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Comparative analysis of difficulty degree of kinematics based on sports skills and daily actions

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ABSTRACT

There are lots of similarities between daily actions and sport skills, and difficulty degree of skills can be effectively assessed from perspective of kinematics. In the process of study and discussion, five commonly used movement skills in daily life were chosen, together with five corresponding sports skills, which are respectively as follows: daily door-pushing, kicking movement, flies-patting, normal leap and walking; powerful serve of tennis, snap pass, instep kick(football), stride jumping and heal-and-toe walking race, joint displacement comparison and that of movement speed are effectively made towards right shoulder and elbow, ankle & wrist on the basis of similarity, so that complexity of sports skills themselves can be manifested to a initial extent, which is furthered in terms of difficulty degree by effectively comparing maximum speed of right foot, knee, hip joint movement. In this study, data analysis and processing, together with effective processing and analysis of video and image data by instruments are made, in order to provide strong theoretical and data basis for the research and exploration.

KEYWORDS

Athletic skill; Daily movement skill; Comparative analysis; Difficulty degree and exploration & research.

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INTRODUCTION

From the perspective of daily actions, whose characteristics have certain similarities with that of sports skills, however, displacement, amplitude and speed of all joints required by sports skills are larger, which differs greatly from that of daily actions, and this makes it possible of making scientific comparison between their difficulty degrees. In the process of research and exploration, comparative analysis was made in combination of five groups of skills: flies-patting and powerful serve of tennis, walk and heal-and-toe walking, door-pushing and snap pass, kicking movement and instep kick(football), and further research was made towards their similarities and differences on the fundamental basis of differences in joint movements, so as to manifest difficulty degree of athletic skill scientifically.

RESEARCH OBJECT AND APPROACH

Research object

In the process of research and exploration, movement of walk, jump, kick, push and whip involved in daily activities were mainly selected for making effective comparison between their basic techniques and that of similar sports, so as to conduct effective analysis of corresponding difficulty degrees on the basis of their similarities and make research process of this study more reasonable.

Research approach

Literature

In the process of research and exploration, large number of literatures in relevant kinematics fields from home and abroad were referred to for composing this study, effectively understanding history of physical education development, together with further exploration made towards difficulty degrees of relevant sports skills, in order to provide sufficient theoretical basis for this study.

Analytical method of film

In the process of research and exploration, effective shooting was made towards relevant sports and basic actions in daily life with high-speed camera. And this study mainly compared following groups of action: flies-patting and powerful serve of tennis, walk and heal-and-toe walking, door-pushing and snap pass, kicking movement and instep kick(football), which is followed by effective analysis of film data through film analyzer, so as to provide solid support of data for the research and exploration[1].

DISCUSSION AND ANALYSIS

Flies-patting and powerful serve of tennis

Displacement comparison between right shoulder, elbow and wrist joint

It's clearly shown in three comparative figures below(Figure 1 to 3), there are lots of similarities and differences between flies-patting and powerful serve of tennis: firstly, it's required for both of them to generate power with right shoulder, elbow and wrist joint, and corresponding sequence maintains a high degree of similarity, while what differs powerful serve of tennis from flies-patting is the final whip movement, fully embodying its technical complexity; secondly, time for completing them is more or less different, with that of powerful serve of tennis being comparatively longer than that of flies-patting; finally, the displacements of right shoulder, elbow and wrist joint are different-both amplitude and trajectory of these three joints in powerful serve of tennis are long, whereas it's rightly the reverse case with flies-patting, for no long displace or amplitude is needed for completing the action; the complexity of powerful serve of tennis can be fully manifested from this aspect, raising higher demand of right shoulder, elbow and wrist joint.

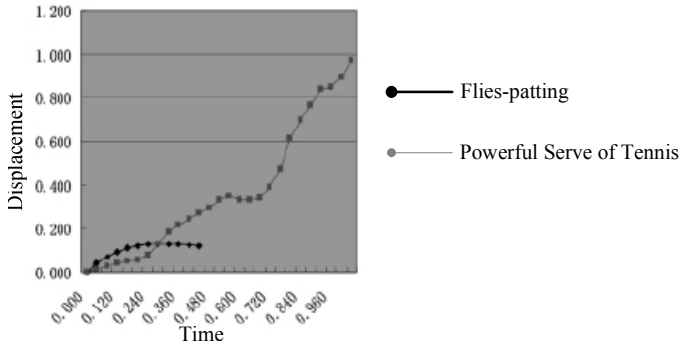

Figure 1 : Displacement comparison of right shoulder joint between flies-patting and powerful serve of tennis

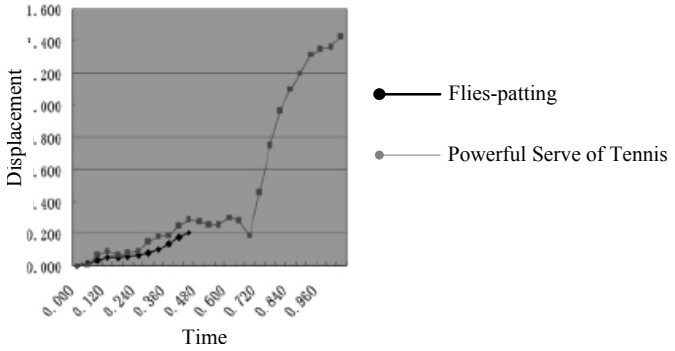

Figure 2 : Displacement comparison of right elbow joint between flies-patting and powerful serve of tennis

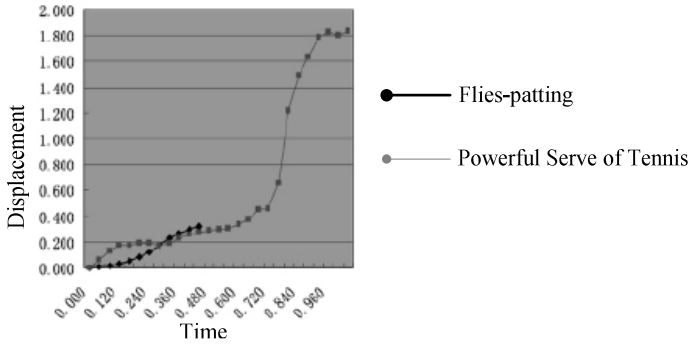

Figure 3 : Displacement comparison of right wrist joint between flies-patting and powerful serve of tennis

Speed comparison of right shoulder, elbow and wrist joint

It's clearly shown in three comparative figures below(Figure 4 to 6), movement speeds of right shoulder, elbow and wrist in performing powerful serve of tennis are fast, and it is substantially larger than that of flies-patting, fully embodying the complexity of powerful service of tennis: faster movement speed, longer movement trajectory and larger movement amplitude.

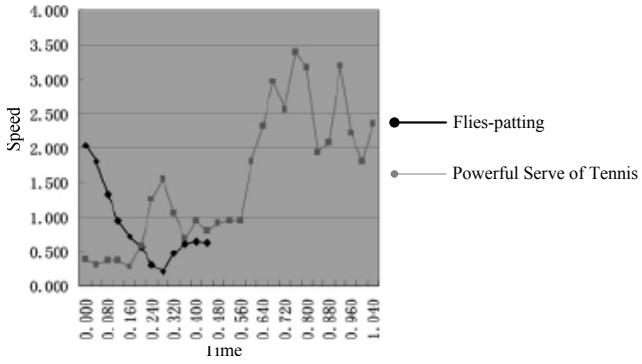

Figure 4 : Displacement comparison of right shoulder joint between flies-patting and powerful serve of tennis

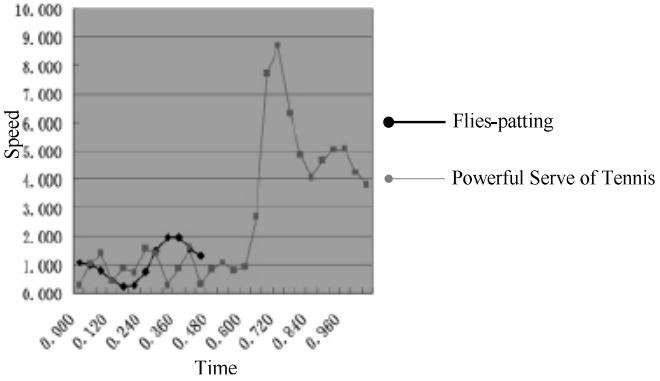

Figure 5 : Displacement comparison of right elbow joint between flies-patting and powerful serve of tennis

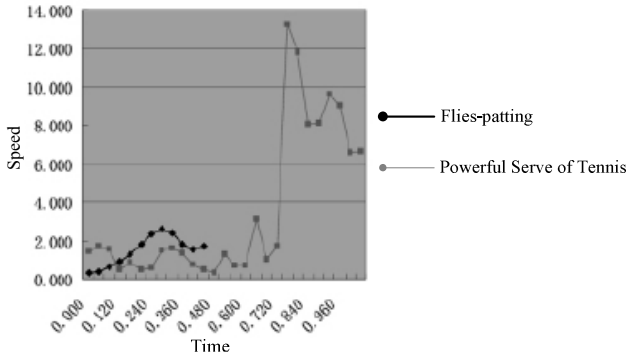

Figure 6 : Displacement comparison of right wrist joint between flies-patting and powerful serve of tennis

In respect of powerful service of tennis, it involves more broad range of technical movements, having certain similarities with that of flies-patting, however, flies-patting lacks lacks the movement of whip, which shows that powerful serve of tennis is harder than flies-patting technically. And comparing with movements of flies-patting, powerful serve of tennis features faster speed, longer trajectory and larger amplitude of right shoulder, elbow and wrist joint, which makes it endowed with strong explosive force.

Walk and heal-and-toe walking

Displacement of Right Foot and Wrist Joint

It's clearly shown in following two comparative in Figure 7, amplitude of arm swing in heal-and-toe walking is larger, which improves the movement speed of human body[3], and this makes it different from normal walking, which is apparently more casual as there is no corresponding specific requirements, however, both of them are repetitive movements, on which lies the similarity between heal-and-toe walking and normal walking.

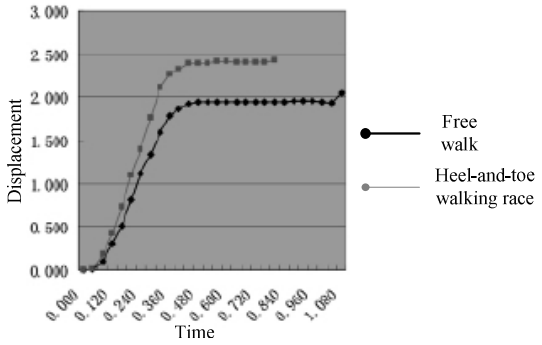

Figure 7 : Displacement comparison of right foot between walk and heal-and-toe walking

In addition, time for completing a multiple step in heal-and-toe walking is shorter comparing to that of normal walking. Finally, movement trajectory per unit time of heal-and-toe walking is also longer than that of normal walking. Though there might be certain similarities between them, heal-and-toe walking is more complex technically, with larger amplitude of wrist joint as well.

Maximum speed comparison between right foot, knee and hip joint

It's clearly shown by data in TABLE 1 that, there are high level of requirements with respect to swing amplitude of right foot, knee and hip joint, force exerted by which constitutes the main difference between it and normal walk, and this makes speed of heal-and-toe walking larger. However, form what's similar about them, it also testify to the technical difficulty and corresponding performance of heal-and-toe walking[4]. And a few factors that embodies this aspect are as follows: one, minimal time of completion; two,large amplitude of joint movement to possible extent;three, maximization of joint trajectory; four, speed of joint movement maintained at the fastest speed.

TABLE 1 : Maximum speed comparison of right foot, knee and hip in heal-and-toe walking

	Speed of right foot	Speed of right knee	Speed of right hip
Normal walk	8.27	4.25	2.74
Heal-and-toe walking	10.01	7.23	5.26

Door-pushing and snap pass

It's clearly shown by data in TABLE 2 that, there are certain similarities between movement essentials of door-pushing and snap pass, which, however, raises higher demand of technical movement on upper limb, i.e., speed of right shoulder, elbow and hand are relatively faster in passing the ball out, and this constitutes the main difference between it and door-pushing, while from another point of perspective, it also shows that technical essentials of snap pass is more complex.

TABLE 2 : Transient speed comparison of right shoulder, elbow and hand between door-pushing and ball-passing

	Speed of right shoulder	Speed of right elbow	Speed of right hand
Transient speed of door-pushing	0.56	0.40	0.32
Transient speed of ball-passing	0.58	2.7	10.17

It's shown in three figures above(Figure 1 to 7) that, in the process of comparison, pressure resistance generated towards ground and corresponding durability continue to increase as action time become longer and longer under the circumstance where body is controlled by mesosome. On the basis of left foot exerting force towards ground, push forward right foot and ensure the whole body won't suddenly incline to the right, which will show the process of technical details' formation more clearly[7]. However, when adding technical movement and effectively control it, the body will move to the right while left foot maintained normal exertion of force towards ground. After making corresponding addition of intention, athlete takes the clamping force test of feet and inner thighs-clamping force increases substantially in the process of putting left foot together, at the same time, ground fiction increases to a certain extent, guaranteeing that body's center of gravity is relatively low when right foot contacts the ground, so as to continuously decrease corresponding buffer distance, in addition, movement details of these technical movements are clearly shown, making it possible for athletes to control their body, as well as improve accordingly to a certain extent and continuously make movement to be more standardized.

CONCLUSION

The above is the study made on comparative analysis of difficulty degree of kinematics based on sports skills and daily actions, starting with the similarities between them. Research and exploration are fully made towards movement trajectory, action amplitude and movement speed of each joint. And effective illustration is made with corresponding comparative figures, in order to provide a strong guarantee for accurately judging and analyzing difficulty degree of sports skills in the realm of kinematics. The research process is rather scientific and rational, and it's expected that this study will provide a solid theoretical and practical basis for effectively conducting further research work.

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