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Validity of the Gait Deviation Index in children and adolescents with juvenile idiopathic arthritis

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Purpose: Effectiveness of the Gait Deviation Index (GDI) in patients with juvenile idiopathic arthritis (JIA) is unknown. The aim of this study was to investigate the validity of the GDI as an outcome measure of gait disturbance children with JIA. *Methods*: Fifty children and adolescents with JIA were included into the study. The control group included 50 healthy children without gait disorders, matched for age and gender. The kinematic gait parameters were measured using a 3D movement analysis system. Walking speed, walking distance, cadence, step length and single support time were also evaluated. *Results*: The findings show a statistically significant difference between the values of GDI for the right leg in the study group and the controls ($p = 0.036$). The individuals included in the study group achieved significantly lower values in this parameter (mean 94.92 ± 8.38 vs. mean 100.00 ± 10.00). The GDI value for right and left leg and the mean GDI value showed low ($0.3 \leq |R| < 0.5$, $p < 0.005$) to moderate ($0.5 \leq |R| < 0.7$, $p < 0.001$) correlations with the other gait parameters and measures. *Conclusions*: The GDI scores were lower in individuals with JIA compared to controls. This difference in the GDI values was only significant for the right leg. The GDI values showed low to moderate correlations with other gait parameters.

Key words: *juvenile idiopathic arthritis, gait, Gait Deviation Index, validity*

1. Introduction

Juvenile idiopathic arthritis (JIA) is considered the most common arthropathy occurring in children and adolescents, however its causes are not fully understood. It is a group of chronic inflammatory diseases affecting connective tissue, presenting heterogenic clinical picture and progressing in different ways. The common symptom is joint inflammation occurring before the age of 16 and lasting longer than 6 months [2], [26]. Advanced pharmacologic therapies, such as disease-modifying agents and biologics, introduced in the last decades, have made it possible to significantly decrease both symptoms of the disease and chronic disability in children and young people with JIA [4]. Despite considerable progress in pharmacological treatments, affected patients experience active joint inflammations and secondary limitations such as joint contractions, decrease in muscular strength and physical activity. Consequently, all these factors adversely affect the quality of life in JIA children and adolescents, compared to healthy peers.

The general condition of child with chronic arthritis definitely affects their gait abnormalities. The gait patterns in these patients may show subtle compensatory changes developing in response to pain and limb deformations. Conversely, complex gait abnormalities may appear in patients with more severe problem and following periods of exacerbation [5], [6], [12], [15], [16],

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[19], [30]. Fairbum et al. [12] concluded that even children with low disease activity can present some gait abnormalities. These include deficiencies related to kinematic, kinetic and spatiotemporal parameters. Inflammation of joints in the lower extremities may be associated with loss of muscle strength, limited range of motion in the joints, and with asymmetric distribution of the centre of gravity [17].

To characterise gait disturbances in individuals with JIA, the related gait profile has been investigated using a variety of methods, including assessment of the spatiotemporal parameters. Gait analysis can be applied to determine degree and severity of biomechanical alterations in JIA and has potential diagnostic, therapeutic, and prognostic implications [30].

Three-dimensional gait analysis (3DGA) provides objective data related to kinematic, kinetic and spatiotemporal parameters [22]. However, 3DGA produces a large body of complex data, frequently difficult to interpret, therefore, simplification of such data and their presentation as a single parameter reflecting changes in gait pattern observed in children and adolescents with JIA would be valuable in the clinical practice. One of the models designed as a single measure of gait characteristics is the Gait Deviation Index (GDI). The GDI assesses the subject's walking pattern relative to normative reference data [27]. The GDI is a generic index which is mostly used and validated for individuals with neurological disorders [1], [8], [14], [20], [24], [28] but Esbjörnsson et al. [11] suggested the GDI may also effectively be used to identify and summarise gait deviations in adult individuals with rheumatoid arthritis (RA).

Feasibility of the GDI in patients with JIA is unknown. A review of the related literature suggests that no studies have been undertaken to assess this population of patients for changes in the gait pattern based on the GDI. The aim of this study was to investigate the validity of the GDI as an outcome measure of gait disturbance in children with JIA.

2. Materials and methods

2.1. Participants

The study group comprised 50 children and adolescents with confirmed diagnosis of JIA (39 girls, 11 boys), between 6 and 18 years of age (mean age 13.2 ± 3.3 years), receiving treatment at the Regional Centre for Rehabilitation and Education for Children and Adolescents, Rzeszów, Poland. In line with the other eligibility criteria, all the subjects were at a remission stage, they were able to walk a distance of 5 meters at least six times (with no assistance or using elbow crutches), and during the four-week period preceding the study received no intra-articular injections into the affected joints. In accordance with the adopted exclusion criteria, the children in the study group had no neurological comorbidities or coexisting congenital or acquired (post-traumatic) locomotor organ deficits unrelated to JIA, and had received no surgical treatment of lower extremities in the past. On average, the JIA diagnosis was formulated 2.9 ± 2.35 years earlier. Assessment carried out using the Visual Analogue Scale (VAS) (0–100) showed mean pain intensity of 34.6. The children included in the study group were receiving the following types of medication: disease-modifying anti-rheumatic drugs (80% of the children), steroidal anti-inflammatory drugs (26%), and/or biologicals (12%); some of them were using more than one type of medication. The most common conditions observed in the study group were oligoarthritis (identified in 25 children), and polyarthritis (identified in 22 children); 2 children had psoriatic arthritis and only one had systemic arthritis. A comparative analysis of data related to the children with the two most common conditions showed no statistically significant differences between these two subgroups regarding the baseline characteristics (Table 1).

Table 1. Characteristics of the study group relative to JIA subtype

	Polyarthritis ($N = 22$)		Oligoarthritis ($N = 25$)		P
	$\bar{x} \pm s$	Min–max	$\bar{x} \pm s$	Min–max	
Age [years]	13.0 ± 3.2	6–17	13.2 ± 3.5	7–17	0.6047
Duration of disease [years]	3.2 ± 2.9	0.5–9.0	2.6 ± 1.8	0.5–7.0	0.9076
BMI	19.6 ± 3.1	14.9–26.9	19.7 ± 3.5	15.5–27.3	0.9579
Number of tender joints	2.4 ± 3.0	0–10	1.0 ± 1.2	0–4	0.2392
Number of swollen joints	0.8 ± 1.3	0–5	0.9 ± 2.0	0–10	0.7918

BMI – Body Mass Index, N – number of subjects, $\bar{x}$ – mean, min – minimum value, max – maximum value, s – standard deviation, P – test probability values.

The control group consisted of 50 healthy children, with no gait disorders, who attended primary or secondary schools in south-eastern Poland. The control group was matched for age (mean age 12.08 ± 4.5 years) and sex (25 girls, 10 boys) to the study group. Gait data acquired from the healthy children were applied to calculate the reference GDI values.

Ethical approval was granted for the study by the local Bioethics Commission of the Medical Faculty. The design of the experiments was in line with the requirements of the Declaration of Helsinki and informed consent was obtained from all the participants enrolled for the study.

2.2. Procedures

Kinematic data used in the present study were acquired with a motion capture system (BTS SMART-DX 700, 250 Hz; BTS Bioengineering, Milano, Italy), comprising six cameras and software, and equipped with SMART Capture, Tracker and Analyzer (BTS Bioengineering, Milano, Italy) as well as two force-plates (AMTI, USA). Passive markers were attached, as recommended by the Davis Marker Placement system, to the children's skin in the following regions: the sacrum, pelvis (the posterior and anterior iliac spine), femur (lateral epicondyle, great trochanter and the lower one-third of the shank), fibula (lateral malleolus, lateral end of the condyle in the lower one-third of the shank), as well as foot (metatarsal head and heel) [10]. The measuring system was calibrated prior to each 3D assessment. During the registered trials, the children walked at least six times along a distance of five metres. They were asked to walk barefoot, at a pace that felt natural to them. The data acquired during the assessment procedure were subsequently processed using the BTS Smart system software (Smart Tracker and Smart Analyzer).

2.2.1. GDI calculations

The GDI was computed from the kinematic data acquired during the 3D gait assessment. The GDI is an overall score calculated as an average value for several gait cycles, and taking into account kinematic data from the pelvis, hip, knee, ankle and foot. More specifically, the GDI incorporates kinematic information related to the sagittal plane (data from the pelvis, hip, knee and ankle), the frontal plane (data from the pelvis and hip joint), as well as the transversal plane (kinematics from pelvis, hip and foot progression). A total of 459 kinematic data points are included in the GDI (i.e., nine angular kinematic variables captured 51 times). These 459 data points are compressed, and 15 parameters are retrieved. The latter are applied to determine an overall deviation of gait, relative to the normal values corresponding to the 15 parameters, measured in a reference group [27].

Given the above, a control group comprising healthy individuals was necessary to calculate the GDI. Separate numeric values are shown for left and right limb. In the present study, an Excel spreadsheet developed by Schwartz and Rozumalski [27] was used to compute the GDI values. As proposed by these researchers, it is possible to determine the degree of gait pathology by calculating the distance between the patient's gait vector and a mean vector identified for a healthy reference group (with no gait disorders). The GDI of 100 or more represents normal gait, similar to that identified in the healthy reference group or observed in a randomly selected healthy individual. Each decrease of 10 points corresponds to one standard deviation (SD) from the normal gait [27]. The mean GDI (mGDI) values were calculated to represent the average GDI for left and right leg.

2.2.2. Clinical measures of functional mobility

The clinical measures of functional mobility used in the present study include a 10-meter walk test assessing gait speed [m/s], and a 6-minute walk test assessing walking distance [m]. During the trials, the children walked at a comfortable speed matching their abilities [9]. The score was calculated as an average from two trials. The 6-minute walk test was carried out in an area where two lines marked a distance of 30 metres [7] and additional lines defined five-metre sections along the whole distance. The children were asked to walk at a self-selected speed for 6 minutes along the 30-metre distance. During the trials, the children were allowed to use their own orthopaedic devices. Additional information taken into account in the analyses included selected spatiotemporal measures of gait, i.e., cadence, step length for right and left leg, and single support time for right and left leg.

2.3. Statistical analyses

Descriptive statistics were used in the analyses of the GDI values identified in the case of the healthy controls and children and adolescents with JIA. The relationships between these groups and between the limbs were examined using Mann–Whitney *U*-test.

Pearson's correlation coefficient was applied to assess the GDI in relation to the other measures of gait [25]. The findings were recognised as significant for $p < 0.05$. Data analysis was carried out using Statistica 13.1 (StatSoft, Poland).

2.4. Sample size

The minimum size of the sample was calculated based on the number of children and adolescents with JIA hospitalised at the rehabilitation ward. In this process, a fraction of 0.6 was used, with a maximum error of 5%, as a result, a sample size of 48 subjects was determined.

3. Results

Clinical and laboratory characteristics of the study participants' gait are shown in Table 2.

3.1. Comparison of all the kinematic variables identified in the children and adolescents with JIA and in the healthy controls

It was shown that there were significant differences in most kinematic parameters between the children and adolescents with JIA and the healthy subjects. The highest differences were found in pelvis tilt in initial contact (Pelvis Tilt – IC), maximum hip extension in stance phase (Hip – max. ext – StP), hip range of motion in sagittal plane (Hip Flex/Ext-ROM), knee position in sagittal plane in initial contact (Knee Flex/Ext –IC), maximum knee extension in stance phase (Knee – max. ext – StP) ($p < 0.001$) and maximum knee flexion in swing phase (Knee – max flex – SwP) ($p = 0.001$). The smallest differences were identified in maximum ankle plantar flexion in stance phase (Ankle max plantar – StP (Tst)) in right leg ($p = 0.039$) and hip position in sagittal plane in initial contact (Hip Flex/Ext – IC) in right leg ($p = 0.029$) – Table 3.

3.2. GDI values for the children and adolescents with JIA and the control group

Comparative analysis of the GDI values identified in the study group and the controls showed a statistically significant difference in the right leg GDI values between the study group and the controls ($p = 0.036$). Children and teenagers with JIA achieved significantly lower values in this specific measure (mean 94.92 ± 8.38 vs. mean 100.00 ± 10.00). In fact, the left leg GDI was also lower in the study group (mean 96.39 ± 10.55 vs. mean 100.00 ± 10.00), but this difference was not statistically significant. The findings also show lower mGDI scores (mean 95.65 ± 8.50) in the study group compared to the healthy subjects (mean 100.00 ± 9.09), however this result was not statistically significant – Table 4.

Table 2. Clinical and laboratory characteristics of the study participants' gait

Clinical and laboratory outcome measure	Descriptive statistics			
	Study group $n = 50$		Control group $n = 50$	
	Mean	SD	Mean	SD
10-m walk test [s]	1.46	0.24	1.68	0.25
6 min walk test [m]	367.85	60.61	418.34	57.57
Cadence	110.83	10.65	122.01	13.98
Step Length r [cm]	0.52	0.06	0.53	0.07
Step Length l [cm]	0.52	0.07	0.53	0.07
Single Support Time r [s]	0.53	0.12	0.49	0.07
Single Support Time l [s]	0.54	0.11	0.50	0.07
rGDI	94.92	8.38	100.00	10.00
lGDI	96.39	10.55	100.00	10.00
mGDI	95.65	8.50	100.00	9.09

r – right leg, l – left leg, rGDI – Gait Deviation Index for the right leg, lGDI – Gait Deviation Index for the left leg, mGDI – mean Gait Deviation Index.

Table 3. Characteristics of kinematic gait parameters in children and adolescents with JIA and the controls

	Study group $n = 50$					Control group $n = 50$					Significance (p)	
	Mean	Median	Min.	Max.	SD	Mean	Median	Min.	Max.	SD	Z	P
Pelvis Tilt – IC – r [°]	10.03	10.05	–0.60	17.40	4.33	6.58	6.95	2.30	12.00	2.33	4.09	<0.001
Pelvis Tilt – IC – l [°]	9.63	9.40	–1.40	18.30	4.37	6.71	6.70	0.70	15.70	2.86	3.68	<0.001
Pelvis Tilt ROM – r [°]	3.51	3.15	1.50	10.60	1.82	3.32	3.05	2.00	5.70	0.98	–0.31	0.753
Pelvis Tilt ROM – l [°]	3.52	3.00	1.10	10.90	1.98	3.46	3.40	2.00	5.30	0.94	–1.16	0.245
Pelvis Obliquity – IC – r [°]	–0.16	–0.20	–6.20	3.90	2.21	0.55	0.75	–2.20	2.80	1.15	–1.60	0.111
Pelvis Obliquity – IC – l [°]	0.55	0.55	–3.40	4.90	2.06	0.59	0.45	–2.00	6.60	1.54	0.21	0.834
Pelvis Obliquity – max – r [°]	3.58	3.60	–0.70	7.50	1.86	4.70	4.60	1.70	7.40	1.37	–2.92	0.004
Pelvis Obliquity – max – l [°]	4.35	4.25	–0.30	8.50	2.05	4.41	4.15	2.10	8.30	1.35	–0.10	0.920
Hip Flex/Ext – IC – r [°]	37.85	37.80	16.50	49.30	7.00	35.12	35.65	25.80	40.80	3.89	2.18	0.029
Hip Flex/Ext – IC – l [°]	38.24	38.50	18.40	50.30	6.41	35.19	35.35	25.50	46.70	4.60	2.64	0.008
Hip – max ext – StP – r [°]	2.01	2.40	–15.30	16.50	7.60	–10.66	–9.85	–20.20	–5.10	3.73	6.80	<0.001
Hip – max ext – StP – l [°]	1.64	1.20	–14.10	18.60	7.01	–11.23	–11.25	–20.60	–4.10	3.51	6.99	<0.001
Hip – max flex – SwP – r [°]	38.26	37.50	17.40	50.90	6.50	36.72	36.35	27.80	44.80	4.02	1.24	0.215
Hip – max flex – SwP – l [°]	38.79	38.20	19.00	52.10	6.45	37.36	37.55	29.10	46.90	4.73	1.19	0.234
Hip Flex/Ext-ROM – r [°]	41.59	41.70	14.80	59.50	7.04	47.40	47.20	38.40	58.00	4.80	–4.21	<0.001
Hip Flex/Ext-ROM – l [°]	42.04	41.00	27.40	58.70	6.44	47.72	47.90	36.30	56.00	4.87	–3.97	<0.001
Knee Flex/Ext – IC – r [°]	14.74	14.15	1.80	28.10	5.56	10.14	10.05	4.50	14.30	2.18	4.44	<0.001
Knee Flex/Ext – IC – l [°]	14.89	14.00	5.00	29.00	4.82	8.89	9.10	3.80	14.20	2.44	5.92	<0.001
Knee – max flex – SwP – r [°]	63.89	65.20	22.90	78.10	7.97	61.50	60.85	55.40	67.70	3.13	3.26	0.001
Knee – max flex – SwP l [°]	64.93	65.25	45.10	74.80	5.89	61.72	61.75	54.70	67.90	3.09	3.30	0.001
Knee – max ext – StP – r [°]	12.03	11.60	0.70	26.40	6.67	5.04	5.30	–0.20	12.50	2.57	5.13	<0.001
Knee – max ext – StP – l [°]	13.27	12.25	3.20	27.00	6.03	4.28	4.75	0.10	9.70	2.40	6.77	<0.001
Knee Flex/Ext-ROM – r [°]	53.44	54.20	22.00	62.30	6.11	56.48	56.70	49.60	62.50	3.22	–2.75	0.006
Knee Flex/Ext-ROM – l [°]	53.34	53.75	32.00	62.40	6.55	57.42	57.50	48.50	64.00	3.75	–3.10	0.002
Ankle max dorsi – r [°]	17.44	18.05	9.80	27.50	4.01	17.41	17.95	10.40	22.50	3.13	0.15	0.884
Ankle max dorsi – l [°]	17.23	17.30	9.30	26.20	3.76	17.39	17.20	11.40	21.30	2.22	–0.21	0.830
Ankle max plan – StP (Tst) – r [°]	12.61	12.05	0.80	26.60	6.48	15.14	15.45	8.30	20.70	3.27	–2.07	0.039
Ankle max plant – StP (Tst) – l [°]	12.39	13.35	–2.50	26.80	6.72	14.99	15.50	9.30	21.00	3.16	–1.90	0.057
Ankle Dorsi/Plan ROM – r [°]	30.08	29.85	11.20	45.40	6.91	32.83	32.25	25.30	39.40	3.81	–1.94	0.052
Ankle Dorsi/Plan ROM – l [°]	29.85	29.25	9.70	45.60	7.61	33.08	33.00	26.60	41.40	3.70	–2.58	0.010

Z – score in Mann–Whitney U-test, p – test probability values, IC – initial contact, r – right leg, l – left leg, max – maximum, ROM – range of motion, Flex – flexion, Ext – extension, StP – stance phase, SwP – swing phase, dorsi – dorsiflexion, plan – plantarflexion, Tst – terminal stance.

Table 4. Significance assessment of the differences in the values of the right/left leg GDI and mean GDI between the children and adolescents with JIA and the control group

GDI	Descriptive statistics		
	n	Mean	SD
rGDI study	50	94.92	8.38
rGDI control	50	100.00	10.00
Significance (p)	$Z = –2.09$ $p = 0.036$		
lGDI study	50	96.39	10.55
lGDI control	50	100.00	10.00
Significance (p)	$Z = –0.90$ $p = 0.369$		
mGDI study	50	95.65	8.50
mGDI control	50	100.00	9.09
Significance (p)	$Z = –1.67$ $p = 0.094$		

rGDI – Gait Deviation Index for the right leg, lGDI – Gait Deviation Index for the left leg, mGDI – mean Gait Deviation Index, Z – score in Mann–Whitney U-test, p – test probability values.

3.3. The GDI in relation to the other measures of gait

There were positive statistically significant but relatively weak correlations between right leg GDI and 10-m walk test ($p = 0.017$), 6 min walk test ($p = 0.010$), step length right leg ($p = 0.018$) and step length left leg ($p < 0.001$), between left leg GDI and step length right leg ($p = 0.011$) and step lenght left leg ($p = 0.002$) as well as between mGDI and 10-m walk test ($p = 0.017$), 6 min walk test ($p = 0.014$) and step lenght r ($p = 0.006$). There was also moderately significant positive correlation between mGDI and step length l ($0.5 \leq |R| < 0.7$, $p < 0.001$) – Table 5.

Table 5. Relationships between the GDI and the other measures of gait

Variables	GDI right leg		GDI left leg		mGDI	
	R	*p*	*R*	*p*	*R*	*p*
10-m walk test [s]	0.34	0.017	0.28	0.053	0.34	0.017
6 min walk test [m]	0.36	0.010	0.27	0.056	0.35	0.014
Cadence	0.07	0.648	–0.02	0.870	0.02	0.902
Step Length r [cm]	0.33	0.018	0.36	0.011	0.39	0.006
Step Length l [cm]	0.49	<0.001	0.42	0.002	0.51	<0.001
Single Support Time r [s]	0.17	0.243	0.11	0.428	0.15	0.286
Single Support Time l [s]	–0.19	0.177	–0.05	0.729	–0.13	0.380

R – Pearson's correlation coefficient, *p* – test probability values, r – right leg, l – left leg, mGDI – mean Gait Deviation Index.

4. Discussion

In this study, the GDI was applied as a measure which potentially makes it possible to characterise gait deviations in children and adolescents with JIA. In the available scientific literature, there are no studies investigating feasibility of the GDI for gait assessment in this population of patients. On the other hand, there are many studies focusing on applicability of 3DGA to children and adolescents with JIA [3], [15], [16], [19], [21], [23]. Scientific research has shown that analysis of the kinematic gait parameters is highly important because it facilitates functional diagnosis, treatment planning as well as monitoring of disease progress and treatment outcomes [13], [18], [31]. However, a complete picture of a patient's gait pattern cannot be determined by measuring isolated kinematic parameters, in other words, if one or two selected parameters of gait are examined it is possible to assess only certain aspects of gait pattern. Considering this, the GDI, which is determined based on 3DGA and takes into account nine kinematic variables, makes it possible to get a more comprehensive picture of gait, and increases effectiveness of clinical assessments [27]. This fact encouraged us to investigate whether GDI would be feasible in assessing changes in gait of children and adolescents with JIA.

In our study group, validity of the GDI was only partly confirmed. Significantly lower values of the GDI for the right leg were observed in the group of children and adolescents with JIA compared to the control group. Furthermore, the GDI values for the right and left leg and the mean GDI value showed low to moderate correlations with other gait parameters and measures.

Many researches currently investigating gait pathology and 3DGA are using gait indices designed to describe gait abnormalities by means of a single, numeric value reflecting how much the gait pattern of a patient is similar to or different from the gait of healthy subjects of similar age. The most popular index is GDI which originally was intended to be applied for assessing children with cerebral palsy (CP) [21], [27]. Review of the available literature showed that, although the GDI is used in 3DGA-based assessments of children and adolescents, no validation studies have been carried out in young populations other than CP children [13], [18], [28], [29]. On the other hand, in older populations, validation of the GDI was reported only for adults with CP and patients with Parkinson's disease [14], [20], [29]. Zakaria et al. [31] assessed utility of the GDI as an early indicator for children with autistic spectrum disorders (ASD). The 3DGA was performed in a group of 10 children with ASD and 30 TD children. Their study showed that pelvis and hip kinematic parameters significantly contributed to the GDI value and they concluded that the latter could be a useful indicator enabling assessment of gait deviations in this population. Forneris et al. [13] applied the GDI in assessment of gait deviations in children with haemophilia. The study group consisted of 42 children with either moderate or mild haemophilia. The findings showed that for the children with moderate haemophilia, the GDI value was just below the norm (approximately by one standard deviation), and, in the case of the children with mild haemophilia the GDI value was above the normal range. A study by Ito et al. [18] assessed gait deviation in children with symptoms of developmental coordination disorders (DCD). The 3DGA was performed in a group of 172 children with and without DCD trait. The study showed a significantly lower GDI score and higher DGI symmetry ratio in DCD group compared to TD children. Sienko et al. [28] used the GDI to classify gait patterns in 43 boys with

Duchenne muscular dystrophy. The study group included patients receiving treatment with or without corticosteroid therapy, and divided into subgroups relative to the severity of the symptoms of the disease. The value of the GDI was 77.28 (14.08) for patients treated with corticosteroids and 78.71 (15.77) for patients receiving no corticosteroid therapy. Differences in the GDI values were also found between the mild versus moderate severity groups (GDI score of 85.0 and 74.8, respectively) and advanced severity group (69.6), but they were not statistically significant.

In a view of the above, it may be assumed that the GDI is a useful tool enabling effective assessment of gait deviations in various groups of patients (in both paediatric and adult populations). However, it requires further research evaluating its reliability, repeatability and sensitivity to the clinical changes in patients' health status.

Study limitations

In our study group, the GDI scores were lower in individuals with JIA compared to controls, but this difference in the GDI values was only significant for the right leg. On the other hand, the current findings also show that the GDI values for both right and left leg as well as the mean GDI values correlate with other gait parameters and measures. Therefore, further research is needed since the findings reported here do not provide clear-cut validation of the GDI for this population of patients. This may be linked to the fact that the children and teenagers with JIA included in the study group did not present severe symptoms of the condition and, consequently, there were no highly significant abnormalities in their gait patterns. It would also be worthwhile to investigate a study group that is more uniform in terms of the JIA subtype, even though there were no statistically significant differences between subjects regarding baseline characteristics.

5. Conclusions

The GDI scores were lower in individuals with JIA compared to controls. This difference in the GDI values was only significant for the right leg. The GDI values for right and left leg and the mean GDI values showed low to moderate correlations with other gait parameters and measures. It is necessary to continue the research since the present findings do not provide clear-cut validation of the GDI for this population of patients.

Conflict of interest statement

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