POSTURE AND MUSCLE IMBALANCE IN YONG TENNIS PLAYERS

Agata **HORBACZ**[1], Mária **MAJHEROVÁ**[2], Květoslava **PEREČINSKÁ**[3]

1.ÚTVŠ UPJŠ Košice, Slovakia
2. FHPV PU in Presov, Slovakia
3.FŠ PU in Presov, Slovakia

Key words:
- muscular imbalance,
- tennis,
- compensatory exercises.

Abstract:

The article presents with diagnoses of posture and muscle imbalance in a group of 13 -17 years old tennis players from Košice region. Testing was conducted on a sample of 20 juniors. The experimental group consisted of 10 subjects that to their training included compensation. Pilates method in a duration of eight months. The control group also consisted of 10 subjects but did not included Pilates method to their training routine. The aim of compensatory exercises, were to prevention and elimination weakened muscles and correct posture in the tennis players. We use individual approach due to the specificity of bad posture, muscle imbalances in musculoskeletal system of the selected participants. For assessment of body posture, we used Jaroša, Lomička [1] method, respectively for muscle imbalance [7] method. Significant changes in posture and weakened and shortened muscles we found in experimental group.

THE PROBLEM

Muscle imbalance is a functional disorder that adversely affects posture, muscle coordination and athletic performance [3], [2], [4], [5], [7], [8], [6]. It limits the range of motion of the joints, which are consequently unequally and disproportionately burdened. Unilateral burdening of young tennis players leads to improper posture, injuries and early termination of the sporting process. For this reason, it is important for coaches to watch the functional status of athletes and pay particular attention to removing muscle imbalance during the training units. An important part of it is correct recovery through compensatory exercises.

It is up to the coach, as well as the participant approaches to this problem.

OBJECT

The aim of this paper is to gain knowledge on the issue of the influence of compensatory exercises on the musculoskeletal system of tennis players in age categories of older pupils and juniors who train in Košice tennis clubs.

METHODS

The initial measurements were conducted in September through to October 2010. The experimental groups (E, E1 – Boys, E2 – Girls) conducted exercise from September 2010 to April 2011 with an intensity of 60 minutes per week, and further from May 2011 to July 2011 with three 45-minute lessons a week. The compensatory exercises were conducted by one of the authors of the paper. The control group (C, C1 – Boys, C2 – Girls) underwent sports training without any intervention program. The final measurements took place after 8 months, in the main competition season.

Correctness of body posture, was assessed, according Jaroš and Lomíček (Bartošík, 1983), in every proband at the beginning and the end of the experimental period. For evaluation, we focused on the following: posture of head and trunk; chest; abdomine and pelvic inclination; back curve (side view of overall curvature of the spine); shoulder height and position of blades-posture in the frontal plane from behind.

The result of individual segments evaluation is reflected in the deviation from standard (expressed on the scale of 1 to 4). The total score is determined by summoning the points of the listed five body regions, the result of which is a classification into one out of four grades:

perfect, good, incorrect, wrong body posture and very bad body posture.

Muscle imbalance was evaluated by the method according [7]. We examined 5 muscle groups with a tendency to shorten and 4 muscle groups with a tendency to weaken**:** (m. trapezius right, left; m. pectoralis major right, left; paravertebrally back muscles; hip flexors (m. ilioposoas) right, left; flexors knee right, left).

In our experiment, we measured the following characteristics: body weight, body mass index (BMI), fat as a percentage and a percentage of the amount of muscle with an instrument Omron.

When evaluating the parameters, the methods of non-parametric statistics and phenomena analysis were used due to the low number of probands. In order to compare levels of somatic indicators and body posture we chose the median of each group, to assess variability we looked at the variation margin. To find statistically significant difference between initial and final data in individual groups we applied the non-parametric paired Wilcoxon test and we evaluated muscle imbalance program effectiveness using the methods of phenomena analysis with the test of relative frequencies.

RESULTS

Comparing the initial measurements, the groups did not show significantly different physical properties between the sexes (Tables 1 and 2). The final measurements data within the experimental and control groups of boys showed increased values of active body mass and a decrease in the share of passive component, with a greater share in the experimental group. In the girls, the same positive phenomenon applies only to the control group, whereas, surprisingly, in the experimental female group the percentage of fat increased, while the ratio of muscle mass decreased.

Table 1. Characteristics of somatic indicators in the EG and CG groups - Boys

	INITIAL MEASUREMENTS				FINAL MEASUREMENTS			
	EG		CG		EG		CG	
Boys	Me	Vr	Me	Vr	Me	Vr	Me	Vr
Age [yrs]	16	2	16	3	17	2	17	3
Height [cm]	183	14,5	181,5	15	184	16	183	12,5
Weight [kg]	74,2	9,1	75,6	19,1	68,5	10	72,8	21,5
Fat [%]	16,8	9,5	16,6	11,2	13,3	9,8	15,8	17,8
Muscles [%]	41,7	2,1	40,1	5,5	43,6	3,7	41,5	10,1
BMI [kg/m^2]	22,16	1,65	22,72	4,25	21,11	2,38	22,31	4,40

Legend: EG – experimental group, CG – control group

Me – median, Vr – variation range

Table 2. Characteristics of somatic indicators in the EG and CG groups - Girls

	INITIAL MEASUREMENTS				FINAL MEASUREMENTS			
	EG		CG		EG		CG	
Girls	Me	Vr	Me	Vr	Me	Vr	Me	Vr
Age [yrs]	15	3	15	4	16	3	16	4
Height [cm]	168	13	170	11	169	13	170	9
Weight [kg]	53,8	18,8	57,8	11,9	55,3	17,7	60,4	13,4
Fat [%]	23,7	17,5	25,6	13,7	24,8	17,3	24,5	10
Muscles [%]	33,4	8,9	31,6	7,1	32,3	7,9	33,7	4,6
BMI [kg/m^2]	20,21	4,57	19,72	4,26	20,27	3,83	20,42	4,07

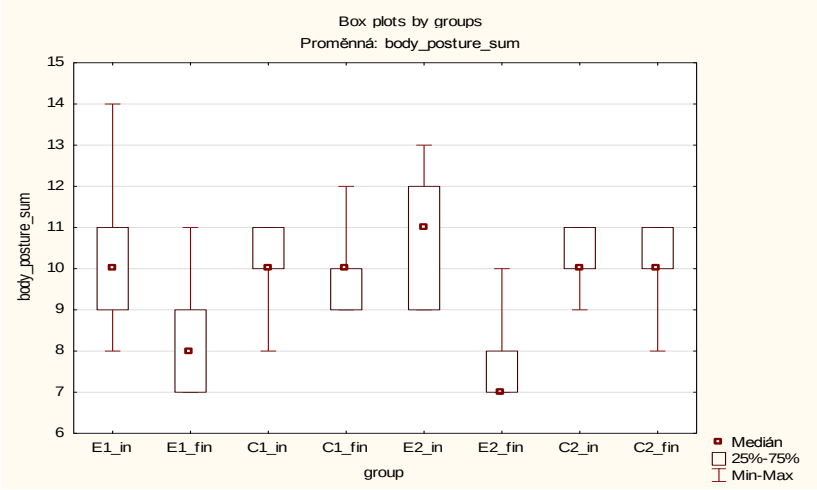
Legend see Table 1

Tennis players of our files for input and output measurements had good and bad posture. After 8 - month completion of the compensation program in athletic training occurred in the experimental groups E1 and E2 statistically significant improvement in posture. None of them had perfect posture. We confirm the findings of several studies that even in active sports is an issue correct posture [3], [4], [5], [8]. We can confirm the findings of several other studies stating that even in active athletes correct body posture is an issue to consider. Nevertheless, when comparing the total score of points, we can observe significant changes at the level $p<0,05$ in the experimental groups of both boys and girls (Table 3).

Table 3. Comparison of initial and final measurements of body posture in groups EG and CG

	Wilcoxon paired test significance level p < 0,05		
variables	valid number	Z - value	p-value
B_EG_in & B_EG_fi	5	2,0226	0,043115
B_CG_in & B_CG_fi	4	0,0000	1,0000
G_EG_in & G_EG_fi	5	2,0226	0,043115
G_CG_in & G_CG_fi	1		

Legend: in, fin - initial, final measurement, T – Wilcoxon test value



Graph 1. Level of body posture in the monitored groups E1, E2, C1, C2
Legend: in, fin - initial, final measurement

Although the poorest initial body posture measurement results were recorded in the female experimental group, also the most significant improvement was observed there after accomplishing the 8-month experiment (Graph 1). In neither of the control groups of boys and girls were observed statistically significant changes in body posture.

At assessing muscle disbalance we focused on the shortened and weakened muscle groups. The shortened muscles showed deviation from standard in every cohort of probands. The smallest "damage" in the experimental groups of boys and girls was recorded in the paravertebral muscle group; what is more, all values in the female tennis players group fell within standard (Tables 4 and 5). Adverse deviations were recorded though in other muscle groups both, on the right and left in the majority of tennis players. Applying the Pilates program in cohorts E1 and E2 incurred practical improvements in muscular balance of the initially shortened muscles - m. trapezius right and left, m. pectoralis right and left, m. iliopsoas right and left. Statistical significance was not confirmed though, which can be attributed to the low number of subjects in the cohort. The knee flexors remained without positive progress in the removal of muscle imbalance.

Table 4. Test of shortened muscle groups significance expressed in percentage whack - Boys

		SS1P	SS1L	SS2P	SS2L	SS3	SS4P	SS4L	SS5P	SS5L
E1	in	80	60	40	40	20	80	80	80	80
	fin	60	20	40	40	20	60	60	80	80
	T	*0,69*	*1,29*	*0*	*0*	*0*	*0,69*	*0,69*	*0*	*0*
C1	in	20	60	60	20	40	40	60	80	80
	fin	60	80	60	80	20	40	20	60	60
	T	*1,21*	*0,69*	*0*	*1,89*	*0,69*	*0*	*1,21*	*0,69*	*0,69*

Legend: in, fin - initial, final measurement, T - relative frequencies test value
SS1P, SS1L - m. trapezius right, left
SS2P, SS2L - m. pectoralis major right, left,
SS3 - paravertebral back muscles,
SS4P, SS4L - hip flexors (m. ilioposoas) right, left,
SS5P, SS5L - knee flexors, right, left

Table 5. Test of shortened muscle groups significance in percentage whack - Girls

		SS1P	SS1L	SS2P	SS2L	SS3	SS4P	SS4L	SS5P	SS5L
E2	in	80	60	40	40	0	60	60	60	60
	fin	40	40	20	20	0	20	20	60	60
	T	*1,29*	*0,63*	*0,69*	*0,69*	*0*	*1,29*	*1,29*	*0*	*0*
C2	in	60	100	20	40	20	40	60	20	40
	fin	60	80	20	40	20	100	100	20	40
	T	*0*	*1,05*	*0*	*0*	*0*	*2,07**	*1,58*	*0*	*0*

Legend see Table 4

After graduating from the compensation program in sports training tennis players in the experimental set boys has improved strength: m. gluteus maximus and oblique abdominal muscles. The girls straight abdominal muscles, neck flexors and abdominal oblique muscles (right) - Table 6, 7

Table 6. Test of shortened muscle groups significance in percentage whack – Boys

		OS1	OS2	OS3P	OS3L	OS4P	OS4L
E1	in	20	40	60	40	100	40
	fin	0	20	0	0	20	0
	T	*1,05*	*0,69*	*2,8***	*2,16**	*2,58***	*2,16**
C1	in	60	40	40	20	80	80
	fin	20	40	20	20	100	100
	T	*1,29*	*0*	*0*	*0*	*1,05*	*1,05*

Legend: in, fin - initial, final measurement, T - relative frequencies test value
OS1 - direct abdominal muscles,
OS2 - arched neck flexion,
OS3P, OS3L - m. gluteus maximum right, left,
OS4P, OS4L - oblique abdominla muscle right, left

Table 7. Test of shortened muscle groups significance in percentage whack - Girls

		OS1	OS2	OS3P	OS3L	OS4P	OS4L
E2	in	40	40	60	40	100	80
	fin	0	0	20	20	20	40
	T	*2,16**	*2,16**	*1,29*	*0,69*	*2,58***	*1,29*
C2	in	60	100	80	60	60	80
	fin	60	100	40	40	100	100
	T	*0*	*0*	*1,29*	*0,63*	*1,58*	*1,05*

Legend see Table 6

Based on work [5], [7], [8], [9], [10] confirmed the presence of muscle imbalance in athletes of all ages.

CONCLUSION AND RECOMMENDATIONS

1. We can unequivocally state that targetted appropriate corrective exercise, in our case the Pilates method, positively influences correct body posture and muscle imbalance of tennis players, in both sexes, in the age categories of older pupils and juniors.
2. Although in some of the cases there were no significant changes, the results of this pilot study unambiguously prove that the Pilates program may be recommended to coaches and tennis players to be used as an appriopriate compensation exercise method during motor activities in sports education.
3. The compensatory exercises that we applied in the preparatory phase of doing sports represent one of the several ways that can be recommended to be used in sports training in order to reduce muscle imbalance and incorrect body posture in athletes, in our case tennis players.

REFERENCES

1. BARTOŠÍK, J. (1983) *Teória a metodika telesnej výchovy oslabených*. Bratislava: SPN, 1983, p. 65.
2. BINOVSKÝ, A. (2003) *Funkčná anatómia pohybového systému*. Bratislava: FTVŠ UK, 2003, p. 274, ISBN 80-223-1380-7.
3. BLAHUŠOVÁ, E. (2005) *Pilatesova metóda III: péče o páteř.* 1. vyd. Praha: Olympia, 2005, p. 104, ISBN 80-7033-900-4.

4. BURSOVÁ, M. (2005) *Kompenzační cvičení*. Praha: GRADA Publishing, 2005, p.195 ISBN 80-247-0948-1.
5. DLHOŠ, M. (2002) *Lateralita funkčných svalových zmien a jej ovplyvňovanie u mladých tenistov*. Bratislava: FTVŠ UK. Kandidátska dizertačná práca, 2002, p. 135. ISBN 80-7169-208-5.
6. DYLEVSKÝ, I. et al. (2000) *Funkční anatomie člověka* 1. vyd. Praha: Grada, 2000. 664 s. ISBN 80-7169-681-1.
7. JANDA, V. (1996) *Funkční svalový test*. Praha: GRADA Publishing, 1996, p. 325. ISBN 80-7169-208-5.
8. KANÁSOVÁ, J. (2005) "Funkčné svalové poruchy u atlétov, tenistov, plavcov, hokejistov, volejbalistiek a moderných gymnastiek OŠG v Nitre". In *ATLETIKA*, 2005, elektronický sborník mezinárodní vědecké konference. Praha: KA FTVŠ UK. 2005. p. 1-7. ISBN 80-86317-39-0.
9. THURZOVÁ, E. (1998) „Skrátené flexory kolena ako dominantná funkčná svalová porucha u detí a mládeže". Bratislava: In *Acta Fac. Educ. Phys. Universitatis Comenianae*, XXXIX, 1998. p. 113 – 142.
10. THURZOVÁ, E. (2003) „Bolesť pohybového aparátu u mladých športovcov". *Tel. Vých. Šport*, 13, 2003. č. 2. p. 31 – 35.