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Evaluation of hand grip strength and range of movement of the upper limb in children with Polyarticular Hypermobility (PH)

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Summary

Introduction and aim:
Contemporary rehabilitation places great emphasis on early detection of faulty posture in children and adolescents. Sadly lacking in these proceedings diagnosis for the presence of polyarticular hypermobility (PH). Implementation of diagnostics and rehabilitation treatment in the early stages of dysfunction will prevent the occurrence of musculoskeletal diseases among children and adolescents.
The aim of the study was to assess grip strength and mobility of the upper limb in children with polyarticular hypermobility.

Materials and Methods:
The study was conducted on a group of children (n = 35) aged 6 to 11 years with diagnosed on the basis of a test Beighton hypermobility of the joints. The control group consisted of 35 healthy children of the same age range. All children handshake was measured using the dynamometer measured manually and the range of mobility of individual joints of the upper limb using a goniometer.

Conclusions:
The study showed that hypermobility of the joints of the upper extremity in people with polyarticular hypermobility does not affect the hand grip. Was obtained statistically significant differences in the movement range of the joints between the groups.

Keywords: hypermobility, polyarticular hypermobility, hand grip strength, joint mobility of the upper limb

Introduction

Hypermobility joint is characterized by range of motion than the standard adopted in the absence of systemic symptoms. There are two forms: an insulated, on a generalized joint and - then it is referred to as hypermobility polyarthritis (PH) [1].

Hypermobility may be congenital or acquired - for example as a result of many years of training in gymnastics dancers or [2,3]. Hipermobility the occurrence of joints is affected by such factors as the age, sex and race [4,5]. Among the European population reaches 10%, the ethnic groups of Asian and African concerns approx 38% of people [6,7]. This condition refers more often to children than to adults. Hypermobility of the joints 3 to 5 times more prevalent in women [8].

One of the tools used to assess the prevalence of hypermobility of joints are standardized tests and measuring scales, for example Beighton 9-point scale. Because of its ease of

implementation and high reproducibility, it is most frequently used by physicians and physical therapists [9].

Please note that PH is common in the general population and may affect the biomechanical efficiency of individual joints, so in everyday clinical practice should pay special attention to children with known PH sports training. Due to the irregular distribution of forces on the joints of PH children, they are exposed to frequent injuries, which in the future may result in the occurrence of musculoskeletal pain, joint degeneration and reduced efficiency [10]. In children, in whom it is possible to conclude that it is necessary PH exercises in closed biokinematics chains, which are intended to stabilize the joint, muscle strengthening and improving proprioception - it should be stressed that in children with known PH is impaired proprioception [11, 12,13,14].

In the available literature Polish and foreign language not found scientific data concerning the analysis of grip strength and range of motion of the joints of the upper limb in children diagnosed with hypermobility of the joints. This fact has prompted the authors to take up this topic.

Aim

Assessment of grip strength and mobility of the upper limb in children with polyarticular hypermobility.

Materials and methods

The study was conducted in a group of 102 children from the Primary School in Szczecin. Guardians were informed about the purpose and gave written informed consent to participate in the study child. In order to determine the prevalence of hypermobility joint in all patients was carried out 9 - Beighton test point. It consists of: a passive extension V hand finger above 90^0 , passive thumb adduction to the inner surface of the forearm, elbow joint hiperextention above 10^0 , hiperextention above the knee joint 10^0 and laying a hand on the whole substrate while the slope in front of the upright knee joints. The basis for the diagnosis of arthritis hypermobility is to assay at least 4 out of 9 points. The occurrence of hypermobility was diagnosed in 35 children (Group I) ranging in age from 6 to 11 years (14 girls and 21 boys). The control group (Group II) included in a random fashion an equal number of boys and girls in the same age as in the research group who have not been found PH.

In the subsequent proceedings in the Group I and II made hand grip strength measurements using a hydraulic hand dynamometer Saehan. Tested were invited to adopt a sitting position, with arm nearing to the body, elbow bent pond at an angle of 90^0, based on the support seat and the forearm and wrist in a neutral position set (Fig.1). Each participant made 3 attempts each of the upper limb. The child was instructed to squeeze a dynamometer "as hard as he can." Breaks between attempts were 30 seconds. Measurements were made on the change once on the left, once in the right upper limb, not to lead to muscle fatigue (Fig.2).

Fig. 1 Measurement of hand grip strength with hand dynamometer source (own materials).

Fig. 2 Saehan dynamometer source (own materials).

Then all patients with Group I and II assesses the range of motion of the upper limb joints selected in accordance with the methodology of measurements by A. Zembatego [15]: raising the front by bending the arm, raising side by visiting shoulder, flex and extend the elbow

joint, flex the radially - wrist joint, flexon in elbow side and radially siade in the radially – wrist joint. The ranges studied in both upper limbs, using the goniometer.

The study was conducted at the gym (room temperature, approx. 20^0C) by the same person. Statistical analysis was performed in a Microsoft Excel 2013 program and a package StatSoft. Version 13.1. To perform the analyzes used Student - t test, and the level of significance of $p \leq 0,05$.

Results

In the first place, the results of the assessment of grip strength distribution in the Group I and II.

Tab. 1. Characteristics of hand grip strength distribution.

Characteristics of distribution	Hand grip strength [kg]			
	Left hand		Right hand	
	Gr. I (H) (N = 35)	Gr. II (C) (N = 35)	Gr. I (H) (N = 35)	Gr. II (C) (N = 35)
min - max	4,33-15,67	3,33-16,00	4,33-16,67	4,33-14,67
$\overline{x}$	10,15	9,49	9,67	9,24
m_e	11,00	9,67	9,33	9,33
SD	3,17	3,06	3,42	2,55
p (student's t test)	0,37		0,55	
R	1,07		1,04	

Legend:

n - group size, Gr - group, H - hypermobile group, C - control group, min - minimal value, max - maximal value, $\overline{x}$ - arithmetic average, m_e - median SD - standard deviation, p - statistical significance level, R - corelation.

Statistical evaluation measure grip strength between the Group I and Group II showed no statistically significant both for the right hand ($p = 0,55$) and left ($p = 0,37$). They recorded the highest median for the left hand in the Group I ($m_e = 11,00$), the second turn to the left hand in Group II ($m_e = 9,67$). However, for the right hand in the Group I and II of the same median ($m_e = 9,33$) (Tab. 1).

The following shows the relationship ranges of motion for each joint in the Group I and II. For each pair of columns of the movement currently on the value of statistical significance. The ranges of mobility are the average results for Groups I and II.

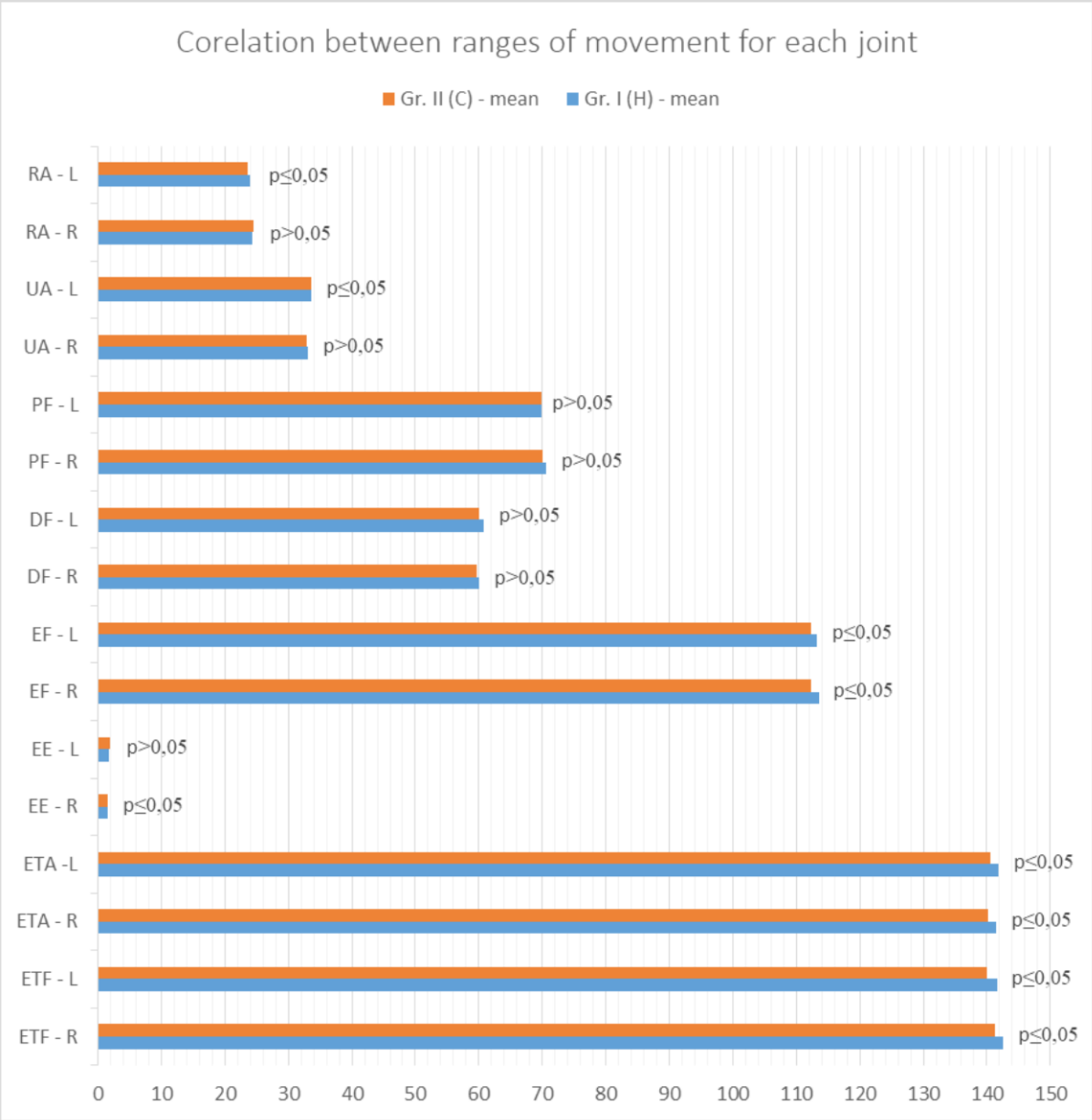

Fig. 3 Corelation between ranges of movement for each joint.

Legend:

p - statistical significance, Gr - group, hypermobile group H, C - control group, R - right side, L - left side, ETF - elevation through flexion, ETA - elevation through abduction, EE - elbow extension, EF - elbow flexion DF - dorsiflexion, PF - palmar flexion, the AU - ulnar adduction, RA - radial abduction.

As is apparent from Fig. 3. the statistical evaluation of the measurement range of movement, upper limb showed a statistically significant difference ($p \leq 0,05$) for raising the upper limb by folding, raising the upper limb by visiting, elbow flexion, extension of the right elbow, bend, to the elbow and to the radial bend left and left in the pond radial - wrist. There was no statistical significance ($p > 0.05$) according to the extension and flexion radially - the wrist, elbow extension, right bending, and flexion to the elbow and to the radial right in the pond radially - the wrist (Fig. 3).

Discussion

The diagnosis of hypermobility is an important issue, undertaken in the current medical literature. Hypermobility of joints may be a cause of injury during physical activity. Incorrectly dosed exercise in people showing hypermobility is the cause of dysfunction on the part of the musculoskeletal system.

With great responsibility should be approached to the recruitment of children and youth to sports in which hypermobility is seen as predisposition. This applies e.g. practice. gymnastics, ballet, acrobatics and others [16]. There is scientific evidence that hypermobility is significantly associated with an increased incidence of injuries in children during sports [17].

In the literature there are no data evaluating the effects of hypermobility of joints on the strength of oppression at the hands of children. As a parameter, which provides similar information can be treated with muscle strength in other muscle groups, although it should be remembered that this is for informational purposes only and may not reflect the correlation between hypermobility and hand grip strength. Pranay Jindal et al. undertook a trial to determine the effect on muscle strength PH in the population of young adults aged about 20 years, the study group consisted of 53 people with hypermobility, including 25 men and 28 women. In their study they found that among men diagnosed with PH individuals have significantly lower muscle strength measured in isometric conditions, but there was no such correlation statistically significant in women. How to claim the same researchers were evaluated only two joints - the knee or elbow, which does not allow unambiguous determination of whether the muscle strength depends to a significant extent of the range of motion and / or diagnosed by an PH [18]. On the other hand research conducted by Ron Bente Jensen et al., demonstrated that girls diagnosed with PH had clearly marked ability to generate faster and larger the force acting on the knee joint - suggested that it could be a compensatory

mechanism allows for smooth operation of the pond. Unfortunately, as the authors pointed out, in spite of obtaining a similar function as in healthy subjects, the compressive forces acting on the knee are larger, which may explain the co-occurrence of joint pain pediatric patients [19]. Based on these studies it is not possible to determine the effect of a range of movement on muscle strength, because the results of these studies are not consistent - it should be remembered that the age and sex of subjects with statistically significant differences were different, so a comparison of these findings possible. The result of the second cited studies seem to confirm the data published by Tina Junge et al. - showed that while the jump in children with PH increased activation is gastrocnemius muscle - is likely to reduce the increased volatility caused by the relaxation of the tendon of the knee and lower stabilizing effect sinewy part semitendinosus muscle. The study was conducted on 56 people, including 26 people showed hypermobility [20].

The hypothesis of an increased muscular strength as a joint compensation changes occurring in PH seems to be biomechanically probable. Unfortunately, the cross-section of the research presented in the literature does not allow to objectively determine the relationship between the PH and muscle strength, particularly in the pediatric population. This analysis further complicated by the fact that the results of published studies seem to be partially incompatible. To confirm or refute the hypothesis according to which children with PH there is an increase in muscle strength in an attempt to compensate for changes in the mechanics of the joint resulting from PH conducted this study. In this work was to evaluate the relationship between the existence of an excessive joint mobility and grip strength of the hand in children with joint hypermobility occurring. No other work, in which it was trying to determine whether a correlation exists above and which may be of importance in the diagnosis and therapy of children suffering from PH.

One of the researchers says that only the development of standards in areas of joint mobility taking into account age, gender and race will allow for reliable PH diagnostics. In this connection it should be established over the standard limit joint movement taking into account the above mentioned characteristics [21].

Physical activity is a natural need of the child and an important element in maintaining the health and well-being. Taking physical activity should be guided not only by the interests of current trends, but also the efficiency possibilities child. Pay special attention to the negative aspects of sport where the human organism has joint hypermobility. Incorrectly selected and dosed exercise, in the event of hipermobility joints can lead to frequent injuries

and musculoskeletal overloads, consequently leading to degenerative changes and disability [10].

Due to the consequences it can bring hypermobility of joints, the assessment of the conditions of its occurrence will take targeted prevention and treatment of people with hypermobility [22]. It seems reasonable to include this issue in the training of physical education teachers and sports trainers.

Conclusions

1. Excessive mobility in the joints of the upper extremity in children does not affect the hand grip.
2. Muscle strength in children with HP is comparable to children without occurring PH features.
3. Determine the normal physiological joint mobility for children.

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