kinematics factors, 2-Dimensional clinical gait analysis is used. The designed system includes a high-speed video camera, markers, a computer, and technical computing software, which were used to track markers attached to the human body while it was moving. Gait features of schizophrenic patients who fall under the age group of 18-45 are presently being studied [8].

Across the physiology of the brain, schizophrenia connects with anomalies of the brain network. The deceptive connection among effective brain regions has been hypothesized as a fundamental disorder, which is mainly accountable for the clinical manifestation of the illness. The term "disconnection" was stressed by Friston and Frith in explaining the significance of corticocortical associations and fronto-temporal associations. There is a disorganization of neurophysiological and mental processes in schizophrenia due to the irregular connectivity in cortico-cerebellar loops. It does not show a certain form of connectivity changes in the brain network [9]. Raymond C. K. Chan et al. suggested that the right frontal gyrus may play a specific role in the execution of the first edge palm task in schizophrenia spectrum disorder [10]. Mehta et al. revealed a dysfunctional mirror neuron system (MNS) in schizophrenia [11].

Human locomotion is an enlightened biomechanical process that requires an elaborate interaction between muscular and inertial forces, resulting in the body moving through space smoothly. Walking is a movement that requires the collaboration of neuromuscular and skeletal systems. Gait analysis is an in-depth evaluation of human movement that encompasses bodily motions, mechanics, and muscle activity.

Studies explain that there is postural instability among subjects with schizophrenia due to an increase in posture swaying [7]. Moreover, the influence of antipsychotics on postural sway leads to falls and fractures. Evaluating balance through tandem gait, supervised by neurological evaluation, showed notably poorer balance while standing among subjects with schizophrenia than among normal individuals. The balance issues in schizophrenia also correlate with vision disturbances [7]. Optical coherence tomography (OCT) studies revealed thinning of the peripapillary or circumfoveal retinal nerve fiber layer, the ganglion cell layer, macular volume, macular thickness, outer, and inner nuclear layer [12].

Social cognition in schizophrenia has been observed to have frequently noticeable changes, and deficits can be established in connection with emotion refining, attribution processes, and theories of mind. Social knowledge appears mostly preserved and presents significant implications in relation to the perceptions that subjects with schizophrenia have regarding social class [13]. Mini Mental State Examination (MMSE) was used to determine the cognitive status in schizophrenia. The MMSE was well-validated in schizophrenia but does not assess all cognitive functions. Ganguli et al. suggested that the MMSE scores reported were based on 272 partly reverted community residence subjects with schizophrenia. Patients living with schizophrenia obtained average MMSE scores of 28/30 at the age of 30, 23/30 at the age of 50, and 18/30 at the age of 70. The values of MMSE decrease with aging in subjects with schizophrenia, especially in hospitalized subjects [14].

doi.org/10.56984/8ZG20A37C

Joint hypermobility in schizophrenia exhibits various dysautonomic symptoms such as palpitations, chest discomfort, shortness of breath, and correlates with anxiety conditions. Schizophrenia shows a larger autonomic cycle which exhibits more severity and positive symptoms as joint hypermobility [3]. Thus, subjects with joint hypermobility and schizophrenia have a greater chance of developing comorbid anxieties which show intense positive manifestations and decreased quality of life. Joint hypermobility was assessed by the Hospital del Mar scale and has an overall point of 10. Scores were separated for males and females: for females 5/4 and for males 4/3, and the values specified for each joint range between 0 and 0.65. PANSS (Positive and Negative Syndrome Scale) [15] was used to identify the severity of positive or negative symptoms of injury which correlate with joint hypermobility. It provides a dual evaluation of both positive and negative symptoms.

Materials and methods

The observational study included data from people with schizophrenia in Adharavu home for schizophrenia between 18-45 years of age. A total of 15 participants were screened and were chosen based on the inclusion criteria of: Diagnosed case of schizophrenia, both men and women, age between 18-45, minimum 2 years of illness with schizophrenia, subjects with a minimum score of 26 on the Mini Mental State Examination. The exclusion criteria were: Recent fractures in the lower extremity, recent surgeries in the lower extremity, recent abdominal surgeries, any severe lower limb deformities, any other neurological disorders, and dementia.

This study was approved on 25.03.2022 by the Institutional Ethical Committee (Ethical clearance number: 8316) of SRM Institute of Science and Technology and obtained permission from the head of Adharavu home for schizophrenia. The study included subjects with schizophrenia aged between 18–45 years. Participants were selected according to the inclusion and exclusion criteria. The procedure was described to the subjects, and informed consent was obtained. The gait of the subjects was captured using a Nikon D3300 camera that captures video at 60 frames per second in 1080p MPEG-4 format. The gait analysis was performed using the Gait On Software. Gait On is a motion analysis program with a built-in gait reference protocol. This set of reference values is based on J. Perry's model (RLA medical center, California). Participants were asked to wear loose clothing or shorts. The following landmarks were marked with colored tapes: on posterior aspects bilateral PSIS, midpoint of the calf, midpoint of the Achilles tendon, insertion point of the Achilles tendon at the calcaneum; on lateral aspects greater trochanter, lateral femoral condyle, lateral malleoli on both right and left sides of limbs, and one marker in front of the calcaneum on the lateral aspect of the foot. On the anterior aspects, markers were placed at the midpoint of the patella and the 2nd toe of the foot on both the right and left sides of the limbs. Participants were then instructed to walk along a 5-meter track.

Results

Table 1 shows the mean value of height, weight, and BMI of 18 to 45 years of males and females with Schizophrenia.

Table 1. Demographic data of schizophrenia

Age [yrs]	Gender	Height [cm]	Weight [kg]	BMI [kg/m^2]
18-45	Male	167.4	65.25	23
18-45	Female	164.8	68.4	25

Table 2 shows the value of kinematic parameters of the ankle joint in schizophrenia. On the right side, the mean values are: initial contact 101, loading response 102, mid-stance 105, terminal stance 92, pre-swing 99.8, initial swing 86.4, and mid-swing 98.7. On the right side, loading response, mid-stance, terminal stance, initial swing, and mid-swing were found to be significant < 0.05, while initial contact and pre-swing were non-significant > 0.05.

Table 2. Kinematic parameters of ankle joint in schizophrenia

Kinematic parameter		IC	LR	MS	TS	PS	IS	MS
Reference values		92.5 ± 2	93 ± 3	82 ± 4	80 ± 4	104 ± 5	99 ± 5	90 ± 3
Right	Mean	101	102	105	92	99.8	86.4	98.7
	SD	26	15	14.4	14.6	11.3	10.2	4.5
	p-value	0.22, NS*	0.03, S*	0.00, S*	0.00, S*	0.17, NS*	0.00, S*	0.00, S*
Left	Mean	83	86	87	86	92.8	80	82.6
	SD	21.5	14.7	8.5	9	13	5.3	3
	p-value	0.12, NS*	0.12, NS*	0.03, S*	0.01, S*	0.00, S*	0.00, S*	0.00, S*

foot note: IC – initial contact, LR – loading response, MS – mid stance, TS – terminal stance, PS – preswing, IS – initial swing, MS – mid swing

doi.org/10.56984/8ZG20A37C

On the left side, the mean values are: initial contact 83, loading response 86, mid-stance 87, terminal stance 86, pre-swing 92.8, initial swing 80, and mid-swing 82.6. On the left side, mid-stance, terminal stance, pre-swing, initial swing, and mid-swing were significant < 0.05, while initial contact and loading response were non-significant > 0.05.

Table 3 shows the value of kinematic parameters of the knee joint in schizophrenia.

On the right side, the mean values are: initial contact 155, loading response 164, mid-stance 168, terminal stance 159, pre-swing 121, initial swing 128, and mid-swing 163. On the right side, all parameters were found to be significant < 0.05.

On the left side, the mean values are: initial contact 166, loading response 166, mid-stance 168, terminal stance 132, pre-swing 140, initial swing 142, and mid-swing 157. On the left side, initial contact, loading response, mid-stance, terminal stance, initial swing, and mid-swing were significant < 0.05, while pre-swing was non-significant > 0.05.

Table 3. Kinematic parameters of knee joint in schizophrenia

Kinematic parameter		IC	LR	MS	TS	PS	IS	MS
Reference values		173 ± 5	160.5 ± 4.5	172.5 ± 4.5	167 ± 4	141.5 ± 5.5	121 ± 5	151.5 ± 5.5
Right	Mean	155	164	168	159	121	128	163
	SD	18.3	3.9	3.16	3.6	9	10.2	6.8
	p-value	0.00, S*	0.00, S*	0.00, S*	0.00, S*	0.00, S*	0.01, S*	0.00, S*
Left	Mean	166	166	168	132	140	142	157
	SD	7.8	4.4	4.16	18.9	18.6	24	7
	p-value	0.00, S*	0.00, S*	0.00, S*	0.00, S*	0.9, NS*	0.00, S*	0.00, S*

foot note: IC – initial contact, LR – loading response, MS – mid stance, TS – terminal stance, PS – preswing, IS – initial swing, MS – mid swing

Table 4. Kinematic parameters of hip joint in schizophrenia

Kinematic parameter		IC	LR	MS	TS	PS	IS	MS
Reference values		23.5 ± 3.5	22.5 ± 3.5	3 ± 3	19 ± 4	11 ± 4	13 ± 4	26 ± 4
Right	Mean	24	9.9	4.7	−11	8.2	13	6.9
	SD	3.6	9	1.6	3.9	9.4	8.3	15
	p-value	0.4, NS*	0.00, S*	0.00, S*	0.00, S*	0.2, NS*	0.8, NS*	0.00, S*
Left	Mean	25	13	3.2	−2.2	1.3	16	20
	SD	6	7.7	6.3	8.7	16.5	12.3	7.7
	p-value	0.3, NS*	0.00, S*	0.8, NS*	0.00, S*	0.04, S*	0.3, NS*	0.00, S*

foot note: IC – initial contact, LR – loading response, MS – mid stance, TS – terminal stance, PS – preswing, IS – initial swing, MS – mid swing

Table 4 shows the value of kinematic parameters of the hip joint in schizophrenia. On the right side, the mean values of initial contact are 24, loading response is 9.9, mid stance is 4.7, terminal stance is −11, pre swing is 8.2, initial swing is 13, and mid swing is 6.9. On the right side, loading response, mid stance, terminal stance, and mid swing were found to be significant < 0.05; initial contact, pre swing, and initial swing were found to be non-significant > 0.05.

On the left side, the mean values of initial contact are 25, loading response is 13, mid stance is 3.2, terminal stance is −2.2, pre swing is 1.3, initial swing is 16, and mid swing is 20. On the left side, loading response, terminal stance, pre swing, and mid swing were found to be significant < 0.05; initial contact, mid stance, and initial swing were found to be non-significant > 0.05.

Table 5 shows the value of the anterior view of the kinematic parameter of knee abduction/adduction in schizophrenia. On the right side, the mean value of knee abduction/adduction is −4.9 and was found to be significant < 0.05. On the left side, the mean value of knee abduction/adduction is −2.14 and was found to be significant < 0.00.

doi.org/10.56984/8ZG20A37C

Table 5. Kinematic parameters of anterior view in schizophrenia

Kinematic parameter	Reference values	Knee abuction / adduction		
		Mean	SD	p-value
Right	0	−4.9	4.3	0.00, S*
Left	0	−2.14	3.8	0.05, S*

Table 6. Kinematic parameters of posterior view in schizophrenia

Kinematic parameter	Pelvic drop		Rare foot angle	
	Right	Left	Right	Left
Reference values	2.5 ± 2.5	2.5 ± 2.5	4 ± 2	4 ± 2
Mean	1.4	0.9	5.5	12.9
SD	1.9	3.5	8.1	8.5
p-value	0.00, S*	0.00, S*	0.4, NS*	0.00, S*

Table 6 shows the value of the posterior view of kinematic parameters in schizophrenia.
On the right side, the mean values are pelvic drop 1.4, and rear foot angle 5.5. On the right side, pelvic drop was found to be significant < 0.05, and rear foot angle was found to be non-significant > 0.05.
On the left side, the mean values are pelvic drop 0.9, and rear foot angle 12.9. On the left side, both pelvic drop and rear foot angle were found to be significant < 0.05.
Table 7 shows the values of spatiotemporal parameters in schizophrenia. The mean values of cadence (110.6), right stance (0.71), left stance (0.71), right swing (0.58), left swing (0.59), and gait cycle (0.88) show significance < 0.05. Cadence shows no significance > 0.05.

Table 7. Spatiotemporal parameters of schizophrenia

Spatio-temporal parameters	Reference value	Mean	SD	p-value
Cadence	115 ± 25	110.6	10.6	0.14, NS*
RT stance	0.58	0.71	0.11	0.00, S*
LT stance	0.58	0.71	0.11	0.00, S*
RT swing	0.39	0.58	0.12	0.00, S*
LT swing	0.39	0.59	0.12	0.00, S*
Gait cycle	1.3 ± 0.5	0.88	0.14	0.00, S*

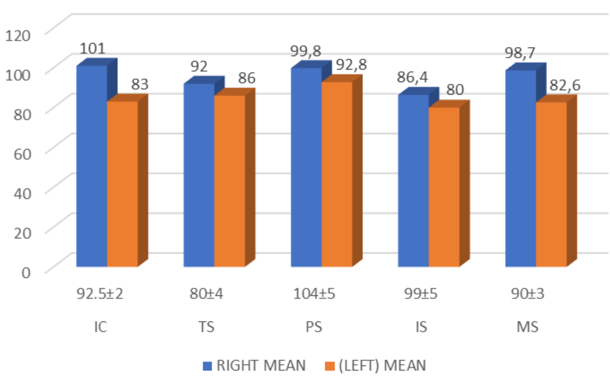

Figure 1. Kinematic parameters of ankle joint in schizophrenia

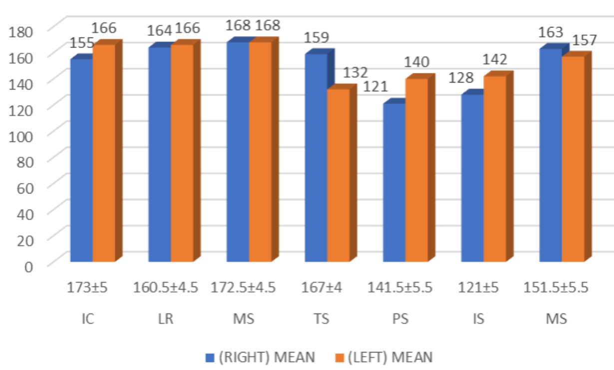

Figure 2. Kinematic parameters of knee joint in schizophrenia

doi.org/10.56984/8ZG20A37C

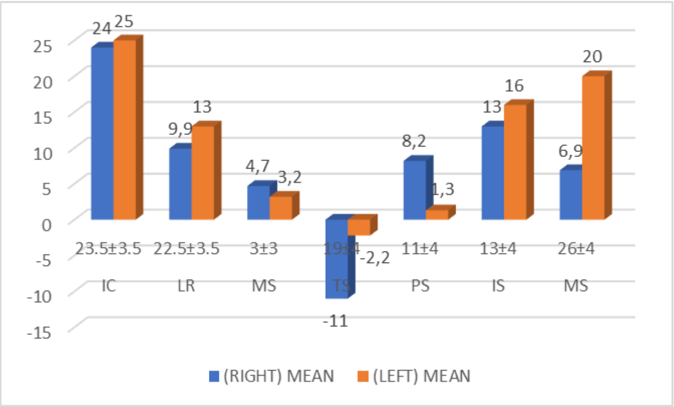

Figure 3. Kinematic parameters of hip joint in schizophrenia

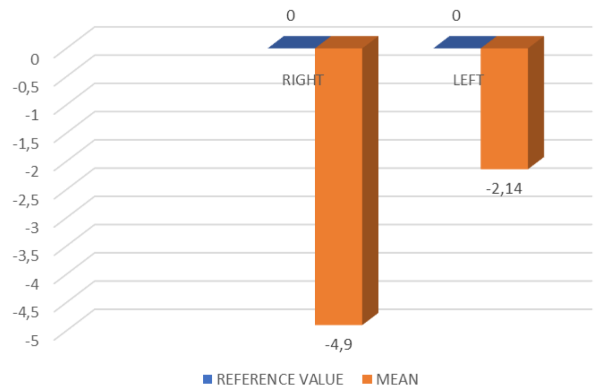

Figure 4. Kinematic parameters of anterior view in schizophrenia

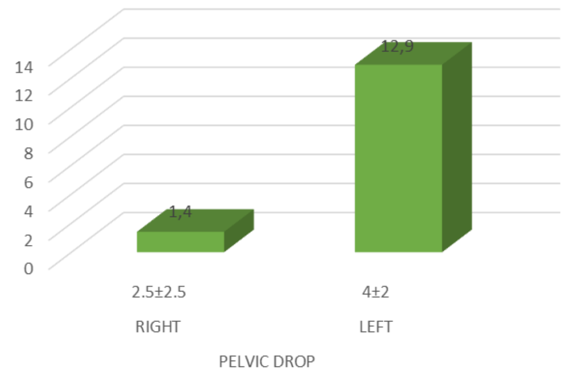

Figure 5. Kinematic parameters of posterior view in schizophrenia

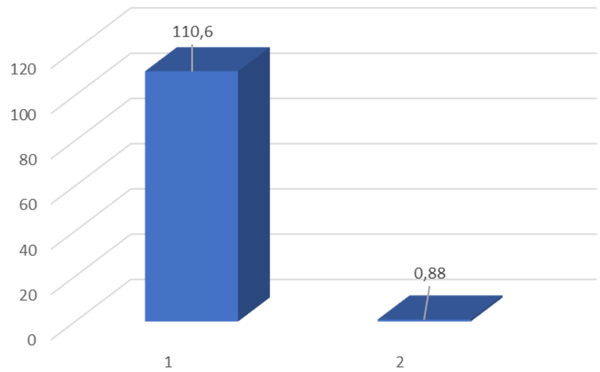

Figure 6. Spatiotemporal parameters of cadence and gait cycle in schizophrenia

Discussion

The motive of this study is to examine spatiotemporal and kinematic variables in schizophrenia. The findings of this study analyzed the gait kinematic analysis and spatiotemporal factors of schizophrenia aged between 18 to 45.

Kinematic analysis of ankle joint

Comparing with the reference value, the results show that 2D analysis of ankle joint kinematic variables in schizophrenia on the right side has significant changes in loading response, mid stance, terminal stance, initial swing, and mid swing, while there are no significant changes in pre-swing. On the left side, significant changes occur in mid stance, terminal stance, pre swing, initial swing, and mid swing, and non-significant changes are seen in initial contact and loading response.

The results are similar to the study conducted by Bulbena, et al (2007), wherein he explained that individuals living with schizophrenia had ankle dorsiflexion ≥ 45° in the standing squat position, which is due to higher autonomic activities and positive symptoms [3].

The results are also consistent with Fatima Sa, et al (2014), which states that schizophrenia patients show fewer variations in ankle dorsiflexion and plantar flexion due to an inactive ankle strategy and respond to larger disturbances in balance, which occur due to motor coordination deficits [16].

Kinematic analysis of knee joint

Comparing with the reference value, the results show that 2D analysis of knee joint kinematic variables in schizophrenia on the right side has significant changes in initial contact, loading response, mid stance, terminal stance, pre swing, initial swing, and mid swing. On the left side, significant changes occur in initial contact, loading response, mid stance, terminal stance, initial swing, and mid swing, while there are no significant changes in pre-swing.

The results align with the study by Fatima Sa, et al (2014), in which they concluded that during the throwing performance, patients with schizophrenia demonstrate more knee flexion due to the disability of motor action conveyed in insufficient collaboration, timing of tension, sensory processing, along with anticipatory adjustments. These changes represent abnormalities in inactive neural activity [16].

Kinematic analysis of the hip joint

Comparing with the reference value, the results show that 2D analysis of hip joint kinematic variables in schizophrenia. On

doi.org/10.56984/8ZG20A37C

the right side, significant changes occur in loading response, mid stance, terminal stance, and mid swing, and non-significant changes are observed in initial contact, pre swing, and initial swing. On the left side, significant changes occur in loading response, terminal stance, pre swing, and mid swing, and non-significant changes are observed in initial contact, mid stance, and initial swing.
The results resemble those of Fatima Sa, et al (2014), which state that during the throwing performance, patients with schizophrenia increased the hip flexion by 100, and showed increased internal rotation of the hip and flexion of the hip due to lower pelvic stability, which occurs due to motor coordination deficits in schizophrenia [16].
The results are parallel with Runge et al (1999), which state that individuals with schizophrenia use hip strategies that are commonly identical, including rapid balance equilibrium with a larger association of hip muscles, due to more time spent in performing motor activities. This reveals a short response interval along with disruptions in initiation and planned activities within schizophrenia.
The results match those of Bulbena et al (2007), which explain joint hypermobility in schizophrenia and observe hip abduction ≥ 85°. This is because subjects with paranoid schizophrenia are more prone to experience panic and social anxieties, which indicate hypermobility in schizophrenia [3].

Kinematic analysis of the anterior view
Comparing with the reference value, the results show that 2D analysis of knee abduction/adduction (frontal plane) kinematic variables are significant on both right and left sides.
The results are identical to those of Bulbena et al (2007), where he stated that joint hypermobility in medial to lateral patella gliding is ≥ ½ among patients with schizophrenia due to higher comorbid anxieties, which correlate with severe positive symptoms and a lower quality of life [3].

Kinematic analysis of the posterior view
Comparing with the reference value, the results show that 2D analysis of the posterior view in schizophrenia indicates significant changes in pelvic drop on the right side and significant changes in both pelvic drop and rear foot angle on the left side. On the right side, the rear foot angle shows non-significance.
The results are proportional to those of Fatima Sa et al, wherein they concluded that patients with schizophrenia compensated for the revolving motion with a capability scheme and flexion motion to a degree of the trunk and pelvis to enhance power when throwing a ball. This also revealed anterior tilting of the pelvis due to anticipatory activation of trunk muscles [16].

Spatio-temporal parameters
Comparing with the reference value, the results show that 2D analysis of spatiotemporal parameters of schizophrenia reveals non-significance in cadence and a significant increase in stance phase time, swing phase time, and gait cycle time.
The results are similar to Putzhammer, et al. [5], which state that assessing gait interruptions in dynamic situations among subjects with schizophrenia varies depending on antipsychotic medication when compared with normal participants. This describes a decrease in gait velocity and no changes in cadence due to the excitability of inhibitory projections from the basal ganglia to the thalamus. Thalamocortical projections lose control over the facilitation of motor-linked cortical regions like the supplementary motor area (SMA), cingulate motor regions, and primary motor regions, as well as cognitive deficits.
The results are in line with Putzhammer, et al. [17] In their study, they stated that reduced gait speed and pace hypometria exist, but regulation of cadence remains unaffected. This suggests reduced gait speed and pace hypometria due to the defective collaboration of a series of motor movements seen in schizophrenia.
The results are analogous to Matteo Tonna et al. [18], in which they concluded that there is a longer gait cycle time in schizophrenia due to different locomotor patterns. They found a "motor paradox" in the control of gait in schizophrenia.
The results contrast with Melanie G. Nuoffer [19], who states that subjects with cognitive disturbances exhibit slower speed, reduced cadence, and shorter stride length. These issues arise due to deficits in central motor control abnormalities, which relate to unusual brain formation and associations in the motor system, including the cerebellum.
It is recognized that individuals with schizophrenia show noticeable kinematic changes in the ankle joint, knee joint, and hip joint in the sagittal view. In the anterior view, significant changes are observed in knee abduction and adduction. In the posterior view, the rear foot angle and pelvic drop show marked changes. In spatiotemporal parameters, such as stance phase time, swing phase time, and gait cycle time, significant changes are evident, but no apparent changes are seen in cadence.

Conclusion
This study's findings concluded that persons with schizophrenia show marked kinematic changes in the ankle joint on the right side, which displays increased plantarflexion at all phases of gait except at the initial swing, which displays increased dorsiflexion. On the left side, increased dorsiflexion occurs at all phases except at pre-swing, which displays increased plantarflexion. In the knee joint, a significant increase in knee flexion occurs at all phases of gait on the right and left side. In the hip joint, increased hip flexion occurs at all phases except at the terminal stance, which displays hyperextension on both sides. In the anterior view, knee abduction and adduction display notable changes on both sides. In the posterior view, there is a significant contralateral pelvic drop on both sides, and significant changes in rear foot angle on the left side, and non-significant changes in rear foot angle on the right side. In spatiotemporal parameters, significant increases in stance phase time, swing phase time, and gait cycle time are noted, and no apparent changes are observed in cadence.

Adres do korespondencji / Corresponding author

D.Malarvizhi

E-mail: malarvid@srmist.edu.in

doi.org/10.56984/8ZG20A37C

Acknowledgements
The authors acknowledge the adharavu home for schizophrenia participants who participate in this study, Professors and Staff members of SRM College of Physiotherapy and who were helped in the study.

Piśmiennictwo/ References

1. Sevincok L, Akoglu A, Topaloglu B, Aslantas H. Neurological soft signs in schizophrenic patients with obsessive-compulsive disorder. Psychiatry Clin. Neurosci. 2004; 58: 274–279.
2. Loganathan S, Murthy RS. Living with schizophrenia in India: gender perspectives. Transcultural psychiatry. 2011 Nov;48(5):569-84.
3. Bulbena A, Sperry L, Anguiano B, Pailhez G, Gago J. Joint hypermobility in schizophrenia: a potential marker for co-morbid anxiety. The open psychiatry journal. 2007 Nov 27;1(1).
4. Deshmukh A, Rosenbloom MJ, Pfefferbaum A, Sullivan EV: Clinical signs of cerebellar dysfunction in schizophrenia and alcoholism. Schizophr Res 2002; 57:281-2
5. Putzhammer A, Heindl B, Broll K, Pfeiff L, Perfahl M, Hajak G. Spatial and temporal parameters of gait disturbances in schizophrenic patients. Schizophr Res. 2004 Aug 1;69(2-3):159-66. doi: 10.1016/s0920-9964(03)00090-2. PMID: 15469189.
6. Jeon HJ, Cho MJ, Cho SJ, Kim SU, Park SK, Kwon JS, Jeon JY, Hahm BJ. Quantitative analysis of ataxic gait in patients with schizophrenia: the influence of age and visual control. Psychiatry Res. 2007 Aug 30;152(2-3):155-64. doi: 10.1016/j.psychres.2006.09.001. Epub 2007 May 23. PMID: 17512059.
7. Teng Y-L, Chen C-L, Lou S-Z, Wang W-T, Wu J-Y, Ma H-I, et al. (2016) Postural Stability of Patients with Schizophrenia during Challenging Sensory Conditions: Implication of Sensory Integration for Postural Control. PLoS ONE 11(6): e0158219.
8. Auptimo, Convergent validity and reliability of a new 2D motion analysis system for quantification of hip and knee kinematics during over-ground running. March 13, 2019.
9. Muller JL, Roder CH, Schuierer G, Klein H. Motor-induced brain activation in cortical, subcortical and cerebellar regions in schizophrenic inpatients. A whole brain fMRI fingertapping study. Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2002 Apr 1;26(3):421-6.
10. Chan RC, Huang J, Zhao Q, Wang Y, Lai YY, Hong N, Shum DH, Chaeung EF, Y u X, Dazzan P. prefrontal cortex coonectivity dysfunction in performing the first edge palm task in patients with first episode schizophrenia and non-psychotic first degree relatives. NeuroImage: clinical.2015 Jan1;9:411-7.
11. Mehta UM, Thirthalli J, Aneelraj D, Jadhav P, Gangadhar BN, Keshavan MS. Mirror neuron dysfunction in schizophrenia and its functional implications: a systematic review. Schizophrenia research. 2014 Dec 1;160(1-3):9-19.
12. Friedel EB, Hahn HT, Maier S, Küchlin S, Reich M, Runge K, Bach M, Heinrich SP, Kornmeier J, Endres D, Ebert D. Structural and functional retinal alterations in patients with paranoid schizophrenia. Translational Psychiatry. 2022 Sep 23;12(1):402
13. Castelli L, Carraro L, Valmori A, Uliana C, Paparella M. Social Perception in Schizophrenia: Evidence of Reduced Prejudiced Attitudes Among People With a Diagnosis of Schizophrenia. Frontiers in Psychology. 2021 Apr 27;12:644488.
14. Maltais JR, Gagnon G, Garant MP, Trudel JF. Correlation between age and MMSE in schizophrenia. International Psychogeriatrics. 2015 Nov;27(11):1769-75.
15. Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. Schizophr. Bull. 1987; 13: 261–276.
16. Fatima Sa, Marques A, Rocha NB, Trigueiro MJ, Campos C, Schröder J. Kinematic parameters of throwing performance in patients with schizophrenia using a markerless motion capture system. Somatosensory & Motor Research. 2015 Apr 3;32(2):77-86.
17. Putzhammer A, Perfahl M, Pfeiff L, Hajak G. Gait disturbances in patients with schizophrenia and adaptation to treadmill walking. Psychiatry Clin Neurosci. 2005 Jun;59(3):303-10. doi: 10.1111/j.1440-1819.2005.01375.x. PMID: 15896224.
18.Tonna M, Lucarini V, Lucchese J, Presta V, Paraboschi F, Marsella F, Daniel BD, Vitale M, Marchesi C, Gobbi G. Posture, gait and self disorders: An empirical study in individuals with schizophrenia. Early Intervention in Psychiatry. 2022 Aug 6.
19. Nuoffer MG, Lefebvre S, Nadesalingam N, Alexaki D, Gama DB, Wüthrich F, Kyrou A, Kerkeni H, Kalla R, Walther S. Psychomotor slowing alters gait velocity, cadence, and stride length and indicates negative symptom severity in psychosis. Schizophrenia. 2022 Dec 30;8(1):116.

doi.org/10.56984/8ZG20A37C