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KINEMATIC STRUCTURE OF THE SLOW FOX FEATHER STEP

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Abstract

In dance, biomechanical methodologies are used to improve aspects of dance technique. Therefore the aim of our study was to gain knowledge of the kinematic structure of the feather step in slow fox routine. Material and methods: Four top level dance couples were involved in the study. To examine the routine biomechanically we have filmed the particular dance figures by high speed camera with frequency of 50 frames per second. Subsequently, we processed and evaluated digitalized images by 2D analysis. The path of gravity and angular changes in knee joint in the particular dance figures phases were evaluated and compared between partners and pairs together. Results: Dancing couples in the same conditions reached different readings in angle of the knee joint as well as trajectory of the centre of gravity during motion.

Keywords: modern ball room dance, 2 dimensional biomechanical analyse, kinematic parameters, trajectory of centre of gravity, angle at knee joint

Introduction

Modern ballroom dancing is a widely performed physical activity which is starting to be considered an actual sport discipline. The aspects of ballroom dance are used for mediating some basic aesthetical values. Dance, as other sports supports and forms physical abilities, discipline, additionally creates aesthetical sense, collective feelings and improves relationship to music. It is art and sport in one and it is also a physical activity, which is done by people of different sexes (Holuš, 1983).We do agree with some statements of Schnabel (1988), Choutka & Dovalil (1991), according to whom the structures of movement are the most difficult, and highly automatic. Aerobic type of work alternates with significant anaerobic one.

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Requirements for coordination ability and creativity of the movement are high, with various dance figures. A figure according to Kasa (2001) can be characterized as a movement that creates a particular area and spatial patterns. The dance figures in modern ballroom dance are performed in a closed dance – position, which s the limiting factor of performing the movement (Špánik, 2009). The way of centre of movement, its horizontal and vertical differences are very important and therefore every dancer must know where exactly his centre of movement is at the particular moment.

It is well known that improving the efficiency at sport is determined by looking for some factors and more detailed analyses of them. One of these factors is the kinematic structure of a particular moving activity, practising shape or dancing figure. Its level with other factors influence and imitate increasing and improving sport efficiency (Kyselovičová, 2008). The system of improving the technique by qualitative bioemechanical analyse includes the following steps (McGinnis, 1999): creating theoretical model of the most effective technique, observing the particular model, evaluating efficiency by comparing the most effective technique, learning from feedback of the current performance and the most effective technique.

Evaluating sport performance at the dance sport is not absolute. It is not possible to measure. Landsfeld (2001) claims that the task of judges is to differ and compare performed sport efficiencies on the floor and Odstrčil (2004) divides evaluation into areas like tact and basic rhythm, body line, movement, rhythmical expression, technique of feet, and the floor wisdom. According to the international rules of evaluating (IDSF, 2002), Odstrčil (2004) also claims that the main criteria is tact and basic rhythm. All the others are on the same level and it is up to the referee how high importance he is going to put them.

The Slow fox dance is the most difficult ballroom dance according to technique. It has four 4/4 tact, tempo is 29 - 30 tact per minute. The switching of slow and fast movements creates a continual movement, which must be perfectly fluent, relaxed and controlled as well (Loja, 2006). The basic characteristic feature is walking and three steps. All the figures are made on the base of these two main features. Dance couples dance this from the very beginners till the masters, who are performing and showing us their technique level. That is why the proper technique is so important, and more, it is the key to solve the question of the movement´s task, which is in harmony with the possibilities of the individual, biomechanical rules of movements and it is done by neurophysical control of movements and it leads to the most effective and advisable performing movements (Koniar, 1986; Psalman & Žák, 2009; Psalman, 2010). One of the parts of gaining the proper technique of figures is gaining the detailed information about dominant phases, their micro phases and understanding the technique of realization. Therefore the aim of our study was to gain knowledge of the kinematic structure of the feather step in slow fox routine.

Methods

Technique description of the Feather step

The feather step belongs into the most basic figures with rhythm of “slow”, “quick”, and “quick”. It is formed of three fluent steps: 1st step is defined as the part of a movement, when foot is about to move on the floor, then in the time and space, when it is moving next to the standing foot, then forwards or backwards till the moment of when the cradle begins; 2nd step or the cradle, when the feet don´t move on the floor, 3rd step begins from the moment of standing on the spot, through moving the centre from the standing foot to the stepping one, which is beginning to be standing as well, till the moment when the tip or heel move on the floor again. For better understanding and analyse Feather step is split into 12 phases as follows (example of male partner performance): 1.step down right (first step); 2.step off left leg (first step); 3.step off right leg (first step); 4.step left leg (first step); 5.step down left (second step); 6.step off right leg (second step); 7.step off left leg (second step); 8.step right leg (second step); 9.step down right (third step); 10.step off left leg (third step); 11.step off right leg (third step); 12.step left leg (third step). Partners are dancing in face to face position.

Design of the study

Four top level dance couples (with the highest „S“performance level) were involved in the study (average age 24,3±2,2 years). To examine the routine and the particular feather step biomechanically we have filmed dance figures by high speed camera with frequency 50 frames per second. Partners danced separately while recording the video. This method was chosen in order to see all necessary points for precise and correct evaluation, otherwise it might happened that partners would cover each other while dancing in pairs. In total, 19 anthropometrical points were evaluated, to which we emphasised vertical and horizontal points. In order to analyse the particular movement, a kinogram was created. Subsequently, we processed and evaluated digitalized images by 2D analysis. The measured data (the path of gravity and angular changes at knee joint) were documented, evaluated and compared between male and female partners as well as dance couples by programme ADOBE PREMIERE PRO 7.

Results

All measured data were compared with dance partners of each other. The spatial characteristics of movement are documented at the knee joint angles during the download phases of the stepping leg and knee joint angle of the stance leg as well as during the cradle (at the moment of out stepping). Next, we followed the path of centre of gravity (COG) of the male and female partners. From the all measured values we have chosen only those after every 25 cm of movement, because of so called “wave” movement, which is very typical and involved in almost every dance figure pattern.

Trajectory of COG during the feather step while dancing Slow fox in the group of male partners is almost identical (figure 1). Dance figure constitutes wavelike pattern (lift and decrease phase), having a similar course for all partners. The difference is in the installation of gravity and height, which is very individual. By comparing the partners the results show a flatter trajectory of the centre of gravity in Partner 3. Thus, its uplift and reduction phases compared to the other dancers of their minimum. On the other hand, the longest path of movement (3.9 m), hence maximum lift phase of partner 4 is beyond the limitation of 2.5 m distance (figure 1).

Figure 1. Trajectory of Centre of Gravity in Feather step during Slow Fox (men)

The value of COG in female dancers documents different trajectory, lifts and reduction phases as well. The most identical, as it is apparent on figure 2, is the distance of approximately 1.25 m, which creates a very similar wave of movement. The longest feather step of Partner 2 (with the length of 3,39 m) results in flatter course of movement.

Figure 2. Trajectory of Centre of Gravity in Feather step during Slow Fox (women)

To show the identical movements of each partner is important for their fluency without vertical difference and lost of contact. Therefore we compare the same characteristics within the dance couples. While in Couple 1 the trajectory almost matched, couple 2 show always different path of COG, which can cause asymmetrical, none well synchronized movement. The length of the feather step was nearly the same in the case of this couple; the only difference was just 6 cm.

The trajectory of COG in couple 3 is noticeable flatter at the first step and the following lift with approximately the same character of the wave at the both partners, but with a difference of 62 cm in length. On the basis of the different dance figure at the partner the tip of lift is moved at the wave. The male reaches his maximum lift at the distance 2,25 to 2,5 m, while the female could reach it at the 2 m distance.

Comparing male and female parameters in couple 4 we consider the path of COG is 75 cm longer in the male. Based on this difference the tip of wave is moved as well. The male has a maximum lift at the vary distance 2,5 till 2,75 m, female 2,25 m, which means that a woman has a flatter area of the centre of movement than a partner in the first step.

The results of angular changes are shown in figures 3 – 6. The angle of the knee joint during the stepping phases (as described previously) was measured for male and female partners. The angle in the stepping out phase of the right moving leg as well as for the step off phase is the biggest *for male partner* 4 (figure 6). During the second step the angle at the knee joint on the right leg was very similar in all the partners with a small divergence for male in dance couple 4. Interestingly, the same person reached the biggest angle (164°) also during the third step.

Figure 3. Angular changes during the Feather step in different phases

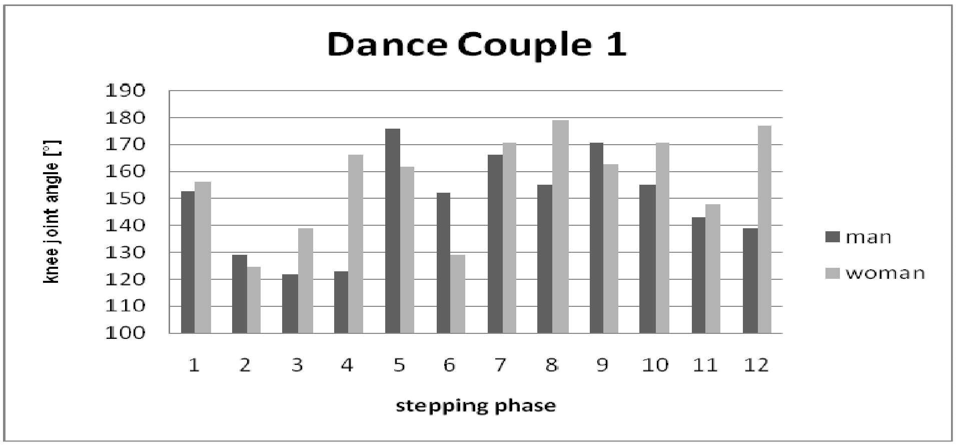


Figure 4. Angular changes during the Feather step in different phases

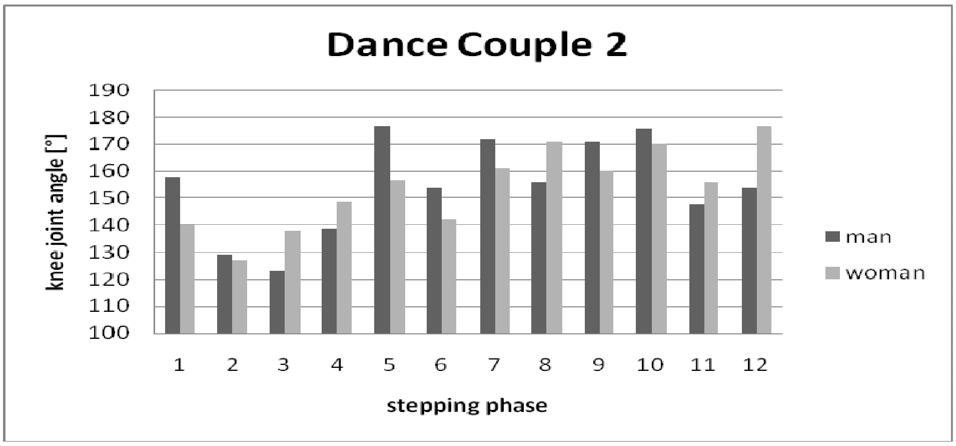


Figure 5. Angular changes during the Feather step in different phases

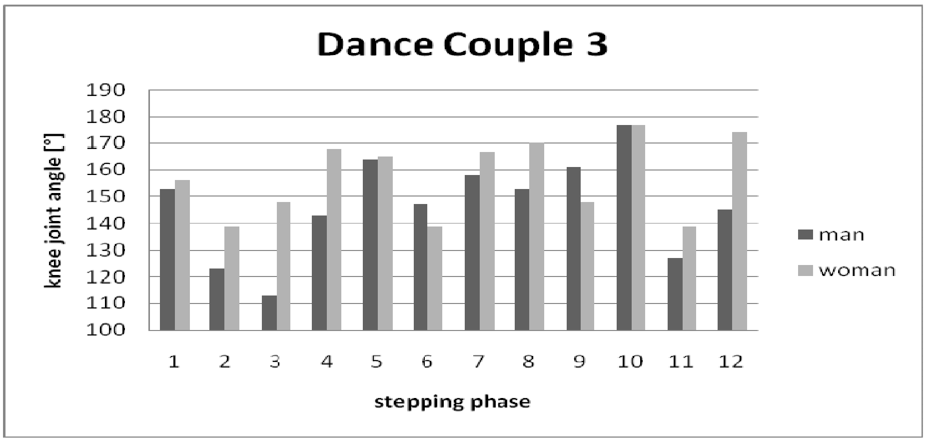
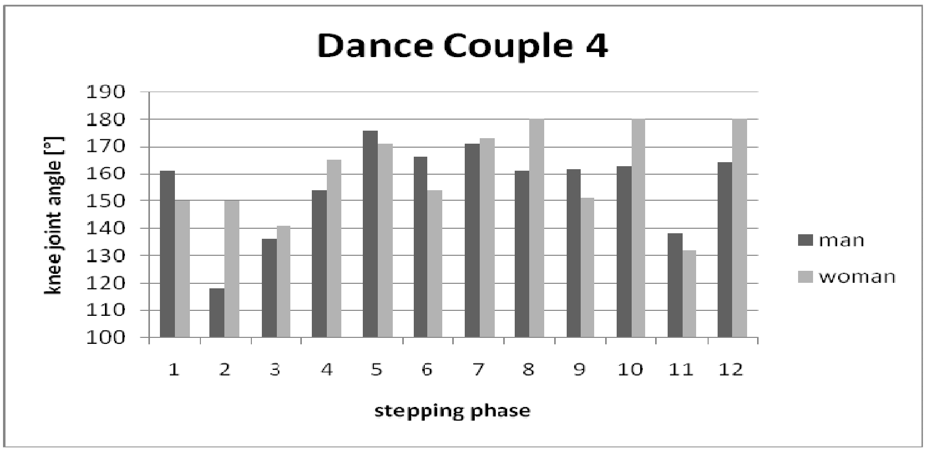


Figure 6 *Angular changes during the Feather step in different phases*



For female partners the results are almost similar in comparison to men. The greatest divergence showed partner number 2 and that is 16° more than the others (the first step). Very similar values have been measured in the knee joint of the right moving leg. The angle during step off the right standing leg was similar at partners with numbers 1, 3 and 4. The left moving leg was bended at similar angle in partners 1, 4 and 2, 3. Further, figures 3, 4, 5, and 6 clarify the differences between male and female within the same couple.

Discussion

All four dance couples differed slightly in measured spatial characteristics. Despite this fact, no couple made a mistake while performing the steps, either in stepping technique or the lined rhythm, and the evaluation showed correct technique. Dancing couples in the same conditions reached different readings in angle of the knee joint as well as trajectory of the centre of gravity during motion. This may be due to differences in somathotype, lack of compression of the stance leg or vice versa too much reduction. Lack of the compression or excessive reduction may interfere with the course in the nature dance movement, but also in pairs, if not done at the same level. During this movement will be mainly different trajectory to the centre of gravity. Will therefore correspond to each characteristic wave dance track shown is figure and gravity. Reduction of quality or stroke will occur vertically excessive fluctuations in the movement of a pair and will not be symmetrical. The readings will be less variance between each pair, the movement is in a pair of compact vertical without fluctuations. The spatial characteristics of movement are documented in individual

Despite of popularity of dances in general few studies are reported in literature. Additionally, such biomechanical analyse of the movement was done at the dance sport in Slovak Republic for the first time. Therefore, the results are hardly comparable because of different dances, dance figures, tempo and rhythm, etc.

It is concluded that a better understanding of the movement is important for creating teaching models that will improve and enhance technical potential.

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