

Analysis of gait, static balance and general functional status of children and adolescents with Juvenile Idiopathic Arthritis

Introduction: Juvenile Idiopathic Arthritis (JIA) is considered the most frequent arthropathy of developmental age, which cause has not been fully detected. It is a group of chronic inflammatory disease of connective tissue with heterogenic clinical picture and course. Mutual symptom is the joint inflammation occurring before the age of 16 and lasting longer than 6 months. Despite considerable progress in pharmacological treatment, active joint inflammation and secondary limitations such as joint contractions, weakening of muscle power and decrease of physical activity are observed. Consequently, all those factors worsen the quality of life of JIA children while compared with healthy peers.

Purpose: The main purpose of the dissertation was to assess the gait, static balance and functional fitness of JIA children and adolescents in various periods, taking into account process of complex treatment. The dissertation presents also the analysis of dependencies of assessed functions from subtypes of the disease, its degree of severity and its duration. Additional effect of conducted research was the assessment of potential use of Gait Deviation Index (GDI) to detect changes in gait pattern in JIA children and adolescents during complex treatment.

Material and method: The research included 50 children and adolescents (average age 13,2) diagnosed with JIA. All patients underwent complex, four week long therapy combined with pharmacological and rehabilitation treatment in Clinical Regional Rehabilitative - Educational Center for Children and Adolescents in County Clinical Hospital nr2 in Rzeszów. Each patient completed three attempts: on the day of the beginning and completion of the rehabilitation and 9 months after the second trial. Gait pattern assessment was done with the use of 3-D gait analysis considering spatio-temporal, and chosen kinematic parameters. GDI was also used. Static balance was assessed on AMTI force platform: standing on both legs with eyes open, eyes closed, standing on one limb right or left. To assess the general functional status Childhood Health Assessment Questionnaire (CHAQ) was applied.

The control group consisted of 49 healthy children (average age 12,6). All individuals in this group were tested once.

Results: The research showed that in the first trial gait pattern of JIA children was significantly different than the one of healthy peers in spatio-temporal and majority of chosen kinematic parameters. After the treatment the major improvement was observed in the step length (kdp $p=0,0078$, kdl $p=0,0031$) and gait speed ($p=0,0007$). Improvement was also

noted in chosen kinematic parameters. GDI was used to facilitate and accelerate the comparison of kinematics. In the first group, in the first trial the score of this factor was slightly lower, however they showed statistically significant difference only in right limb. ($p=0.03$). Comparison of the GDI scores with control group in the second trial did not show any statistically significant differences what indicates that the gait pattern was comparable to the one of healthy peers. In trial performed 9 months after the end of rehabilitation, GDI score showed substantially lower value, what proves that gait pattern in the researched group worsened.

Assessment of static balance did not show differences between both groups during standing on both legs with eyes open. In standing on both legs with eyes closed JIA children obtained higher COP-X amplitude values ($p=0,0023$) and COP-Y ($p=0,0164$). 13 children were unable to perform standing on one leg. JIA children, who were able to complete the task of standing on right leg obtained better result than healthy ones (path length $p=0,0114$, average speed $p=0,0015$). Standing on both lower limbs with eyes closed as well as standing on one leg showed improvement after the treatment was completed.

Functional status, subjectively assessed by patients with the use of CHAQ showed significant improvement (-0.15 ; $p=0,0000$) after the completion of treatment. Pain afflictions ($p=0,0000$) as well as exacerbation of disease ($p=0,0000$) were decreased.

The subtype of disease influenced the spatial-temporal gait parameters. The patients with oligoarthritis, in the first trial were walking faster ($p=0,0410$), their steps were longer (kdp $p=0,068$, kdl $p=0,0279$) and narrower ($p=0,0209$). Additionally, this group of patients obtained lower values in CHAQ ($p=0,0455$). In children with polyarthritis the bigger decrease of values was observed, however the difference was statistically insignificant.

Conclusions: JIA is the source of very severe disorders of gait pattern and static balance. Complex treatment, including rehabilitation positively improves the gait pattern, balance and functional ability. GDI is an useful measure of overall gait quality in individuals. GDI enables to detect the changes in gait pattern of JIA children after complex therapy and to compare them with healthy children.

The patients with polyarthritis present more severe disorders of gait pattern in spatio-temporal parameters and worse functional status. The subtype of disease does not significantly influence the gait efficiency, GDI and balance while BMI does. Slim children have stronger pain affliction and exacerbation of disease while obese patients struggle to maintain balance standing on one leg.