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Effects of aikido exercises on lateral spine curvatures in children

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Summary

Study aim:

To examine the effects of aikido exercises on the angles of lateral spinal curvature in frontal plane in cases of scoliosis.

Material/methods:

A group of 202 boys aged 7 – 10 years participated in the study. They were divided in 3 groups: experimental (subjected to aikido exercises; n = 68), corrective (subjected to conventional corrective exercises; n = 75) and control (no corrective exercises; n = 59). Children with and without scoliosis were studied; those without scoliosis had slanting pelvis in the frontal plane. Posturometric measurements were conducted in 2002/2003.

Results:

The decrease of the angle of lateral spinal curvature was obtained in experimental and corrective groups.

Conclusions:

The applied aikido exercises reduced the lateral spinal curvature in scoliotic children. In the non-scoliotic ones, the increased spinal angle was significantly smaller than in control groups.

Key words:

Scoliosis • Aikido • Spinal curvatures

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INTRODUCTION

Traditionally, fairly conventional forms of exercise were used to correct postural disorders. Exercises of that kind are rather monotonous and thus accepted by children with some difficulty. Besides, children consider such exercises merely a kind of therapy, which arouses negative feelings and, thus, Aikido exercises could become an attractive alternative. Aikido exercises, being a form of self-defence, interest children and, at the same time, they may bring about compensatory/corrective effects in spinal curvature disorders. It was reported earlier [10] that the frequency of abnormal spinal curvatures in boys practicing aikido was significantly lower than in the entire school community. Other authors have also noticed positive effects of aikido exercises on children's health. However, no comparable empirical studies on postural disorders, employing appropriate diagnostic methods, were found in the available literature. Litwiniuk and Cynarski [8] carried out a survey among people who practiced aikido exercises for at least 5 years. In addition to beneficial health effects emphasised by the respondents, the parterre and on-all-fours exercises were supposed to prevent and heal spinal curvature disorders and to improve the cardio-respiratory and other functions. Karski [6] noticed stretching exercises and according to him they might prevent scoliosis as well as heal it.

The aim of the study was to examine the effects of aikido exercises on one-arched, grade I scoliosis in children, and on the angles of lateral spinal curvatures in the frontal plane.

MATERIAL AND METHODS

Subjects: A group of 202 boys, aged 7–10 years, with Grade I right- or left-sided scoliosis (by Gruca's [7] classification) or threatened with scoliosis due to slanting pelvis in the frontal plane were studied. None of them practiced any corrective exercises before.

The boys were assigned into 3 groups: experimental (E; $n = 68$) and 2 control groups - corrective (C1; $n = 75$) and control (C0; $n = 59$). The boys from Group E participated in aikido sessions, lasting about 60 min, 3 times a week. Those from Group C1 participated in conventional corrective exercises 2 times a week. The activities of both groups were out of curriculum. The boys from the control group C0 were subjected to no exercise programme except having attended curricular physical education classes. Children from Groups E and C0 attended schools in Konin and Koło, those from Group C1 - in Wałbrzych, Rzepin and Twardogóra (all were urban areas). The results of that latter group were obtained from screening examinations.

Study organisation and methods: All procedures in the study were used according to Śliwa [14]. At first, the positions of the spinous process apices from C7 to L5 and to the posterior superior iliac spine were determined. In case one of the anterior superior iliac spines was lower than the other one, the relative length of lower limbs was measured with a tape in lying position. The distance between anterior superior iliac spine and medial ankle apex was measured. When lower limbs proved different in length, wooden boards 0.5 or 1 cm thick were put under the shorter limb in standing position in order to bring the pelvis back to fully horizontal position.

Next, the following measurements were made with the use of "Posturometr-S" device (Posmed, Poland):

- The angle (absolute value) of lateral spinal curvature in the frontal plane;
- Asymmetry of the posterior iliac spines, described as the difference in height (in mm) of the spines to one another.

Measurements of relative lengths of lower extremities and of the position of the posterior iliac spines were used to detect possible pelvic obliquity in non-scoliotic boys. Groups E and C0 were examined three times during the school year 2002/2003: in September (before starting the exercise programme), at the beginning of March, and in mid-June. Group C1 was examined twice, in September and mid-June. All examinations were conducted in the morning hours.

Exercises applied: The exercises applied to Group E were selected from the aikido school founded by Koichi Tohei, wrist joint locks and throws being not allowed [10]. The exercises used were mostly asymmetrical. A considerable part of the exercises involved twisting and rotating, a great number of them being relaxing and stretching, especially in the initial stage of training (cf. [13]). The movements during exercises were natural, muscle function being dynamic and muscle tension auxotonic.

Data analysis: One-way ANOVA with *post-hoc* Student's *t*-test for dependent or independent variables and STATISTICA® 6.1 PL software were used, the level of $p < 0.05$ being considered significant.

RESULTS

Mean values (\pm SE) of lateral spinal angles recorded in 3 groups of boys are presented in Figs. 1–3. Overall,



those angles ranged from 6 to 25° in boys exhibiting scoliosis at the beginning of the study and from 0 to 27° in those who did not.

In Group E a significant improvement was noted, the mean angle decreasing by nearly 2° in March ($p < 0.05$) and by over 3° in June ($p < 0.01$). The slight improvement noted in Group C1 between September and June was non-significant, and in Group C0 a rather dramatic worsening took place, the mean angle increasing by 5° ($p < 0.01$; Fig. 1).

A somewhat different picture was obtained after the boys have been classified into subgroups: those who exhibited scoliosis at the beginning of the study (A) and those who did not (B). Subgroups E-A and C1-A improved as the scoliosis decreased by about 7.5 and 8.8°, respectively ($p < 0.01$), between September and June, while Subgroup C0-A remained unchanged over that period. On the other hand, subjects exhibiting no scoliosis at the beginning of the study (i.e. those who had slanting pelvis) behaved differently. Subgroup E-B showed a slight increase in the lateral angle (from 0° in September to 2.3° in June) while subgroups C0-B and C1-B significantly ($p < 0.01$) worsened, the angles amounting to 9.1 and 6.7°, respectively.

DISCUSSION

Measurements of the spinal curvature angles involved determining the positions of vertebral spinous processes in three-dimensional space. The precision of the so measured lateral spinal curvature was confirmed by Ovadia *et al.* [12]. Lateral curvature angles measured with the use of Ortelius 800 device significantly

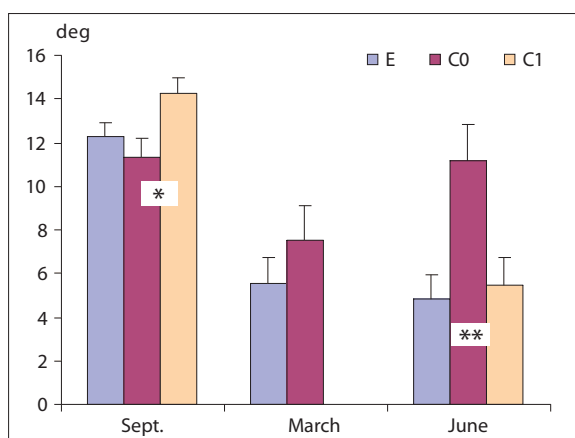


Figure 2. Mean values (\pm SE) of the lateral spinal angle determined on three occasions in three groups of boys aged 7–10 years, exhibiting scoliosis at the beginning of the study. Legend: E – Experimental (Aikido) group ($n = 38$); C0 – Non-exercising boys (controls; $n = 26$); C1 – Boys practicing conventional corrective exercises ($n = 40$).

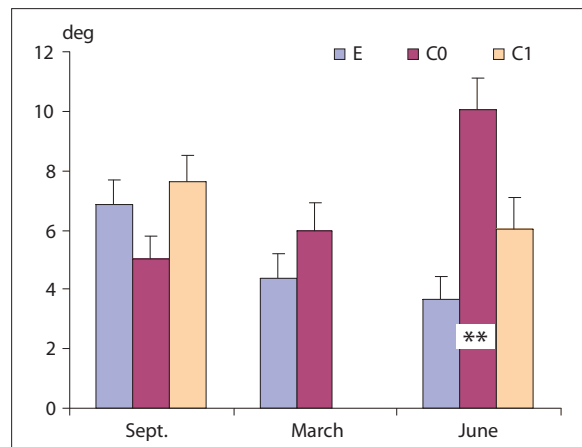


Figure 1. Mean absolute values (\pm SE) of the lateral spinal angle determined on three occasions in three groups of boys aged 7–10 years. Legend: E – Experimental (Aikido) group ($n = 68$); C0 – Non-exercising boys (controls; $n = 59$); C1 – Boys practicing conventional corrective exercises ($n = 75$). For explanation of asterisks see Fig. 3.

correlated with Cobb's angle determined by X-ray, the concordance and reproducibility of results being observed for angles not exceeding 46°. These findings confirm the reliability of our measurements whose advantage was the avoidance of using an X-rays.

The obtained results show that in subjects exhibiting scoliosis at the beginning of the study (Group E) aikido exercises brought about a decrease of lateral spinal curvature, like in Group C1, where traditional corrective exercises were employed. No significant

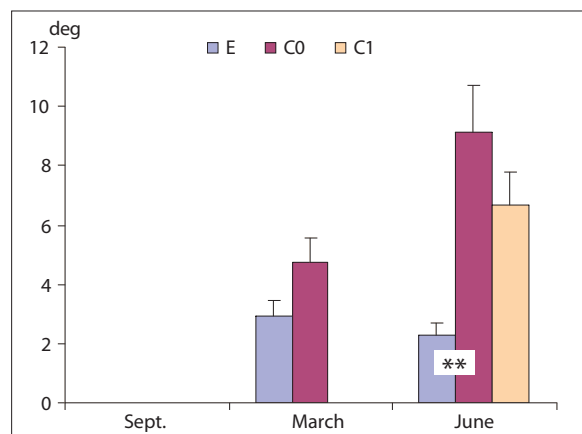


Figure 3. Mean values (\pm SE) of the lateral spinal angle determined on three occasions in three groups of boys aged 7–10 years, exhibiting no scoliosis at the beginning of the study. Legend: E – Experimental (Aikido) group ($n = 30$); C0 – Non-exercising boys (controls; $n = 33$); C1 – Boys practicing conventional corrective exercises ($n = 35$); Significant differences between groups covered with white field or between the middle group and the neighbouring ones: * $p < 0.05$; ** $p < 0.01$.

differences were found in the control group C0, so the mean angle was significantly ($p < 0.01$) greater in that group compared with the two other ones.

The originally non-scoliotic subjects had only an incorrect pelvis position in the frontal plane. All these subjects developed a mild scoliosis (March) which considerably increased in June in Groups C0 and C1, remaining unchanged in Group E (Fig. 3). Scoliosis can thus be preceded by frontally slanting pelvis, which was reported also by other authors [1,15]. Unlike traditional corrective and compensatory exercises, a great many of those applied to the experimental group activated pelvic as well as spinal muscles. These results are suggestive of a preventive value of aikido exercises in cases of threatening scoliosis.

In our opinion, traditional corrective exercises do not meet children's needs for motor activities as many such exercises are performed in lying position. In contrast, aikido exercises offer the much needed freedom, as a child exercises with a partner, moving around on the aikido mat, the partner serving as a natural exercising device. Moreover, aikido exercises are not regarded as a kind of therapy, which also encourages children. In order to tailor the exercises to children's

needs, motor games based on martial arts were used which made them readily acceptable [2,5].

Aikido exercises used in the experimental group can be applied for compensatory and corrective purposes in postural disorders and are additionally attractive as a form of self-defence. Martial arts based on *Budo* principles have a good pedagogical impact: they can teach respect and promote highly ethical and moral attitudes [3,4]. This effect can be enhanced by teaching aikido techniques and explaining them by biomechanical principles [9] made perceivable by children. The attractiveness of corrective and compensatory exercises is particularly important [11]; as parents know very little about postural disorders, they hardly co-operate with those dealing with prevention and therapy of postural disorders in children.

CONCLUSIONS

1. Aikido exercises brought about a decrease of lateral spinal curvature angle in Grade I scoliosis.
2. Aikido exercises were effective in preventing the development of scoliosis in originally non-scoliotic children with frontally slanting pelvis as compared with control subjects.

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