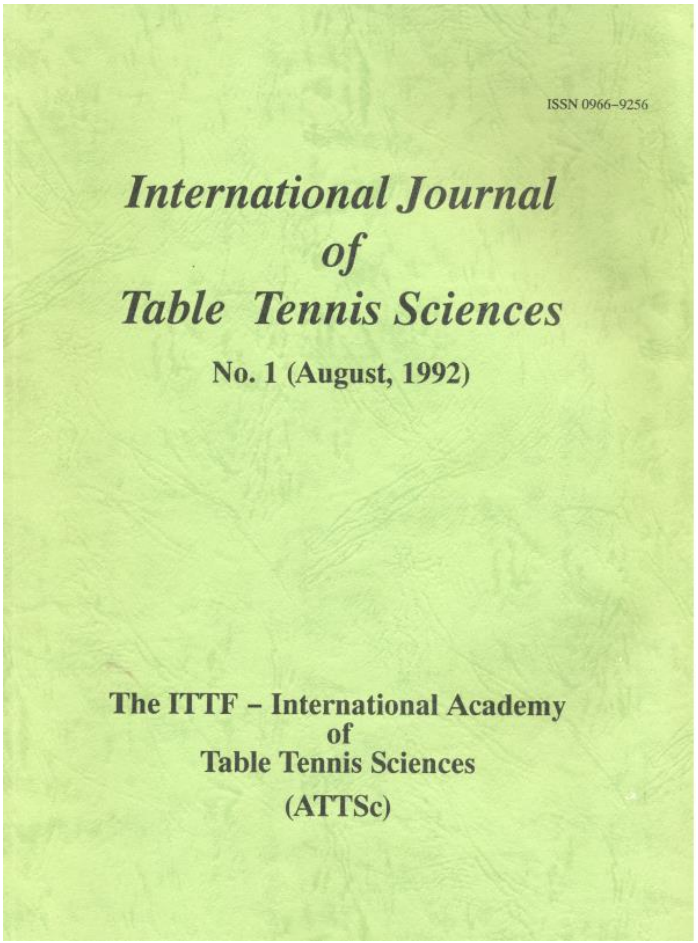
BOOK OF ABSTRACTS – 1989

NOTICE!

In front of the 1st ITTF Sports Science Congress Book of abstracts was not published but it was included in first issue of the International Journal of Table Tennis Sciences



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Summary of Addresses at *the 1st ITTF Sports Science Congress (the ITTF Scientific Congress)*

Development of a Sport Specific Field Test of Physical Fitness for Elite Table Tennis Players in Canada

Alfred Reed,
University of Ottawa, Ottawa, Canada

Introduction

The sport of table tennis requires a high level of physical fitness that is specific to the demands of the game at the level of play for which the player is training and competing. In order to determine if a training programme is producing the proper improvements in fitness, it is necessary to monitor training with a testing program.

Such a testing program exists in Canada with the National Team players. Part of the testing program includes the use of a field test, called the motor-ball test, which is used several times during the year at the National Training Centre in Ottawa.

The purpose of this presentation is to describe the motor-ball test and its use to monitor the physical fitness of table tennis players in Canada.

Rationale

The speed and power requirements of international table tennis competition result in demands on speed and power. Physiologically, this requires use of the aerobic and anaerobic energy production systems within skeletal muscle.

The anaerobic systems (both lactic and alactic) provide high rates of energy, particularly in fast-twitch muscle, to support quick, powerful movements. The aerobic system provides basic fitness and the recovery speed required between points, games, and matches during the course of a tournament.

The motor-ball field test has been developed to evaluate both the ability to execute accurately a series of high speed movements and also the physical reaction and recovery, as indicated by heart rate and blood lactic acid levels.

On the following pages are both the testing protocol and a recent set of test results of Canadian National Players for the motor-ball test.

Testing Protocol for the Canadian National Table Tennis Team Motor Ball Performance:

The anaerobic testing relies on high intensity play for short durations in a repeating format to determine two maximal physiological responses and the accuracy of the player's shots. As such, this fatigue test generates high heart rates and high lactates for each player (lactate - an intermediate metabolic fatigue agent).

First, during the test 10 balls are served, one per second, from the other side of the net with a high enough bounce to facilitate a fast top spin return action. The server has at least 100 balls on hand and serves on cue from a prerecorded tape message. Rest intervals of 10 seconds intersperse each series of volleys. Another player has the responsibility for counting the number of misses. Misses are recorded for each repeat and a total is recorded.

Heart rate recovery, at test's end, is recorded from a PE3000 heart rate monitor at the 30, 60, and 120 seconds marks. Total heart rate recovery for the two minutes is then calculated along with the percentage of the total recovery that the one minute recovery represents.

Blood lactate is measured from a mixed venous-arterial sample of 20 microlitres, taken at a fingertip of the non-racket hand. Samples are taken at the 2, 3, and 5 minutes marks.

An overall peak lactate value is determined (and recorded) by passing the samples through a lactate analyzer. A lactate recovery index is obtained by the following calculation: (peak value - 5 minute value)

divided by peak value.

MOTOR-BALL RESULTS

WOMEN (n=9)	MEAN	S.D.
Peak laktate (mmol)	3.29	1.01
Peak heart rate (bpm)	166	8
2 MIN. Heart Rate Recovery (bpm)	75	12
% Heart Rate Recovery 1 min. (%)	73	13
Absolute Lactate Recovery (mmol)	0.61	0.32
Lactate Recovery Index (%)	21	14
Number of misses	8	6
Men (n=7)		
Peak Lactate (mmol)	3.54	1.17
Peak Heart RAte (bpm)	152	15
2 min. Heart Rate Recovery (bpm)	56	12
% Heart Rate Recovery in 1 min. (%)	68	12
Absolute Lactate Recovery (mmol)	0.51	0.10
Lactate Recovery Index (%)	16	6
Number of Misses	8	5

The results show that the average accuracy of Canadian National Team players to return the 90 balls during the motor-ball test is slightly better than 90%, since the average number of misses for both men and women was 8.

The test is moderately demanding for men with the average heart rate of 152 and lactate of 3.54. Although the heart rate response of the women is higher, the mean lactate is slighter lower. Heart rate recovery is better for the women than the men, but the women are recovering from higher levels, so the value of the comparison is limited.

Both men and women remove about 0.5 mmol lactate from 2 min.. to 5 min. post motor-ball test. On a relative basis, this represents about 15-20% of the peak lactate they produced as indicated by the post test measures.

The values presented here represent considerably lower heart rates and lactate responses and improved recoveries from when the motor-ball testing was first initiated two years ago, indicating the motor-ball test is sensitive and responsive to the changing fitness levels of the players.

Test results from the motor-ball exercise are used in a program of minimum fitness standards which all players must reach and maintain to continue their participation on the national team. The motor-ball test is also used for fitness assessment of provincial and junior level players.

For some National A players it has been necessary to increase the difficulty of the return from flat drive to top spin in order to keep the test challenging for the higher calibre player.

Properly Applying Psychology and Physiology to Technical And Tactical Training of Table Tennis

Qiu Zhong Hui

Introduction

This article mainly discussed the function of psychology and physiology in technical training of table tennis.

Procedure

Technical and tactical training should lay emphasis on unfixed and flexible training, imitating and

adaptable competition are important guarantee of making good performances.

Abstract

Scientific training, the key to rapid development of technical levels, is one of the secrets to make success in competitive sports for different countries. Modern sports competitions, to a certain extent, can be characterized as competitions scientifically applying trainology, physiology, biomechanics and psychology.

1. The flexibility of training

Table tennis sport has the characteristics of antagonism and flexibility. So it is important for players to have advanced nerve activities, which can not only get excited quickly but also inhibited timely.

And the Transforming process between excitation an inhibition is very short . Consequently the players are changing fast in both techniques and tactics, and have a strong controlling ability.

Technical and tactical training should lay emphasis unfixed and flexible training. Only on the premise that energy are completely concentrated and excited, and first quality training is pursued as standard one, can the transforming ability be increased from excitation to inhibition on the cerebral cortex, On this basis various conditioned reflexes can be intensified.

2. Imitating Training

Having realized that table tennis, as an antagonistic competitive sport,it required to have its technical and tactical practice with certain opponents. We are doing our best to select and bring up players whose styles are similar to the foreign players as imitators. They vividly imitate the styles, technical and tactical features, even dresses, bats and sounds of the opponents so that the opponents can get a true feeling in technical, tactical, especially psychological training, and can get an apparently good training result.

3. Adaptable competition

Table tennis in one of the ball games which take the longest time for continuous competition. It has a high demand in psychology for player because of their great loss in strength and vigor, and unfixed competition sites, climates and time difference in international competitions. The audience's different habits and enjoying levels of different regions and countries, or the possibilities of making wrong judgement or missing a judgement by an umpire also can cause the player to psychological obstacles.

THE ROLE OF THE SPORTS MEDICINE SPECIALIST IN TABLE TENNIS

Italian Table Tennis Federation

Until about ten years ago the general physician who participated in sports had few medical tasks. He evaluated the preparedness of the athletes for competition and treated the injuries which occurred. He followed the injured athletes during their recovery and rehabilitation.

Today the sports medicine specialist has a much more complete and complex role. The first task is to do a functional evaluation of the athlete; following this he participates in the training programme, determines the functional adaption and modification of the various organs of the muscular skeletal system: another principal task is to have the athletes avoid the frequently encountered functional overload and repeated microtraumas which can be prevented by meticulous observation. Obviously, the task of preventing and treating general injuries is a major ongoing undertaking of the sports medicine specialist.

Recently the psychological needs of the athletes have become very important in the overall training program and thus, meeting these needs, has become another task of the sports specialist. The importance of jet-lag in the performance of athletes, the prevention of chronic fatigue, performance at different altitudes and rapid acclimatization often require pharmacological intervention by the team physician. Table tennis is a sport which is individualistic, asymmetric, requiring a precise technical ability and both aerobic and anaerobic work. It also entails a light degree of cardio-vascular endurance.

The participants must have quick reflexes, a high level of muscular tone and resistance, coordination, elasticity, and a complete range of muscular movement. Also, as we have noted, there must be a high degree of psychological preparation, particularly at the national and international competition levels.

The table tennis match itself does not have a fixed duration; however, the general match time does not exceed 15 minutes. The matches are played indoors and require a modest energy output from 350 to 400 Kcal/hour and perhaps a comparatively greater psychological stress.

It is difficult to describe the ideal table tennis player from the physical and psychological point of view. In fact, among the various champions in the field we can see alight, normal and heavy muscular builds. However, the ability of total concentration for the entire match is essential.

Both weight and center of gravity are important. The player's weight must be near the ideal weight for his or her stature and the center of gravity must be low.

Once the candidates for the table tennis team have been chosen, the sports medicine specialist begins the physical and psychological evaluation of each team member.

The basic objective of a complete and efficient raining program is to increase the efficiency of the body–mechanisms involved in table tennis.

Warm–up exercises should progress for at least 20 minutes and have a gradual increase in intensity. They should involve the large muscle groups which should be exercise to the state of fatigue; two or three training sessions a week are mandatory? It is help to have a variety of exercises in each session to avoid monotony. Each session should end with a cooling–down period.

The cardio–vascular component of the training program must increase maximum cardiac frequency and systolic out–put with a consequent increase in both cardiac capacity and capillary flow and a shift in blood flow from the vegetative organs to the muscular system.

At rest there should be a decrease in the athletes heart rate and a concomitant reduction in systolic and diastolic pressures.

At the cellular level, an adequate training program increases mitochondria size and some authors believe that also the number of mitochondria is increased. There is also a increase in myoglobin and enzyme reaction times in the oxidative metabolism of glucose waste products. Finally, there is an increase in capillarization, muscle fiber hypertrophy and an improvement in cholinesterase function.

A well planned training program can increase the response of fast muscle fibers. Obviously a complete training program incorporates cardio–vascular endurance, muscle tone and strength, flexibility and coordination.

Omitting one or more of these components of physical preparation reduces the capability of the athlete.

The traumatological aspects of ping–pong are rather specific. There is a functional asymmetric overload and/or frequent microtrauma. Trauma is most frequently localized in the joints and the ligaments–capsular structures.

The frequency of joint trauma from most to least frequent is : knee; vertebral column; shoulder, foot; elbow; and wrist.

Muscle trauma includes: contractures; pulls; and less frequently, tears. These injuries are usually localized in the femoral biceps, quadriceps and the femoral adductors and triceps.

Finally, tendon pathology is usually the result of trauma which leads to a degenerative state without preceding inflammation. The trauma is often the result of dynamic overload, incoordination and vascular disturbances.

The sports medicine specialist must also be involved in the dietary management of the athletes. While the effects on performance of selected diets are controversy, the results of a poor diet are not. The basic components of the athlete's diet are not different that of from the normal or sedentary individual; the main difference is in the quantities. Therefore, it is, important to evaluate the basal metabolism, the individual caloric needs for daily and sporting activities and the eating habits of each team member.

The percentage of the basic macromolecules are: protein 10–12%; lipids 25–30%; and carbohydrates 55–60%.

The distribution of calorie intake is usually divided into three to six meals. The precompetition meal should be consumed two or three hours before competition. The basic components of this meal should be carbohydrates.

Fluids are essential in the preparation of the athlete. The idea fluid will help maintain the electrolyte–fluid balance and should not have a temperature of less than 10 C. Obviously, carbonated beverages should be avoided.

In addition to the above mentioned tasks of the team physician, there are many secondary duties that cannot be overlooked. These include:

- training programs;
- prevention of acute and chronic fatigue;
- prevention of injuries;
- physiotherapy;
- choice of training camps and preseason preparation;
- preparation of clinical charts;
- diet tables;
- electrolyte solutions;
- acclimatization;
- biorhythms;
- vaccinations;
- pain therapy;
- doping.

Other associated duties are:
- collaboration with others members of the team management;
- scheduling medical examinations;
- scheduling vacations.

Our Table Tennis National Federation is composed of:
- a national medical council;
- medical consultants;
- preventive medicine specialists;

Our personnel organizations divided into sections, each of which overseas:
- planning;
- evaluation and medical assistance of athletes;
- trauma diagnosis and physiotherapy;
- consultations with other specialists;
- teaching;
- research.

In conclusion the sports medicine specialist, in collaboration with the others members of the training group is responsible for evaluating the athletic qualities which are indispensable for high level competition.

It is obvious that today's team physician must be highly trained and experienced. Our professional capacity and enthusiasm for table tennis enables us to overcome problems which at times can be difficult; these qualities also allows us to help advance the art and science of table tennis for both the sport itself and for in National Table Tennis Association.

APPLICAZIONE DI "ELITE" ALLO STUDIO DELLA CINEMATICA NEL TENNISTAVOLO

Italian Table Tennis Federation

Introduction

In sporting practice, the trainer is constantly engaged in the evaluation of athlete's gesture in order to formulate technical judgments, to verify training programmes, to single out and modify errors of execution.

The evaluation can be accomplished at a qualitative and quantitative level.

Generally, in order to get information about athlete's total efficiency we consider quantitatively the result of the performance (length, time, height) or that of some exercises connected to it, while the technical aspects are analyzed from a qualitative point of view. The qualitative analysis is made through

the visual inspection of the gesture or by the revision of television recordings. The final result is, however, the synthesis of sensation that, through experience and knowledge, the trainer translates into practical suggestions. When the observation of the gesture gives quantitative results, the trainer's intervention becomes more incisive, because his analysis is supported by a larger quantity of information. The knowledge of quantities difficult to perceive like velocity and acceleration, the total and exact description of all the periods of the movement, the possibility of employing the data stored in the archives and then of accomplishing adjective comparisons during the time, are part of this information. Working on this level is very important in all the sports where the technical aspect is the most important element to gain a result.

The table–tennis is one of this sport and is characterized by a further complication for the qualitative analysis due to the very complex and quick movements performed by the athlete and to the speed of the ball. Therefore, it's natural the interest that the possibility offered by the newer electronic technologies of computer vision for the quantitative analysis of the movement can provoke in the table–tennis trainers. The aim of this research is to illustrate through some preliminary results, the potentiality of application in table–tennis of the automatic TV image analyzer "ELITE".

Instrumentation

The instruments to recognize kinematical data must satisfy several requisites in order to guarantee right measures, particularly they must not alter the natural evolution of the movement. This tie becomes very restrictive when we talk about the sporting gesture, or a situation that see the man engaged in expressing all his motor potentialities.

Another element which is very important is represented by the time requested by data processing. If it is excessively dilated, it weights not only on the cost of the analysis but also on the possibility of an extensive application, making, so, improvable the statistical validity of the information resulting from the results. The time of the data processing is essential in sporting applications when the results are employed not only to acquire new knowledge but also to consider directly the effect of technical information and training programme on athlete's motor co–ordination. ELITE system has such requisites.

PICTURE–1 shows the essential elements of ELITE: 2 TV cameras take the moving subject and send its image to the first level of intelligence which recognizes the makers, calculates their co–ordinates and sends their numerical values to second level of intelligence.

The second level is represented by a general purpose computer which provides for the acquisition of the co–ordinates, for the elaborations and for the graphic representation of the results.

In common application, the markers are half–spheres 8–12 mm in diameter covered with light reflecting material, and are fixed to the subject or to the tool, by tape with double adhesive surface. The markers appear on TV image as luminous points, because they reflect selectively, towards the TV camera, the light emitted by a stroboscopic source of light, coaxial with the objective. The source of light emits in the infra–red spectrum which is not perceived by human eye. The identification of intelligence of "ELITE", elaborating mathematically the TV image which analogical signal is transformed by an analogical–digital converter in a numerical matrix of 256 lines for 256 columns.

Every element of the matrix corresponds to a pixel of the TV image and it is associated with a numerical value proportional to the level of gray took by the TV camera sensor for that pixel. Appropriate mathematical algorithms, which consider the circular and the brightness of the marker through a bi–dimensional function of cross correlation, are applied to the matrix–image. It is transformed in a new image in which it is easy to recognize the markers. The result is shown on a monitor through the correlated image. The presence on the correlated image of as many white areolae as the markers which are present on the original TV image, witnesses the correct setting–up of the system and the possibility to acquire, rightly, the co–ordinates of the markers during the movements. The system employed for the experiments acts with a frequency of 100 Hz (100 frame in a second). In order to achieve a recognition in line, or during the execution of the movement, it is necessary that the computer accomplishes a very high number of operation in a very short time, inferior to 10 thousandths of a second which divide 2 following frames. The second level of intelligence, represented by the general purpose computer, executes the following operations:

- acquisition of the co–ordinates of the pixels belonging to each marker

- computation of the barycentre of each maker, referred to the internal co-ordinates of the TV cameras and weighed with the values of the function of cross-correlation
- correction of the optical and electronic distortion of the image
- reconstruction of the three dimensional co-ordinates x, y, z of the markers as regards the system of spatial reference;
- order of the markers in relation to the model which represents the subject and the possible tool
- reconstruction of the co-ordinates of the markers darkened during the movement
- data filtering
- computation of linear velocity and the acceleration of the markers
- computation of the angles, velocity and angular accelerations among different segments and between segments and Cartesian axes
- graphic and numerical representation of the results

Results

Here, we show some preliminary results which have been obtained in experimental meeting near the National School of Athletics in FORMIA where ELITE is now installed.

The object of our study have been 2 young table-tennis players belonging to the Table-Tennis National School in Fiuggi. The verifications of applicability have been made according to three levels:
- analysis of the movement of the ball
- analysis of the movement of the subject and the table-tennis bat
- analysis of the movement of the subject, table-tennis bat and ball

Ball

The analysis of the movement of the ball in relation to the athlete's type of drive and ability of execution, is an essential reference-point for the trainer. Therefore it is very important to make experiments in these terms.

The ball has been covered with small disks of reflective material, spaced in such a way as to produce a good marker without altering the rebound properties.

Picture-2 we show some data obtained after the acquisition:

A) trajectory of the ball in a perspective vision

B) in frontal projection

C) in projection on the playing surface

D) in projection on the playing surface

Through filtering and derivative procedures, obtained by the computing programmes, we have got the values of velocity of the ball.

Picture-3 we describe the velocity of the ball through its components along the three axes X,Y,Z and through the moduli. The moment when the ball comes into contact with the table-tennis bat is clearly recognizable on the two graphs and it coincides with the brusque changes which we can observe in the curves. Analyzing the Y component of velocity we can value exactly also the moment of the contact with the table (minimum on the left of the curve) and consequently we can identify the interval of time which divides the rebound from the contact with the BAT.

The experiments we have made, have allowed to compare the values of the highest velocity of the ball going out after the execution of a service, of a top-spin, of a smash and also to measure the value of the velocity when the ball is going to be received by a player who undergoes a smash. The average values of the different velocity with the respective standard deviations, are shown in the histograms in Picture-4. As we can observe, the data give a quantitative confirmation of the differences well known by the trainers: the velocity increases during the passage from the service to the top spin and from this one to the smash. The velocity of reception after the execution of the smash appears naturally reduced in comparison with the going out velocity, in consequence of the air braking effect. An interesting datum regards the amplitude of the standard deviations. This statistical factor, which points out the variability of a phenomenon, shows that the four technical executions present different characteristics of repetitions. This can depend on the motor difficulty of the gesture, on the subject's executory ability and another cause is the non-use of a robot which standardizes the ball throwing.