

A Study on the Method of Examinations with 100 Strokes in Table Tennis

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1. Introduction

The method of examination with 100 strokes in table tennis is a technical diagnosis method derived from multi-ball exercise. This method is to examine table tennis players through scheduled technique combinations with the fixed quantity of 100 strokes, and it puts forward a quantitative evaluation on the basis of the statistics of faults and the calculation of percentage of successful hits. Multi-ball exercise has been widely adopted by table tennis coaches since the 1960's. Never the less, enough attention has not been paid to the recording of the quality of multi-ball exercise, to correct technique diagnoses for the enhancement of exercise effectiveness, nor to the production of a quantitative evaluation.

The method of examination with 100 strokes enables athletes to make correct diagnosis of their techniques through examination so that a transition from empiric judgment to quantitative evaluation can be obtained. We know that, as an important landmark of marching to scientific teaching and training, a quantitative evaluation for exercise quality should gain due attention.

Key Words : Examination with 100 strokes, motor skill, technical diagnosis, quantitative evaluation.

2. Purpose

2.1 To explain theoretically that the method of examination with 100 strokes can promote the formation and development of motor skills of table tennis players.

2.2 To explore the method of applying a group or individual technical diagnosis and a quantitative evaluation to subjects by designing and carrying out two scheduled procedures of examination with 100 strokes.

3. Method of Study

3.1 Method of examination

Procedure A:

Five handworks of forehand attack (1. net play 2. fast attack 3. off-table attack 4. pivot drive 5. smash) are chosen for procedure A with the quantity of 100 strokes.

Examination content is divided into 15 sets. In the former 5 sets, subjects stroke 10 balls continuously with one specific handwork in each set. In the latter 10 sets, subjects stroke 5 balls in each set, using handworks mentioned above in sequence. Times of fault will be registered for the calculation of percentage of successful hits. All the balls will be delivered by the coach and the ball placements are shown in diagram 1.

Procedure B:

Five comprehensive techniques (1. net play 2. push or block 3. pivot attack. 4. dash to forehand 5. backhand attack) are chosen for procedure B with the quantity of 100 strokes. Examination content is divided into 15 sets. In the former 5 sets, subjects stroke 10 balls continuously with one specific technique in each set. In the latter 10 sets subjects stroke 5 balls in each set, using five techniques in sequence. Times of fault will be registered for the calculation of percentage of successful hits. All the balls will be delivered by the coach and the ball placements are shown in diagram 2.

3.2 Method of mathematical statistics

3.2.1 Examining the exercise effectiveness of the examination and re-examination by applying t-test on percentage method to the percentage data of the two samples.

3.2.2 Calculating the correlation coefficient between the techniques examined in procedure A or B, and the match performance with a rank correlation method; and examining the significance and applicability of this coefficient.

3.3 Subjects

Players majoring in table tennis from classes of Sports Department (N=13) and of Physical Education Department(N=8), the Beijing Institute of Physical Education; players from Qinghua University table tennis team (N=8).

4. Results and Discussion

4.1 Practice indicates that the design conception and the test method of "the method of examination with 100 strokes" are consistent with the regularity of development process of motor skill explained in exercise physiology. So it is scientific to a certain degree.

The content of examination with 100 strokes, as is mentioned above, is divided into 15 sets. In the former 5 sets, subjects stroke 10 balls continuously in each set, using one specific handwork (or technique); in the latter 10 sets, subjects stroke 5 balls continuously in each set, using five handworks (or techniques) in sequence. The method of examination is based on the regularity about the development of motor skill explained in exercise physiology. A reference of exercise physiology points out that: "The development process of motor skill, with the participation of diversified sensible function, means the formation of the nerve connection of temporary between diversified sensible function and kinesthetic cell of cerebrum context. Proprioceptive sensibility plays an extremely important role in the development process."

The formation and development process of motor skill involves four sequential stages; namely, the generalization stage --- the differentiation stage --- the consolidation stage --- the kinesthetic automatic stage. These four stages indicate the general regularity about grasping any motor skills. The method of examination with 100 strokes has extremely active effects on the transition from generalization stage to differentiation stage for table tennis players.

4.2 Examination with 100 strokes, taking percentage of successful hits as the standard of quantification, reflects the training effectiveness obtained by a group or an individual after a certain stage of teaching or training, through comparison between the two results of examination and re-examination, in order eventually to put forward a quantitative evaluation.

Two radial-shape sketch maps for procedures A and B (diagram 3,4) have been drawn according to the comparison tables (Tables 2,3) of percentage of successful hits obtained separately in examination and re-examination of procedures A and B.

The radial-shape diagrams reflect accurately the group level of players from a class (Grade 91, majors in table tennis) of Physical Education Department, the Beijing Institute of Physical Education. The average percentage of successful hits rose from 68.9% to 83.6% in procedure B. T-test of the two sample percentages in procedures A, B are all very significant with $t=6.85$ in procedure A and $t=23.7$ in procedure B. And $t > t_{[0.01]}$ ($p < 0.01$).

The diagrams also indicate that the players have made great progress in grasping the five comprehensive techniques chosen for procedure B (net play -- push -- pivot attack -- dash to forehand -- backhand attack) and they have been able to apply various technique combinations to training practice.

4.3 The feedback information obtained from the examination with 100 strokes and the radial-shape diagrams shows the current state of players' completing handwork (or technique) chosen for examination, puts forward a quantitative technique diagnosis and lays a reference base for designing and regulating the training schedule.

Radial-shape diagrams of procedure A for player Qiao, who comes from table tennis class of Physical Education Department, show that the percentage of successful hits of five forehand attack handworks are: 68% for examination and 81% for re-examination. Although the percentage of successful hits have risen by 13%, the hit state of all sub-item techniques shows that pivot drive is still a weak point and enough attention should be paid to the enhancement of the ability of attacking back-spin balls (diagram 5).

Radial-shape diagrams of procedure A for player Gao, who comes from Qing-hua University table tennis team, show that his percentage of successful hits using comprehensive techniques are 80% and he had the worst performance in dash to forehand after pivot attack, with the percentage of successful hits being 55%. We can see that his footwork for dash to forehand has serious weakness (diagram 6).

Just like the two examples mentioned above, we made quantitative technique diagnoses for the current state of subjects' motor skill on the basis of feedback information obtained from examination with 100 strokes, and thus we put forward relevant training measures.

4.4 The results of calculating the rank correlation between percentage of successful hits and match performance in procedure A and B reveal that we should take the rationality and applicability of technique combination into consideration when choosing items for examination. For athletes on a certain level, examination content and degrees of difficulty should be related to the playing style and characteristic of athletes as closely as possible.

4.4.1 In procedure A, the calculated rank correlation coefficient between percentage of successful hits in examination with 100 strokes and match performance, is as follows: $R_s=0.62$ ($p<0.05$) for players from Sports Department (Grade 83, majors in table

tennis); $R_s=0.79$ ($p<0.05$) for players from Physical Education Department (Grade 91, majors in table tennis). From the data above, we can draw a conclusion that rank correlation between percentage of successful hits of examination with 100 strokes and match performance implies significant meaning. The reason is that "as one main attack technique and scoring means for table tennis athletes, forehand attack possesses the characteristics such as fast speed, power, great effect, flexibility, and so forth. The quality of five forehand attack handworks have an immediate effect on the results of competitions."

4.4.2 The calculated rank correlation coefficient between percentage of successful hits in examination with 100 strokes and match performance in procedure B, is as follows: $R_s=0.77$ ($p<0.05$) for players from Physical Education Department (Grade 91, majors in table tennis) with p being significant; $R_s=0.61$ ($p>0.05$) for players from Qinghua University table tennis team with p not being significant.

When analyzing the reason of divergence, we can see that most of the former players, who were beginners practicing standard preliminary training, have not formed a regular playing pattern, so their quality of preliminary training is related closely to their match performance. As is shown in procedure B, those who got higher percentage of successful hits got higher ranking place in matches as well. The other athletes, players qualified for first-class level, have formed their regular playing patterns and technique styles. There are many other factors, besides the appearance during the examination of five comprehensive techniques, such as technique of service or re-service, consciousness of initiative attack, application of tactics, physiological quality, physical fitness, and so forth that have some influence on match performance.

The above-mentioned practice experience reveals that the examination content should stress individual characteristics and reflect a variation of techniques with different difficulty degree, on condition that the players have formed regular playing patterns and technique styles. It is important that the contents vary from individual to individual. In a word, we should take various factors into consideration when choosing the technique combination for examination and make the combination more rational and more applicable.

5. Conclusion and Suggestion

5.1 The method of examination with 100 strokes is an examination method which offers a technical diagnosis for training effectiveness, inheriting some of the advantages from multi-ball exercise. Popularizing the use of this method has practical significance in a transition time from empiric judgment to quantitative evaluation for table tennis teaching and training, and it will promote the development of scientific teaching and training in table tennis.

5.2 The methods of examination with 100 strokes adopts different test methods for the examination of five technical indices in the former 50 balls and in the latter 50 balls. The theoretical basis of the design conception is consistent with the regularity of the development process of motor skill explained in exercise physiology.

5.3 It is easy to calculate the percentage of successful hits when you apply the method of examination with 100 strokes. Comparison of data of the average percentage of successful hits for groups between examination and re-examination can reflect group training effectiveness after a certain stage of teaching and training. The coaches and athletes can make use of the feedback information to evaluate the current state of play-

ers' technique and to put forward a basis for designing and regulating the training schedule for groups or individuals.

5.4 The five technical diagnoses and their difficulty degree chosen for examination should be appropriate for the current training level of athletes. The exercise sequence of the five techniques should be combined with the needs of actual matches as closely as possible. And the technique combination for athletes on a certain level should be characterized by their playing patterns and styles so that the combination could have more applicability.

5.5 We suggest that the table tennis coaches, drawing on the experience of the design conception in the method of examination with 100 strokes, creatively choose various technique combinations for examination according to each particular practice. The practice experience reveals that, during the popularization of this method, the quality of strokes, besides the mere percentage of successful hits, should be considered and the evaluation for quality of strokes should be carried out when necessary. The combination of percentage of successful hits and the evaluation for technique will better enhance the rationality of technical diagnoses.

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