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Original Article

Motion control capability improvement in young sport dancers via static dynamic exercises

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Abstract
The rationale for this study is explained by the immaturity of theoretical and practical approaches to sports dancing coaching at the initial stage of training adjusted for specific intermuscular and intramuscular coordination that is common to European and Latin programs. The purpose of the study is to form a pedagogical basis to the proprietary technology of static dynamic exercises at the stage of initial training of young dancers that is based on the approach of biological feedback and aimed at the formation of neuromuscular coordination, associated with different neuromuscular contraction types in European and Latin programs. The main method of study was a pedagogical experiment. The authors compared the parameters associated with young dancers capability to control and dose their muscle tension and their technical competence. The dancers were distributed into control and test groups. The training of the first group was performed according to the traditional method; the training in the test group was performed according to the proprietary technology. Positive results, shown in the test group, prove significant positive changes in dancers capability to evaluate and control dynamic motion parameters in comparison to the children in the control group. This fact allowed the dancers to increase dancing training program efficiency. The materials of this article can be useful for sport dancing coaches during the students training process in this field.
Key words: sports dancing, static dynamic exercises, motion control, biological feedback.

Introduction

The issue of motion control in sports is related directly to the training tasks (Bernshtein, 1991; Bogen, 1985; Veldyaev, 1999; Gaverdovskiy, 2007; Donskoy, 1994; Evtushenko, 2011; Farfel, 2011).

Physical capacity control, characterized by minimal voluntarily control, high precision and confidence of performance, is the main training objective in sports practice (Matveev, 1991; Menkhin, 1990; Chikalova, Kiselev, 1991). Dancing technique is a complicated motion activity, which requires high capability to muscle tension differentiation in time, optimal load distribution in different movement chains and economic consumption of muscle energy, based on the specifics of European and Latin dancing programs (Eresko, 2005; Kareva, 2013; Korenberg, 2005; Laird, 2003; Mikhailov, Kovalenko, 1999; Putintseva, 2008; Laird, 1986; Moore, 1994; Howard, 1977). From the sports perspective, it is described as a combination of local micromotion and body movement in space, that is associated with specific intermuscular and intramuscular coordination that forms the basis of static dynamic motion stereotype in the specified dance programs (Gaverdovskiy, 2007; Donskoy, 1994; Evtushenko, 2011; Korenberg, 2005). Due to this fact, the implementation of methods, that increase the capability to evaluate the changes in muscular status as an element of motion control, is relevant at the initial stage of training in sport dancing.

However, in modern sport dancing coaching the issue of initial sport dancers training remains understudied and is solved by a limited amount of methods.In this aspect, the attention should be drawn to static dynamic exercises – power exercises that combine dynamic and static types of muscle contractions (Kareva, 2013; Repnikova, 2006). The possibility to perform precise motion during static dynamic exercises is an important condition for voluntarily control and timely correction of movements by means of biological feedback (BFB), which, in its turn, positively influences the precision of sportsman's movements (Sentyabrev, Shamardin, 2004; Chenegin, Gerasimova, Pogudin, 1994; Farfel, 2011).

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The purpose of the study is to increase the efficiency of voluntarily muscle control in young dancers based on static dynamic exercises.

Object: young dancers initial education and training process.

Subject: implementation of static dynamic exercises in the initial dancers training.

Materials and Methods

40 children (20 dancing couples), aged 7-9 years old, were enrolled in the study. They were divided into two groups (control and test), 10 couples in each one. Training conditions (quality, duration, load volume, number of training sessions) were equal for both groups. The control group was trained according to the traditional power training complex, and the test group was trained according to the proprietary technology that consisted of a special static dynamic exercise complex.

The comparative analysis of the implemented approaches efficiency was performed by the parameters, that characterize the children's capability for muscle tension dosing (50% of the tension force in a handgrip test), voluntarily tension and relaxation (myotonometry), as well as by the motion errors count in special body, arms, legs and head positions taken during the competition performance (Kareva, 2013).

Results and Discussion

The developed complexes of static dynamic exercises have local character, they were chosen for selective impact on the body, legs and arms muscles. The movements were distinctly defined by space and time parameters: amplitude and tempo. In particular, the amplitude of motion was identified as the distance from the floor, which the working link has to cover. Depending on the biomechanical peculiarities, used in power exercises, the authors defined the following approximate motion amplitudes: 5, 10, 15 cm (Kareva, 2013).

Exercise tempo depended on the working link motion rate, required for covering the estimated distance. It involved different motion modes with varying static dynamic exercise phases. Due to this, three types of exercise performance were defined:

1) the static motion component prevailed and the shift from one movement amplitude to another was done with 10-second static position;
2) the shift from one amplitude movement to another was performed with a 1 – 2 seconds stop;
3) included spring-like movements with maximum speed at the total amplitude of 1-2 cm and with 10-second duration at each level.

Special orienteers, associated with different exercise amplitude, were used for receiving biological feedback. The objects of different height, like marks on the wall, etc., were used as such orienteers (Kareva, 2013).

During static dynamic exercises, it is necessary to follow the outlined guidelines:

- working link should not be placed into the initial position and should be kept 0.5 – 1 cm from it, thus creating the conditions for incomplete relaxation of the trained muscle;
- voluntarily tension should be created in a muscle group that is trained;
- muscle groups, that should not be involved in the motion, should be voluntarily isolated.

The developed exercise complexes were included in the traditional training program of young dancers three times a week.

To develop strength endurance, as one of the major features in sport dancing (Terekhova, 2008; Chikalova, Pochitaev, 2001), the exercises were performed by the type of circuit training at the end of main training part with strict rest intervals between the circles (not more than 30 seconds). There were three circles performed. The exercise sequence in each circle was fixed, only the way of performance was different (Kareva, Repnikova, Antsiperov, 2012).

The results of the pedagogical experiment showed that the implementation of special static dynamic complexes during the training allowed the young dancers to increase their capacity for voluntarily muscle tension and relaxation (Table 1).

The results of the muscle tension tonus and elasticity tonus in the children in both groups showed significant advantage of the test group over the control one. In particular, there was a significant increase in tension tonus in young dancers in the test group ($p<0.05$-0.001) in comparison to the control group. Less significant changes were obtained in the elasticity tonus parameter in the test groups. However, in the control group, this parameter changed even less.

It should be highlighted that there is a significant increase in the tonus amplitude, which is an objective criterion of neuromuscular functional capabilities increase in young sportsmen in the test group (Sentyabrev, Shamardin, 2004).

Table1. Muscle tonus parameters in young dancers during the pedagogical experiment, (myotones)

№ parameter	Muscle	Sex	Test group (n=10)				Control group (n=10)			
			Study phase		T/P	Δ, %	Study phase		T/P	Δ,%
			Initial ($\overline{X}$ ± m)	Finial ($\overline{X}$ ± m)			Initial ($\overline{X}$ ± m)	Finial ($\overline{X}$ ± m)		
Tension tonus	Musculus quadriceps femoris	M	89.7±2.81	101.7±2.02	3.47**	11.8	83.1±2.89	90.2±1.96	2.03	7.87
		F	81.0±1.56	97.7±2.33	5.96***	17.1	81.1±2.73	88.8±2.65	2.02	8.7
	Musculus biceps femoris	M	80.0±2.32	100.3±2.49	5.98***	20.2	84.4±2.60	90.0±3.05	1.39	6.2
		F	74.4±1.89	92.7±2.58	5.74***	19.7	76.3±2.04	85.4±2.74	2.14	10.7
	Musculus biceps brachii	M	96.6±4.16	109.7±2.37	2.74*	11.9	87.8±3.22	96.6±4.16	1.55	9.1
		F	89.4±3.78	99.0±4.06	2.31*	9.7	85.4±2.53	91.2±3.24	1.41	6.4
Relax tonus	Musculus quadriceps femoris	M	80.9±2.50	83.1±2.42	0.66	2.7	78.4±2.26	83.5±2.23	1.59	6.1
		F	74.3±1.72	76.1±2.61	1.02	2.4	72.9±2.98	77.2±2.75	1.06	5.6
	Musculus biceps femoris	M	80.0±2.31	84.6±2.38	1.38	5.4	76.9±1.92	86.8±3.46	2.49*	11.4
		F	70.5±2.79	72.9±2.85	0.60	3.3	69.2±2.63	76.9±2.83	1.99	10.0
	Musculus biceps brachii	M	81.1±2.99	86.9±4.39	1.08	6.6	79.1±2.0	83.8±2.25	1.54	5.5
		F	77.2±2.66	81.8±1.97	1.39	5.6	73.4±2.81	76.4±2.10	0.85	3.9
Elasticity tonus	Musculus quadriceps femoris	M	80.0±2.31	83.4±2.26	0.66	4.1	78.0±1.45	84.3±2.19	2.38*	7.5
		F	75.1±1.98	76.5±2.07	0.49	1.83	73.4±2.84	79.2±1.98	1.68	7.3
	Musculus biceps femoris	M	88.0±3.27	84.3±2.78	0.86	4.4	77.6±2.05	83.3±2.45	1.78	6.8
		F	76.2±2.87	72.5±2.96	0.90	5.1	71.8±2.75	79.7±2.06	2.30*	9.9
	Musculus biceps brachii	M	82.1±3.18	84.3±2.81	0.51	2.6	76.7±3.16	82.0±2.39	1.35	6.5
		F	78.2±2.42	80.6±3.02	0.62	3.0	75.4±2.87	81.6±2.05	1.76	7.6
Tonus amplitude	Musculus quadriceps femoris	M	9.1±3.23	20.0±2.96	2.48*	54.5	5.6±0.99	8.9±1.38	1.95	37.1
		F	6.7±2.16	21.6±2.28	4.73***	69.0	8.2±1.25	11.6±1.10	2.05	29.3
	Musculus biceps femoris	M	7.4±2.13	16.9±1.56	3.57**	55.9	8.0±2.19	7.0±1.77	2.86*	14.3
		F	3.9±2.9	19.8±2.27	4.32***	80.3	7.1±1.59	8.5±0.09	1.12	16.5
	Musculus biceps brachii	M	16.0±3.3	35.7±4.04	3.78**	55.2	12.7±2.24	15.0±2.80	0.65	15.3
		F	12.2±0.12	17.2±2.09	2.39*	29.1	12±0.28	14.8±1.14	2.39*	18.9

Note. Significance was estimated by the Student's t-test: * - at p<0.05, ** – at p<0.01, p<0.001***.

The results of the evaluation of young students' capability to reproduce the required strength parameters, presented in Table 2, also show significant improvement of the capability to control and reproduce motion force characteristics, developed after static dynamic exercises performance.

Table 2. Average error values at the reproduction of 50% tension from the individual maximum of handgrip test at the end of the study, (kg)

Values / Groups		Sex	Before the experiment ($\overline{X}$ ± m)	After the experiment ($\overline{X}$ ± m)	Δ,%	t	P
Test	Right arm	M	3.1±0.11	2.5±0.13	24.0	3.0	<0.05
		F	3.2±0.20	2.6±0.02	23.1	3.0	<0.01
	Left arm	M	2.7±0.16	2.2±0.54	22.7	2.5	<0.05
		F	3.2±0.50	2.7±0.35	18.5	2.5	<0.05
Control	Right arm	M	3.8±0.54	3.6±0.32	5.5	0.32	>0.05
		F	2.0±0.46	1.9±0.18	6.8	0.19	>0.05
	Left arm	M	3.1±0.42	2.9±0.23	6.9	0.42	>0.05
		F	2.5±0.44	2.3±0.11	8.7	0.44	>0.05

Note: M- males; F- females. Critical correlation coefficient values P <0.05 – 0.444; P <0.01- 0.561; P <0.001- 0.679.

Thus, the implementation of the developed complex of static dynamic exercises into the training program of young dancers creates favorable conditions for the improvement of children's capability of voluntarily muscle tension control and dosing differentiation of force efforts in the controlled muscles, which, in its turn, increases motion control efficiency.

Further evaluation of the young dancers' efficiency in main dancing movements showed that in the test group the boys' average error count during European dancing program performance was significantly lower than in the control group. The parameter values varied from 10% to 50%.

Table 3. Motion error count in boys' performance of dancing programs

European program			
Groups / Errors	**Control**	**Test**	**Difference, %**
Minor	10	9	10.0
Significant	13	7	46.2
Major	6	3	50.0
Latin Program			
Minor	9	7	22.2
Significant	8	4	50.0
Major	5	2	60.0

During Latin program performance, which is technically very complicated, young dancers' error count in both groups differed quite significantly. Thus, the difference for minor mistakes was 22.2%, for major mistakes - 60.

A similar difference in the quality of dancing programs performance was seen in girls (Table 4).

Table 4. Motion error counts in girls during the dancing programs performance

European program			
Groups / Errors	**Control**	**Test**	**Difference, %**
Minor	11	10	9,1
Significant	9	6	33,3
Major	7	3	57,1
Latin program			
Minor	11	8	27,3
Significant	7	3	57,1
Major	5	2	60,0

Training by the authors' program, their error count was significantly lower during European program performance. The difference was from 9.1% to 57.1%. In Latin program, it varied from 27.3% to 60.0%.

The obtained results showed that the implementation of the authors' program into the training process of young dances in the test group improved instant and precise reaction to even minor motion errors in the planned movement.

Conclusion

The obtained data proves the efficiency improvement in young dancers initial training results due to the implementation of the authors' training program based on static dynamic exercises, that was developed considering the muscle tension peculiarities for different dancing programs. The developed program was aimed to form the respective neuromuscular coordination in children. Precise performance of static dynamic exercises allows the dancers to control their technical side more efficiently due to objective data entry, which contains the information on qualitative motion characteristics that act as feedback channels. This is one of the major moments in the formation of a functional system that acts as a basis for motion control (Farfel, 2011) and improves the technical efficiency of main dancing skills in young dancers during initial training.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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