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The change of pelvis placement at children under influence of aikido training

Authors' contributions:

A Study design
B Data collection
C Statistical analysis
D Data interpretation
E Literature search
F Manuscript preparation
G Funds collection

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<p>Study aim:</p> <p>Material/methods:</p> <p>Results:</p> <p>Conclusions:</p> <p>Key words:</p>	<p>Summary</p> <p>The aim of the paper was to examine the influence of aikido exercises on pelvis placement in the frontal plane at children.</p> <p>The subject of investigation were boys with asymmetry of placement of back hip spurs and with indication to apply heel pads on the side of pelvis lowering in the frontal plane. Also boys at whom the threat of slanting pelvis in the frontal plane due to scoliosis was recognized, were qualified for investigation. Altogether, 202 children in age 7-10 years participated in experiment and all of them were divided into three groups. The experimental group consisted of 68 boys who practiced aikido. The remaining ones constituted two control groups. The measurements were taken with Posturometre- S in 2002/2003 school year.</p> <p>The pelvis position in frontal plane improvement has been the most significant in the experimental group.</p> <p>It was confirmed that practicing aikido improved pelvis placement in the frontal plane by reducing asymmetry of the back hips spurs and influenced the gradual reduction of heel pad insertions on the side of pelvis lowering in the frontal plane in the experimental group. At children with no indication for heel pads at the beginning of the experiment, aikido exercises resulted in the lowest percentage of heel pads indication in the experimental group. Similarly, at children without asymmetry of back hips spurs at the beginning of the investigation, the increase of asymmetry was also the smallest in the experimental group.</p> <p>pelvis • aikido • scoliosis</p>
<p>Full-text PDF:</p> <p>Word count:</p> <p>Tables:</p> <p>Figures:</p> <p>References:</p> <p>Author's address:</p>	<p>http://www.archbudo.com/get_pdf.php?IDMAN=11418.pdf</p> <p>3982</p> <p>-</p> <p>6</p> <p>17</p> <p>Andrzej Mroczkowski, Physical Education Department at Zielona Góra University, al. Wyspiańskiego 57, 65-762 Zielona Góra, Poland, e-mail: amroczkowski@eranet.pl</p>

BACKGROUND

Pelvis and spine function as links in biokinematic chain, in which change in one link induces changes in neighbouring links. The changes, for example, of forward tilted pelvis are associated with changes of front and back spine curvatures due to the so called pelvis-lumbar rhythm in functioning of pelvis and spine [17]. Similarly, the changes in placement of pelvis in the frontal plane are also associated with spinal changes on this plane in the form of scoliosis. Mroczkowski and Jaskólski [7] state that slanting pelvis position in that plane could be the reason for creation of vertebra rotating force which accelerates scoliosis development. The exact, early investigation of pelvis placement might accelerate undertaking of proper exercises preventing incorrect shaping of spine curvatures at children.

Shortening of one lower limb together with inefficient muscle system responsible for correct pelvis setting may be one of the reasons of pathological placement of pelvis. Such prolonged pelvis placement may result in some muscles contraction and outstretching of others. The slanting pelvis causes asymmetric burdens acting on the growing child's bone. Such asymmetry revealed in posture distortion, not corrected early enough, may lead to asymmetric bone growth and thus preserve defects already on structural basis [16]. According to Mroczkowski [4], practicing aikido may correct pelvis placement at children as well as eliminate contractures in hip joints. It was also stated that in the 1st degree functional scoliosis they could decrease the spine curvature angle [6].

The aim of the experiment was to examine the influence of aikido exercises on pelvis placement in the frontal plane at children.

MATERIAL AND METHODS

Investigative material

The subject of investigation were children with asymmetry of placement of back hip spurs with indication to apply heel pads on the side of pelvis lowering in the frontal plane. Also children at whom the threat of slanting pelvis in the frontal plane due to scoliosis was recognized, were qualified for investigation. Altogether 202 boys in age 7-10 years, pupils of the 1st - 4th grade of primary school, participated in the experiment. None of them took part in corrective gymnastics classes. They made up three investigation groups, including two control groups. In the first control group, there were 59 boys at the average age of 8 years and 11 months. Boys from this group did not

participate in corrective gymnastics classes, but they participated in regular physical education lessons at school. The second control group constituted 75 boys at the average of age 8 years and 4 months. This group attended corrective gymnastics classes conducted in the traditional way. The experimental group consisted of 68 boys at the average age of 8 years and 8 months at the beginning of experiment. Classes in the experimental group were conducted outside regular curriculum, three times a week, in afternoon hours. Boys actively participated in aikido exercises for about 60 minutes. During the experiment, the boys from this group did not apply heels pads despite being told to do so. The investigation was led in school year 2002/2003. The first control group and experimental group consisted of boys from primary schools in Konin and Koło. In the second control group, there were boys from primary schools in Wałbrzych, Rzepin and Twardogóra, for whom the results were obtained during sift investigation. The boys from all groups lived in cities, the majority of them in flats. To facilitate description of the investigations results, it was accepted, that groups will be called appropriately, the experimental group - group E, the first control group - group C0, the second control group - group C1.

The method and the organization of investigations

The research was carried out with Posturometre S (Posmed, Poland) which determines the anthropometrical body points location in three-dimensional space, similarly to Ortelius 800 [8]. With the use of Posturometer S [12], the angle of lateral spine curvature was marked. The purpose of such a measurement was to qualify for experiment boys, at whom the threat of slanting pelvis in the frontal plane due to scoliosis was recognized. The methods of measurement and analysis of body posture were conducted according to W. Śliwa's method [13]. With the use of Posturometer S, the value of asymmetry of back hips spurs was marked and expressed (in mm) as difference between height of both spurs. After forepart examination of the subject, in case of diagnosing lowering of one hip front upper spur, the measurement of relative length of lower limbs was made. Measurement was executed with the use of centimetre measurement tape with the subject lying on his back. Distance was marked from front upper hip spur to apex of paracentral ankle. In case of difference in length of lower limbs, boards measurement was made in standing position. Under the shorter limb, a board 0.5 cm or 1 cm thick was put, just to estimate the thickness necessary to settle the pelvis in even horizontal position.

Investigations in group E and C0 were performed three times during the school year 2002/2003. For the



first time in September, for the second at the beginning of March, for the third in June near the end of the school year. In group C1, attending classes of traditional corrective gymnastics, the investigations were executed twice within the span of ten months. In group E and C1, the first investigations were conducted before classes with children started. Next investigations in these groups were executed after definite time of participation in them elapsed. All investigations were carried out in the morning hours.

Method of exercises

In aikido training a big pressure is put on practising exercises in kneeling position. These exercises differed however from the practices of Klappa type, because for moving in this position, the so called shikko is used. Moving in such a way requires active participation of the pelvis muscles and optimal movability in hip joints by limitation of feet and knees movement. Some call it "samurai walk" [15]. The applied aikido exercises origin mainly from the aikido school founded by Koichi Tohei. For the need of corrective gymnastics, some of the exercises were modified by A. Mroczkowski conducting such exercises [5] (non-published materials).

RESULTS

For analysis of the investigative material, the methods of statistical mathematics were used including the programme Statistica 6.1 Pl. The following statistical tests were applied: F Snedecora (in ANOVA) test, chi square, t - Student test for dependent variables. The chi square test was used for analysis of range of percentage changes in recommendation of pads ap-

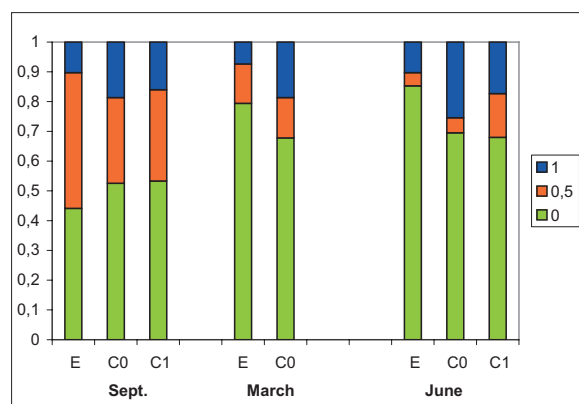


Figure 1. The range changes of recommendation to apply pads in next investigations for 202 children, for every of 3 groups. Legend: pad 1cm – 1, pad 0,5 cm - 0,5, the lack of a pad – 0. E – Experimental (Aikido) group (n = 68); C0 – Non-exercising boys (controls; n = 59); C1 – Boys practicing conventional corrective exercises (n = 75).

plication in the following investigations (fig. 1, 2, 3). The variables assumed only three values (0, 0,5, 1). The lack of a pad -0, the use of a pad 0,5 cm - 0,5 and the use of a pad 1cm - 1. With the use of χ^2 test it was checked whether the kind of a group and the investigated variables are dependent. Also the values of correlation coefficients of the Spearman`s ranks were determined. In order to evaluate the significance of percentage differences (for the pad`s size = 0) between investigation 1 and 2 and investigation 1 and 3, one-sided test was used which is called the difference test between two structure coefficients.

It was proved, that at all the investigated subjects with recommendation to apply a pad, as well as at those with a lack of such a recommendation at the beginning of the experiment, the essential proportional growth of non-application of the pad was noted in each group in successive investigations (fig. 1). The largest essential difference was revealed in group E for $p < 0,01$, in remaining groups for $p < 0,05$. In investigation 1 (September) and 2 (March), the percentage (1.0 which means 100%) of pads non-application for 202 children did not depend on the kind of group, however it was dependent in investigation 3 (June) ($p < 0,05$).

In case of the examined with recommendation of a pad`s usage at the beginning of the experiment (fig. 2), in each group there was a considerable percentage increase in non-recommendation of such an insertion ($p < 0,01$). The highest percentage was noted in group E and was essentially different from groups C0 and C1 in research 3 ($p < 0,01$). The kind of a group decisively influenced the percentage of non-recommendation of pads in research 3 ($p < 0,01$), but in groups E and C0 such a diversification proved meaningless.

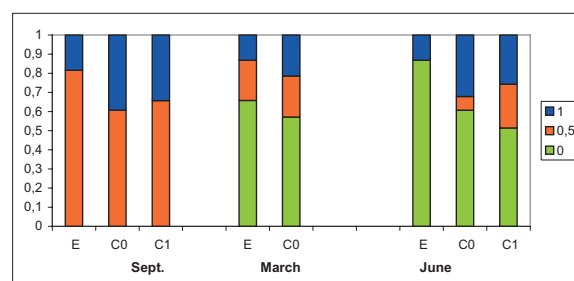


Figure 2. The range changes of recommendation to apply pads in next investigations at children with recommendation to use it at the beginning of the experiment, for every of 3 groups. Legend: pad 1cm – 1, pad 0,5 cm - 0,5, the lack of a pad - 0. E – Experimental (Aikido) group (n = 38); C0 – Non-exercising boys (controls; n = 28); C1 – Boys practicing conventional corrective exercises (n = 35).

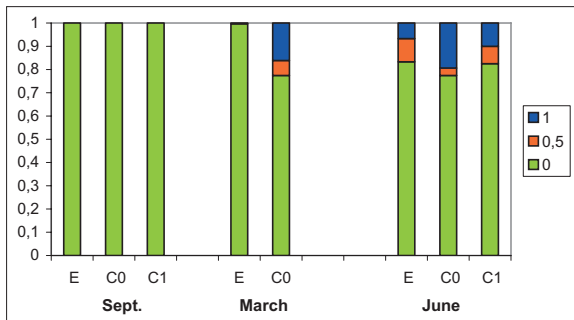


Figure 3. The range changes of recommendation of applying pads in next investigations at children who at the beginning of the experiment did not have such a recommendation, for every of 3 groups. Legend: pad 1cm – 1, pad 0,5 cm - 0,5, the lack of a pad - 0. E – Experimental (Aikido) group (n = 30); CO – Non-exercising boys (controls; n = 31); C1 – Boys practicing conventional corrective exercises (n = 40).

Analysis of percentage range of changes in recommendation of pads application for the examined not advised to do so at the beginning of the investigation (fig. 3) proved statistically relevant percentage decrease in the number of the subjects without a pad recommendation in group E, research no 3 ($p < 0,05$). In group CO, essential decrease in investigation 2 and 3 ($p < 0,01$), and in group C1 in investigation 3 ($p < 0,01$) was noted. The smallest percentage of recommendation of applying insertion was affirmed in group E. However, the percentage of not recommending pads did not differ particularly between groups indeed.

To evaluate the significance of changes in asymmetry of the back spurs of pelvis (fig. 4, 5 and 6), in successive investigations the F the Snedecora (in ANOVA) and the t-Student tests were used for dependent variables. The analysis of variances was performed in order to examine the influence of group kind upon

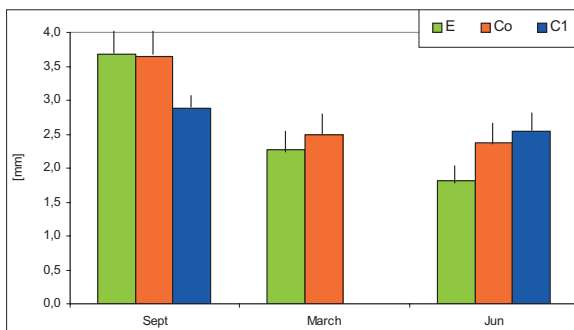


Figure 5. Changes in the value of asymmetry of the back pelvis spurs in successive investigations at children with asymmetry present at the beginning of the experiment, for every of 3 groups. Legend: E – Experimental (Aikido) group (n = 57); CO – Non-exercising boys (controls; n = 46); C1 – Boys practicing conventional corrective exercises (n = 61).

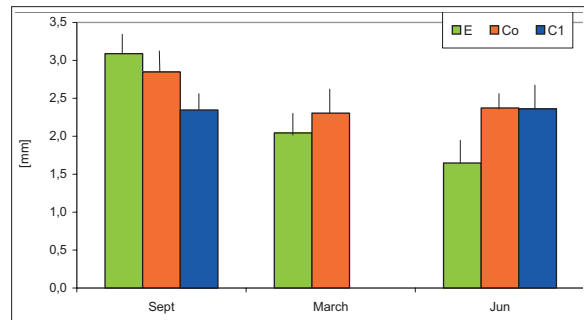


Figure 4. Changes in the values of asymmetry of the back pelvis spurs in successive investigation on all of children (202), for each of 3 groups. Legend: E – Experimental (Aikido) group (n = 68); CO – Non-exercising boys (controls; n = 59); C1 – Boys practicing conventional corrective exercises (n = 75).

the value of the continuous random variables in the three examinations. In order to examine the differences of variable values between examinations 1 and 2 and between examinations 1 and 3, t-student test was used for dependent variables.

The analysis of variations proved that almost in all investigations the changes in asymmetry values of pelvis back spurs (fig. 4, 5 and 6), there is no significant differentiation between groups. The only essential difference was in the investigation 1 in analysis of changes of asymmetry at the examined, at whom it was present at the beginning of investigations. Such a differentiation was not revealed however between group E and CO (fig. 5). Changes of asymmetry values of the back pelvis spurs at all studied subjects (fig. 4), both with asymmetry present at the beginning of investigations, as well as with her lack, showed in successive investigations considerable decrease of the average value of asymmetry only in group E ($p < 0,01$). Change of this asymmetry at the examined, at whom the asymmetry was present at the

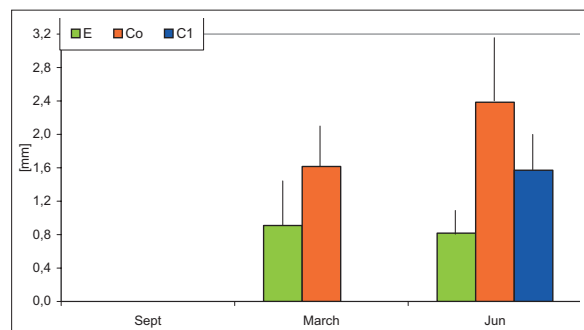


Figure 6. Changes in value of asymmetry of the back pelvis spurs in successive investigations at children with lack of asymmetry at the beginning of experiment, for every of 3 groups. Legend: E – Experimental (Aikido) group (n = 11); CO – Non-exercising boys (controls; n = 13); C1 – Boys practicing conventional corrective exercises (n = 14).



beginning of observation (fig. 5), proved to decrease essentially in group E and CO (the $p < 0,01$). The scope of changes was greater in group 1. The analysis of asymmetry changes at subjects who did not reveal it in the first period of investigation (fig. 6), showed essential growth in all investigations in groups CO and C1 (the $p < 0,01$). The significant growth was noted in group E in the investigation C1 ($p < 0,05$).

In the investigation, the recommendation to apply heel pads and asymmetries of the back pelvis spurs were subjected to analysis and on such a basis the changes in placement of pelvis in the frontal plane were evaluated. The most spectacular reduction of asymmetry of back pelvis spurs and percentage limitation of usage of heel pads for 202 investigated subjects (fig. 1 and 4) was noted in group E. Aikido exercises improved in the experimental group placement of pelvis in the frontal plane. Introduction of aikido exercises at children, at whom at the beginning of the experiment there was no recommendation to use any heel insertion, resulted in group E in the smallest percentage growth of such an indication in the experimental group. Similarly, at children without asymmetry of back pelvis spurs at the beginning of the investigation, the growth of asymmetry was also the smallest in the experimental group.

DISCUSSION

To define precisely the placement of pelvis, we would assume that it is a kind of a three-dimensional shape and we should specify its location according to xyz coordinates. However the authors of this work believe, that none of the contemporary applied methods is able to define it precisely. It is not only due to the lack of precise equipment, but also it is difficult to define localization of proper anthropometric points according to which the three-dimensional placement of pelvis could be achieved. Perhaps it might be possible at children with advanced changes in pelvis. But the investigation material accessible in this experiment was not sufficient for this purpose. Therefore, only changes of pelvis placement in the frontal plane were analyzed without considering the cases of slant location.

The results of the conducted investigations showed, that in course of experiment changes were revealed in pelvis placement in the frontal plane in all groups. Definitely, one of the factors could be the child's growth. Opinions of scientists on the necessity of use of heel pads are divided [9]. However it would be advisable by recommending pads to control changes in pelvis placement and check the necessity of using any insertions. Malawski [3] discerns such a necessity

recommending a control every 3 months. Incorrect pelvis placement may result not only from anatomic distortions but also from the weak muscle system responsible for that. In opinion of the authors of this paper, application of pads must be accompanied by proper exercises which may improve the activity of muscles responsible for pelvis placement.

For correction of pelvis placement, the manual therapy is used. The application of the manual therapy at children requires utmost attention because of great plasticity of skeletal system. Work with children in this area requires from therapists experience [10]. Passive mobilizations of lumbar-hips joints may bring the improvement of placement symmetry of pelvis mainly in the frontal plane [11].

In Karski's opinion [1,2], contractures in hip joints are one of the main reasons of idiopathic scoliosis at children. According to this author, continuation of flex-extend contracture of hip joint may lead to extension of one and shortening of another lower limb. Such a situation enforces slant position of the pelvis. In his therapy Karski recommends exercises to avoid contractures in hip joints.

Despite confirming of frequent relationship between the slanting pelvis placement and spine lateral scoliosis, in sets of exercises for children with such pathology, there are no complex exercises for muscles responsible for proper pelvis placement. The authors mean here exercises which might be used during corrective gymnastics for a big group of children with such pathology, exercises adapted to the children movement demands. Such exercises were offered in the experiment on the basis of aikido.

During investigation, recommendations to use heel pads as well as asymmetry of back pelvis spurs were analyzed which material led to conclusions regarding changes in pelvis location in the frontal plane. The most significant reduction of asymmetry of back pelvis spurs as well as percentage of recommendations to use heel pads at all the investigated subjects (fig. 1 and 4) was noted in group E. The application of aikido exercises resulted then in correction of pelvis placement in the experimental group.

It is worth stressing that in course of investigation, the slanting placement of pelvis was revealed at some children which was not the case at the beginning of the experiment (fig. 3 and 6). At those subjects, scoliosis was revealed. The progression of scoliosis quite often induces unfavourable changes in pelvis which was already described by Tylman [14]. Scoliosis starting high, e.g. on the breast level, often „goes” down and

causes changes in pelvis. The results suggest that such changes in the frontal plane may be the case even at I grade scoliosis according to Gruca, which grade was confirmed in the experiment. It is not possible to declare that aikido exercises stopped unfavourable changes. We may take for granted that they limited the threat of their occurrence. We may also state that the slightest unfavourable changes were revealed in the experimental group. The aikido exercises applied at children who were not recommended to use heel pads at the beginning of the experiment, resulted in the least percentage of indications to use insertion in the experimental group. Similarly at children without asymmetry of back pelvis spurs at the beginning of the exercise, the increase of asymmetry was also slightest in the experimental group.

Pelvis as a link in biokinematic link may influence shaping curvatures of a child's spine. Exercises performed on pelvis muscles may influence its placement. In case of scoliosis, such exercises may contribute to support proper static balance in placement of pelvis and through pelvis also of spine. In authors' opinion, it is necessary to investigate influence of such exercises on scoliosis of higher grade. Many aikido techniques may be involved, including e.g. moving in

shikko, in which exercise the transverse spine movement is minimal. So, there should be no fear about exercises deepening rotation of the spine vertebra. Application of such exercises might restrain, to some degree, further progression of scoliosis by taking care for the spine foundation which is pelvis.

CONCLUSIONS

1. It was certified that aikido exercises improved the placement of pelvis in the frontal plane by reducing asymmetry in location of back spurs and decreasing the percent of recommendations to use a heel pad on the side of pelvis lowering in the the frontal plane in the experimental group.
2. Influence of the applied aikido exercises at children with scoliosis, at whom the use of insertion under heel was not recommended at the beginning of investigations, caused the smallest percentage growth of recommendation to apply the heel pad in the experimental group. Similarly at children with scoliosis, without asymmetry of the back spurs at the beginning of investigations, the growth of asymmetry was the smallest in the experimental group.

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