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Tracking center of mass displacement in a novel speed test for evaluation of badminton-specific movements

a predictor of performance?

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The Science and Practice of Racket Sport for Improved
Performance and Health
Special Focus on Table Tennis

April 25-27, 2018

Book of Abstracts



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Thursday 26 of April 2018

Keynote I

Physical activity is the most important thing you can do for your brain

Anders Hansen, MD, MSc Karolinska institutet, Stockholm, Sweden

If I would have guessed ten years ago what the best way to train the brain would be, I would probably have thought about crossword puzzles, sudoku or cognitive apps. But then I would be wrong. The best way is physical exercise. During the last decade, neuroscience has shown that physical exercise has extraordinary effects on our brain.

Most people know by now that exercise will improve their mood - but few know that it will boost all of their cognitive abilities - memory, attention, creativity and how we cope with stress - it all gets better in a way unparalleled by any drug, food-supplement or cognitive training method.

In my speech, I will show how - and why the brain benefits from exercise and how one should exercise to reap the benefits.

Key note II

Performance optimization in Danish elite badminton (Badminton Denmark) with special emphasis on strength and conditioning

Mads Brink Hansen, Physiologist and Strength & Conditioning Coach, Team Denmark

With a history of 9 Olympic medals (2 Gold) since badminton became a part of the Olympic Games in 1992, 48 World championship medals (9 Gold) since 1977, and 63 European titles and countless silver and bronze medals since 1968, Denmark has a strong tradition of developing world class badminton players. The environment on Elite center Brøndby is characterized by a strong relationship between players and a community of coaches and the performance director. A learning environment focusing on developing intelligent, self-aware, self-regulating and dedicated players.

The presentation will focus on practical examples of performance enhancement through strength and conditioning in this environment, in close collaboration with the national coaches and other Team Denmark experts within sports psychology, physiological testing and applied research projects, recovery, physiotherapy and prehab, ergogenic aids, nutrition etc.

Parallel session I: Oral presentations

Health and Innovation

A Swedish female tennis player's junior-to-senior transition: A narrative case study

Alina Franck, Center of Research on Welfare, Health and Sport (CVHI), Halmstad University, Sweden

Natalia Stambulova, Center of Research on Welfare, Health and Sport (CVHI), Halmstad University, Sweden

Introduction

The junior-to-senior transition (JST) is key for athletes who want to reach the elite sport level, and often lasts between one and four years (Bruner, Munroe-Chandler, & Spink, 2008; Stambulova, 2009). Narratives (e.g., performance, relational, discovery) are often rooted within particular socio-cultural contexts (Carless & Douglas, 2012) and influence athletes' development and identities.

Aim and theoretical framework

This study aimed to explore the JST process through a narrative approach (e.g., Carless, 2008). The objective of this study was to explore an individual sport athlete's transition pathway through the JST with an emphasis on the psychosocial factors that the athlete perceived as facilitating and debilitating the transition process.

Method

In narrative research, the athlete is the storyteller (Smith, 2016), and the story is the source of data that provide understanding of the athlete's JST process. A narrative type interview was conducted, and the athlete Jessika was a 26 years old former national-level tennis player. During the interview Jessika was encouraged to reflect retrospectively on her JST. The interview (approximately 90 minutes) was transcribed verbatim, and the holistic-form structural analysis (Smith, 2016) was used to analyze the story.

Results

Jessika had a performance narrative as the central storyline; Jessika had high sport ambitions: "My goal was to go through the lower levels of [competitions] fast, so that I would advance to a level where tennis would be my job and I would be able to make a living at it". But, during her JST, she had to battle the challenges of a severe injury. This situation caused Jessika to rethink and restructure her life and develops an injury and reorientation narrative side storyline: "My biggest challenge has always been my body and finding a balance between practice and competitions that would make it possible to sustain a whole season. The idea was to balance

being away on the tour [competitions both national and international] to the time spent at home, meaning approximately 20 to 25 weeks per year on tour”.

Discussion and conclusions

In the end of the JST Jessica made the decision to terminate her career, but did not regret the years she spent focusing on sport. These findings illustrate that careers are neither just successful nor unsuccessful, but often a combination of both. Even though a career doesn't culminate in a gold medal, the athlete may still perceive it as successful (e.g. Carless & Douglas, 2012: 2013a).

Key words

Career transition; junior-to-senior; narrative.

Injuries Prevention Strategy / Table Tennis

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Aspetar, Orthopedic and Sports Medicine Hospital, Qatar

International Table Tennis Federation / Sports Science and Medical Committee

Introduction

High performance is the result of a multidisciplinary teamwork according to a sports career plan. High performance components are: technical, tactical, physical capacities, sports psychology, sports nutrition, sports recovery, injuries prevention strategy, healthy lifestyle.

The rate and the severity of sports injuries (acute and overuse) are closely correlated with the athlete's performance.

Table tennis is a non-contact sport. Overuse injuries are more frequent than acute injuries. The severity of acute injuries is linked to the time loss. Most overuse injuries allow table tennis athletes continue training and competing with pain and dysfunction which may affect negatively their performance and aggravate the injury itself.

Discussion and conclusions

The data collection is essential to identify the main sports injuries: incidence, prevalence, severity, mechanisms and aetiologies. Then a multidisciplinary team (physician, physiotherapist, biomechanics, fitness coach...) will collaborate and elaborate an "injuries prevention program" according to the data collection findings and the sports biomechanical and physiological requirements. After that, common preventives measures will be implemented. Additional personal preventive exercises can be applied according to personal previous injuries and the findings of the clinical examination and the functional tests (imbalances, weaknesses, discrepancies, lack of range of motion, lack of flexibility...). At the end, the effectiveness of the preventive measures will be assessed and the "injuries prevention program" might be improved.

I will share the experience of the data collection procedure within my company "Aspetar-Aspire Zone Foundation" which can be applied for Racket Sports and represent the first step to design a specific "injuries prevention program" that will influence positively the athlete's performance.

Key words

Performance, prevention, injuries, table tennis, racket sports.

SwingPingis – An innovative and norm critical physical activity tool for health for everyone

Lars Kristén, Center of Research on Welfare, Health and Sport (CVHI), Halmstad University, Sweden.

Mikael Ring, Associate professor. Unit for Human Geography, Department of Economy and Society School of Business, Economics and Law, University of Gothenburg

Introduction

Many children with a disability also face the risk of illness as well as exclusion. Exclusion from Physical Education in school is often related to the fact that there is a lack of inclusive sports equipment. SwingPingis consists of a ping pong ball attached to a string that is mounted on a door frame or any other extension of the room. The ball is hit by an ordinary ping pong racket. The tool is constructed for children with a disability, since the string makes the ball return on every hit.

Aim and theoretical framework

The aim of this article is to investigate an open collaborative innovation with lower level of activity goal that can contribute to a better quality of life for people with a disability. The question asked here is whether performative, independent bodily, norm critical, and existential aspects involved in the use of an innovative aid called Swing Table tennis (SwingPingis), has any impact on health and wellbeing for the children using the innovation?

Method

This study combines two types of method: phenomenography and ethnomethodology. The methods used in this study are interviews and observations of children with disabilities (pre-and post-measurement) and interviews with their Physical Education teachers. Observations were also carried out during classes using the tool.

Results

The results suggest that children and teachers perceive the tool as a means to an embodied and creative part of collaboration during the lesson, and in the teaching of the subject Physical Education. Children perceive Swing Table Tennis as an opportunity to get motor training and build bodily capacities to perform, which in turn were reported as a feeling of the joy in movement. The open character of SwingPingis as a health technology is seen here as creating a health benefit, an aid to help in the desire to master independency and aspects of collaboration, and thus also a potential stimulation of health.

Discussion and conclusions/expected outcome

The study shows the importance of adult overview, but also as challenging norms, demanding learning and creativity, and for creating inclusion. The results suggest that children and teachers

perceive SwingPingis as a creative part in the lesson and the teaching of Physical Education. Children perceive Swing Table Tennis as an opportunity to get motor training and feel the joy of movement. The children also reason about various health benefits. Teachers emphasize its usefulness and accessibility.

Key words

Children, disability, embodied physical education, norm critical innovation, health technology.

The effect of Spraino® on performance in a novel speed test for evaluation of badminton specific movements

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Introduction

Ankle sprain injuries are the most-frequent musculoskeletal injury, accounting for up to 30% of all sports-related injuries. Indoor sports are responsible for the highest prevalence of lateral ankle sprains, with the high shoe-surface friction mentioned as a major risk factor. This also applies to badminton, where the ankle joint is by-far the most-frequently injured bodypart with 23.5% of all injuries and 86.5% of these classified as lateral ankle sprains.

An innovative approach to prevent lateral ankle sprains is to reduce friction along the lateral edge of a shoe using Spraino®. This allows the foot to be repositioned whenever initial contact is made with the lateral aspect of the forefoot.

Previous studies have shown protective effects against ankle sprains with no limitations to performance and safety during typical indoor sports movements.

Aim and theoretical framework

High friction is in many ways viewed as fundamental to performance but is also associated with an increased risk of injuries. Hence, the primary aim of this study was to investigate if Spraino® can be used without reducing performance during a Badminton-specific Speed Test (BST) designed to simulate match-play. The secondary aims were to look at lower extremity kinematics and foot positioning.

Methods

Twenty-one international elite badminton players participated in the randomized crossover study (Thirteen males and eight females). All participants performed the Badminton-specific Speed Test (BST) two times in both conditions: with- and without Spraino®. Kinematic data were collected at 240 Hz using 15 highspeed infrared cameras (Oqus700+, QualisysAB, Sweden). Lower extremity joint kinematics were analyzed using Visual3D (C-Motion Inc., USA). A paired samples t-test was applied on the completion time of the badminton-specific speed test. A one-way repeated measures ANOVA was conducted on ankle, knee and hip kinematics, and the horizontal movement of the foot-center-of-mass, during the stance phase of the badminton lunge using Statistical Parametric Mapping.

Results

No significant differences were found in the overall performance of the BST ($p = 0.086$), with a completion time of 31.0 ± 2.2 s (Spraino) and 31.5 ± 2.4 s (Control), respectively. No differences were found in lower extremity kinematics between the conditions. No additional horizontal movement (sliding) was shown despite initial contact on the lateral aspect of the heel.

Discussion and conclusions/expected outcome

The trend towards a faster completion time highlights, that Spraino® can be used in badminton without reducing performance and without affecting lower leg kinematics.

A randomized controlled trial (NCT03311490) is investigating the degree of injury prevention when using Spraino® during seasonal play.

Key words

Badminton, ankle sprains, injury prevention, performance.

Theory based interventions – the value of motivational theory in health promotion

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Health-care costs are increasing twice as fast as wealth, making health promotion and development of cost-effective care increasingly important for generating sustainable health-care solutions. Health risks of physical inactivity are comparable to the risks of smoking, and the societal and personal benefits of helping people turn sedentary lifestyles into more physically active ways of living cannot be understated. Despite the large amount of information regarding the health benefits of regular physical activity, helping people participate in sustainable physical activity and changing exercise behaviours have therefore proven to be significant challenges. As much as half of all exercise initiators drop out within 3-6 months and it is well known that numerous exercise and physical activity interventions are ineffective in changing the targeted behaviour (Rhodes et al, 2017). One explanation is that traditional physical activity and exercise promotion programs often lack sound theoretical foundations and fall short in terms of structure and suitable evaluation systems. Previous research and practice have generated substantial knowledge of *what* works in exercise and physical activity promotion on a general level (e.g. goal setting, prompts, health information), but less is known more specifically about *why* interventions works; i.e. what the underlying motivational mechanisms are (Cerin & MacKinnon, 2009). Basing programs in adequate theoretical frameworks of motivation may increase adoption of sustainable health behaviors such as physical activity and exercise. Self-determination theory (SDT; Deci & Ryan, 2017) is a recognized and empirically supported theory of motivation that has a considerable amount of research supporting its notions in health behaviour change. In SDT the importance of autonomy support (e.g. encouraging choice) is recommended above using control (e.g. using demands or coercion) for successfully inspire behaviour change. Using SDT, analyses of the underlying motivational processes can provide a better understanding of why some interventions and programs are successful and others are not.

Keywords

Physical activity, intervention, self-determination theory.

Parallel session I: Oral presentations

High Performance

The fire that burns from within: Tales of legendary Swedish table tennis players

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Introduction

What are the psychological explanations behind the forces that motivate elite athletes to accomplish excellence in sports? Research indicated that elite athletes display high levels of intrinsic and extrinsic motivation (e.g., Mallett & Hanrahan, 2004), they exhibit high task and high ego orientations (e.g., Duda, 2001), and a stimulating environment combined with social support is essential for optimal development in later years (e.g. Côte, 1999). The current master thesis examined table tennis legends' perceptions of motivational forces across career stages by combining motivational and career frameworks.

Aim and theoretical frameworks

Self-determination theory (SDT; Deci & Ryan, 2000) distinguishes between behaviours individuals perform autonomously and those they perform for more extrinsic reasons. Achievement goal theory (AGT; Nicholls, 1989) proposes that differences in which individuals judge their competence (e.g., task *vs.* ego) are critical antecedents to direction and intensity of behaviour. Wylleman and Lavallee's (2004) lifespan model reflects the concurrent, interactive, and reciprocal nature of athletes' development in athletic, psychological, psychosocial, and academical/vocational domains.

Method

Jan-Ove Waldner and Jörgen Persson were invited to take part in the study. Narrative in-depth interviews were conducted; each participant was stimulated to tell his story in retrospect based on his perceptions of motivational drives across career stages. A holistic content and form, and critical narrative analysis were carried out based on Narrative Oriented Inquiry (NOI; Hiles & Čermák, 2004) model.

Results

Results revealed that both participants were (a) strongly driven by personal goals (e.g., winning major titles), (b) had high perceptions of ability (e.g., high task and high ego oriented), (c) table tennis was central to their lives, (d) they were surrounded by supportive environment, and (e) their basic psychological needs were satisfied. The *initiation phase* (7-9 yrs.) was characterized by both being involved in various sports and receiving social support from family and peers. During *developmental stage* (age 10-14 yrs.) both got involved in intensive practices and became National team members. A longer stay in China ignited their dream to win major titles. Waldner and Persson became professional athletes during *mastery stage* (age 15 and up). Winning gave the

biggest satisfaction during this stage, combined with dedication to learn, hard work, and independency to continuously develop the game.

Discussion and conclusions

Understanding what motivates elite athletes to accomplish high levels of performances across career stages may help coaches and parents to create an appropriate climate that facilitate optimal development. This study indicated that self-determined types of motivation combined with a stimulating environment and social support from significant others is essential to optimize learning and long-term development.

Keywords

Achievement motivation, career transition, elite athletes, self-determination, table tennis.

Technical-tactical comparison of women's and men's elite table tennis matches

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Match and notational analysis are well-recognized methods to collect and summarize important information about technical and tactical performance in racket sports in general as well as in table tennis. The most used technical and tactical indicators in Table Tennis are related to shot and footwork types used by the players during the game. The aim of this study was to compare the shot and footwork distributions in women (W) vs. men (M) elite Table Tennis competitions.

Ten women's and ten men's matches were analyzed. All players were in the top 111 (W) and 120 (M) positions of the ITTF world ranking. An expert coach analyzed game video footages in slow motion with the software Kinovea and collected data about the footwork and shot types used by the players across the whole games.

The results showed a higher number of shots/rally in W (5.7 ± 1.0) compared to M (4.7 ± 0.4) and significant differences between W and M in the distribution of both shots and footwork. Considering the shots, service is one of the most used shot by W (17.5%) and M (21.5%), and the top spin was the most frequent shot type in both W (27.6%) and M (27.0%). The push is mainly used to return services, represented 13.9% and 17.1% of the shots in W and M, respectively. Relevant differences between W and M are linked to the shots used to continue the rallies. In fact, W used more often the block (W:19.8%, M: 14.6%). Conversely, M prefer to counterattack with a Top counter Top (W: 5.5%, M: 11.0%). Considering the forehand (F) and backhand (B) shots, W adopted a more balanced style of play (F: 50.8%, B: 49.2%) compared to the M (F: 65.4%, B: 34.6%) and it is mostly evident in the use of the backhand drive (W:14.2%, M: 0.4%). Concerning footwork types, W prefer to hit the ball without performing any step (W: 40.7%, M: 20.9%), the "one step" is the most used step in M (36.6%, W: 21.8%), and the "crossover" is mainly used by M (10.6%, W 3.3%).

In conclusion, W showed a different distribution of technical variables in respect to M players, with a specific use of shots and footwork techniques. This study can be useful for athletes, coaches, and physical trainers to design specific training sessions for women and men in elite table tennis.

Key words

Match analysis; shots; footwork; women.

Effect of short term Creatine, Glucose and Creatine+Glucose supplementation on anaerobic performance in female table tennis player

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Introduction

Creatine supplement have been used by many athletes as ergogenic aid. Some researchers reported that this supplement is associated with improve performance and delaying fatiness. However, Creatine supplementation effect especially in combination with glucose in table tennis player is unknown.

Aim and theoretical framework

Therefore, the aim of this study was to investigate the effect of short term Creatine, Glucose and Creatine+Glucose supplementation on anaerobic performance in female table tennis player. in a randomised, double blind design, 40 female table tennis players randomly assigned in four groups including: 1. Glucose (G), 2. Creatine, 3. Creatine and Glucose supplement (Cr+G) and 4. Placebo groups. Subjects in all group consumed their supplement for 7 days. G group consumed daily 300-gram glucose, Cr group consumed daily 20 g Creatine supplement (in 4 meals, each meal 5 g) and Cr+G group consumed daily 300 g glucose and 20 g Creatine in combination with 250 ml water and placebo group consumed daily 250 ml placebo in one week course. Subject anaerobic power determined by 30 second Wingate test and vertical jump in baseline and after one week supplementations course.

Results

Present study results indicated that one week Creatine alone or with glucose supplementation don't affect anaerobic performance in female table tennis player.

Discussion and conclusions

According to present study results, it seems that short term Creatine supplementation can't improve anaerobic performance in female table tennis player and probably long term or high dose of creatine is required for improve anaerobic power of table tennis players.

Key words

Anaerobic power, Performance, Supplementation.

The Effects of the upper extremity weight gain on the Accuracy and Movement Pattern of Forehand Drive of Novice Players

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Introduction

Table tennis skills has a degree of complexity. The novice players require to learn important and effective factors such as movement pattern and accuracy.

Aim and theoretical framework

The purpose of this study was to determine the effects of upper extremity weight gain on the accuracy and movement pattern of forehand drive of table tennis in novice players.

Method

The 23 Female novice players with a mean age 22 ± 0.82 years were selected through convenience sampling and were randomly divided to under three different weight gain in upper extremity (no weights, light weights, heavy weights). After the pre-test, subjects took part in 3 different weight gain in upper extremity; no weights, light weights (500 gr) and heavy weights (1000gr), 40 trails for each. They performed 120 trails totally. Counterbalance conditions for weight gain were considered. Masters et.al test (2008) and researcher make scale were used to measure the accuracy and movement pattern of forehand drive, respectively. And also, different Weights, ball machine, digital video cameras were used to measure the accuracy and movement pattern of forehand drive. The data were analysed by ANOVA with Repeated Measure.

Results

Results showed that there is not a significant difference among the three different condition as increases in upper extremity weight; no weights, light weights and heavy weights on accuracy forehand drive, but there are a significant difference among 3 different condition from movement pattern of forehand drive of table tennis.

Discussion and conclusions/expected outcome

These findings suggested that upper extremity weight gain has an effect on the movement pattern of forehand drive, but, not effect on the accuracy of forehand drive in table tennis.

Key words

Weight gain, Forehand drive, Accuracy, Movement pattern.

The effect of using shadow practice to improve level of performance of the skill of footwork for table tennis juniors

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Introduction

The aim of this study is to improve the performance level of the skill of footwork for table tennis juniors in Egypt through shadow practice. The sample of this study was (16) players in the age group of (10 - 13) years old, they have divided into two groups, one is the experimental group and the other is the control group, the strength of each 8 players.

Method

The suggested training program has been applied to the experimental group for (8) weeks, to improve the skill of footwork through the shadow practice. While, the control group continued to be trained in the way followed in most of the clubs. It has been used the specific table tennis motor abilities tests, Ojokic Zoran 2010, in performing the pre and post tests on the two groups of study to measure the performance level of the skill of footwork in table tennis. A Mann-Whitney-U test for independent samples was performed to examine statistical differences between the two groups (experimental - control) in the variables of the study.

Results

The results of post-tests showed significant statistical differences between the two groups (experimental - control) in favour of the experimental group in the variables of study.

Conclusions

The researcher attributes the superiority of members the experimental group on members of the control group in the results of the post-tests in the specific table tennis motor abilities tests to the proposed training program by the researcher. Which indicates, the positive effect of using shadow practice in improving the performance level of the skill of footwork for table tennis juniors in the age group between (10 - 13) years old.

Key words

Table tennis, Shadow practice, Footwork.

A Comparison of Psychological Variables of Expert Women Table Tennis athletes with Physical Disabilities

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Sima Limoochi, Department of Motor Behavior, table tennis instructor, Alzahra University, Tehran, Iran

Aim

Dose the degree of disability influence the psychological variables?

Method

This study investigated the arousal, self-confidence, cognitive and somatic anxiety in expert women table tennis players with physical disability. Participants were 54 table tennis women players (27 sitting classes, 27 standing classes) from top 16 teams whom participated in 2018 Iran table tennis women super league. Self-confidence and somatic anxiety were assessed by two items of the Mental Readiness Form (MRF-3; Krane, 1994), Arousal and cognitive anxiety levels that were measured by "sport grid-revised" (Ward & Cox, 2004), 15 minutes before the scheduled time of the first match in 1/8 round of the competitions.

Results

Results of independent sample t-test analysis showed that cognitive and somatic anxiety of the players in standing classes were significantly higher than that of the sitting classes players. Self-confidence of the players in standing classes was lower than that of the sitting classes players. But there was not significant difference between two groups in arousal.

Discussion and conclusions

The results of the study show that, in spite of more physical disability and more limitation in movement, the players in sitting classes, had a higher level of mental readiness in comparison with players in standing classes. Therefore, more importance should be given to classification system for para table tennis players.

Key words

Classification System, Psychological Variables, Physical Disability, Para Table Tennis Players.

Parallel session I: Oral presentations

Sport Science

Attentional and Perceptual Abilities in Badminton Single Players

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Introduction

Although badminton is the world's fastest racket sport, it has received little attention in the sport psychology literature. In recent years there has been a growing interest in discovering whether there are differences in attentional biases of expert vs non-expert sports players. A study of basketball players found that experts show longer fixations for their target whereas beginners have longer fixations for the preparation of target (Vickers, 1996). A study of badminton players found that experts fixate more on the racket (69%) and the wrist (26%) than any other area in comparison to beginners (51%; racket, and 33%; wrist) (Alder, Ford, Causer & Williams, 2014). Recent research propose that experts may have the ability to evaluate intentions by using key points from body language (Jackson, Warren & Abernethy, 2006). Hence, deception and anticipation are two concepts of importance when researching sport. Noteworthy, within badminton, players need well-developed anticipation skills (Müller & Abernethy, 2012) as limited time hinders players from changing a stroke once they have started it. The most important shot in badminton is the serve. It determines who starts a rally and players unable to defend a serve will find themselves at the disadvantage in a match.

Aim and theoretical framework

The aim was to establish whether eye movement patterns differ between beginners and experts in a real-life badminton setting. As well as to create reliability in findings and to further develop the understanding of badminton and the existing abilities in players. Participants returned a total of 60 backhand serves (20 short, 20 long, 20 either short or long) on a badminton court in an arena whilst wearing SMI Mobile Eye trackers that recorded fixation sites and tracking patterns. The players are 11 beginners and 9 youth coaches from Halmstad Badminton Club, 11 experts from the Malmö Badminton Gymnasium and four experts from the Malmö Badminton Academy team and the Swedish Badminton League team. It was expected to find differences in development of fixation sites between beginners and experts.

Method

Quantitative-, eye tracking- and correlational studies.

Results

The hypothesis was accepted, the study did indeed find perceptual differences between experts and beginners.

Discussion and conclusions/expected outcome

The study seems to support the outcomes of previous studies- there are differences between experts and beginners in their fixation- and eye movement patterns. The implications of these findings will be discussed.

Key words

Badminton. Fixations. Eye movements. Correlations.

Comparative study on the number of training hours and the feedback provided by the coaches in individual sports that use or do not use rackets

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Introduction

The number of hours spent on the training field depends on the effort and type of confrontation that is specific of each sport. (Ciaccioni et al, 2017; Lei, 2017; Pluim, 2014). During the training hours, the coach provides technical indications and feedback, to preparing the athlete for future competitions (Yang and Jowett, 2013; Rocchi et al., 2013).

Aim and theoretical framework

The aim of this study is to investigate the relationship between the number of training hours and the feedback provided by the coach.

Method

We investigated 28 athletes divided in 4 groups (7 from table tennis; 8 from tennis; 6 from judo and 7 from fencing) with results in national and international competitions. The athletes have been assessed based on a survey regard to the number of training hours (hours of specific training - playing against an opponent, depending on each sport). For the purpose of this study, the training hours or other methods of preparation have not been taken into consideration. The coach's feedback has been assessed on a scale from 1 to 3, i.e. 1 = weak; 2 = average; 3 = very good. The participants have been assessed during the competition season.

Results

The MANOVA results indicated significant differences between type of sport and number of training hours, $F [3.27] = 5.77, p = .005, \eta^2 = .43$ and between type of sport and the feedback from the coach about athlete activity $F [1.27] = 6.59, p = .018, \eta^2 = .25$. No significant differences were determined between the training hours and type of the sport related with feedback from the coach, $p = .244$.

Discussion and conclusions/expected outcome

The racket sports differ from judo and fencing. One of the differences is explained by the time and type of contact between the athletes. Since judo and fencing are contact sports, the number of face-to-face training hours is smaller than in the case of racket sports, because of the higher risks of injury. On the other hand, in what concerns the athlete's perception of the feedback given

by the coach, our results show that in racket sports, athletes have a positive opinion about their relationship with their coaches, as opposed to contact sports, which show smaller values.

Key words

Rackets sports; individual sports; training hours; feedback.

Ping pong health! A table tennis intervention for improved health at the workplace

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Introduction

Physical activity has a positive impact on physical and psychological well-being (Delisle, Werch, Wong, Bian, & Weiler, 2010), as well as social relations and skills development (Lamu & Olsen, 2016; Perkins & Williamon, 2014). Adopting a "healthy organization" culture through health programs, with strong senior and middle management support, and using interventions can promote health at workplaces (Rajaratnam et. al., 2014). We, therefore, consider it relevant to have physical activity, social relations and skill development as the starting point in a table-tennis intervention at the workplace.

Aim

The aim was to develop, implement, and evaluate an intervention for improving health and well-being in the workplace by introducing table tennis.

Methods and results

The intervention design consisted of two workshops and five table tennis sessions. Thirteen employees from a warehouse within the retail sector participated in the intervention. The participants had various backgrounds in table tennis and sport in general, different motives to participate, and came from different groups of employees (management and stock). After an introductory workshop, two table tennis coaches held one training session a week over the five-week intervention period. The employees were divided into two groups and each group had a 45-minute session.

The evaluation is in progress at present. Pre- and post-measurement has been conducted using health questionnaires Short Form 36 Health Survey (SF-36) and International Physical Activity Questionnaire (IPAQ). These will be analysed using a Bayesian paired t-test analysis.

Based on the results of the questionnaire focus group interviews will be conducted with participants. Three focus groups of 4-5 participants in each group. The questions will focus on

experiences of the intervention and reflections on future directions for table-tennis and well-being activities at the workplace.

Finally, there will be a workshop pointing out future directions for sport-based health activities at the workplace.

Keywords

Health, well-being, workplace intervention.

Early or late specialization in elite sports – an investigation of Danish racket sports participants' road to the top

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Introduction

In order to achieve sporting success, a great deal of effort and training is required. But the question of whether a talented athlete should specialize in one sport from early childhood or experiment with different sports until a later age remains unanswered. This study investigated the question of early versus late specialization in racket sports athletes.

Aim and theoretical framework

The aim was to investigate whether racket sports athletes who specialize early or late achieve more success later in their elite career. Early specialization, as advocated by Ericsson (1996), is described as the accumulation of hours, in which the athlete performs deliberate practice, a practice activity with the purpose of improving a specific aspect of skill in the given sport. As the accumulation of practice hours is key, early specialization on just one sport is recommended for success. Late specialization, as advocated by Côté (2007), is described as the more playful form of practice and subjection to different sports in the athlete's childhood. As a wide range of sporting experiences is key, late specialization in one sport is recommended for success.

Method

Participants were 46 Danish athletes supported by Team Denmark divided into two groups (elite, n=16, and sub-elite, n=30) based on their results.

They completed a cross-sectional survey of retrospective nature, in which details on psychological characteristics, amount of training hours, and competition history, among other things, were asked about. To determine the decisive variables concerning specialisation and diversification, statistic regression analyses of the data were conducted.

Results

The regression analysis showed that two factors were important for later success. Age when entering the investment phase in Côté's model (i.e. when to specialize on just one sport) was significant - the older, the athlete was, the higher chance of success, lending support to Côté's notion of late specialization. Age when participating in first national tournament was also significant - the younger, the athlete was, the higher chance of later success, lending in part support to Ericsson's notion of early specialization.

Discussion and conclusions/expected outcome

It is not possible to draw a unequivocal conclusion based on the results of this study. As the two main findings to some extent contradict each other, it seems that the question of sporting success cannot be boiled down to a question of early versus late specialization, but that other factors should be considered as well.

Key words

Talent development, deliberate practice, deliberate play, racket sports.

To serve to win or to serve not to lose: Is there any difference?

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Introduction

Contemporary research has examined the phenomena of pressure performance in general, and that of choking and excelling in sport when performing under pressure in particular. While most research has looked into how performance deteriorates in a pressure situation, when compared to a non-pressure situation, studies examining how different types of pressure may influence same given performances have been scarce.

When it comes to the sporting arena, it would appear of particular interest to understand, fully, how different types of pressure may influence performance differently. For instances, it has been suggested that the pressure induced by the prospect of an incentive, if a given outcome is attained, may influence performance differently (given the incentive). Thus, different pressurising situations could affect athletes differently and, ultimately, both the impact of such perceived pressure on actual performance and the way athletes prepare to cope optimally with these different situations could, potentially, vary accordingly.

Aim and theoretical framework

We aimed at producing two distinct, ecologically-valid pressure performance tennis situations for both future research and applied uses. In particular, we focused on validating two different, pressurising tennis-serve scenarios – serve was chosen given the key role it plays nowadays in the game.

It was expected that both serve pressure situation scenarios would lead participants to experience higher emotional state levels (somatic and cognitive anxiety), when compared to a baseline, non-pressurising, serve situation scenario. No hypothesis was produced for the comparison between the two serve pressure situations.

Method

Firstly, two scenarios that related to different, yet plausible tennis match pressurising situations were developed (serve in the final set tie-break of a match). More precisely, Scenario 1 (serve to win) described the situation in which a player is closest to win the match (final set tie-break 6-3 up); if he won the serve he would win the match but if he lost the serve he would not lose the match. While Scenario 2 (serve not to lose) described a situation in which a player is closest to lose the match (final set tie-break 3-6 down); if he won the serve he would not lose the match but if he lost the serve he would lose the match. A baseline scenario that reproduced a no-pressure, serve situation at an early stage of a match was also developed.

Then, participants ($N = 23$; $M = 27.39$, $SD = 11.89$ years of age) with a tennis level ranging from 3 to 8 ($M = 6.39$, $SD = 1.34$; ranking ranged from 1 [sub professional] to 9 ([novice])), were randomly

assigned to complete cognitive and somatic measures for the baseline serve scenario first and, then, for either Scenario 1 (n = 11 players) or Scenario 2 (n = 12 players).

Results

Both tennis-serve pressurising situations (closest to win the match [Scenario 1] and closest to lose the match [Scenario 2]) were perceived as high-pressure situations when compared to the baseline, no-pressure serve situation; both scenarios produced higher somatic and cognitive anxiety levels in participants. More precisely, 'serve not to lose' (Scenario 2) was perceived as being emotionally more pressurising than 'serve to win' (Scenario 1).

Discussion and conclusions

In this study, we developed two different high-pressure situations using the same ecologically-valid task (tennis-serve). Findings are addressed in terms of how athletes perceive a stressful situation differently, given the incentive at stake (outcome pressure). Indeed, the risk of losing the match was perceived as more stressful than the prospect of winning it.

Keywords

Pressure; tennis-serve; serve to win; serve not to lose; cognitive and somatic anxiety.

Development of image processing system acquires characteristics of table tennis player from video image – Toward realization of table tennis strategy board

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Introduction

When the coach gives advices to the player in table tennis match, the coach will inform the player some of the strategies accumulated in his past experiences. However, the data of past matches he/she gave advices is not always analysed enough objectively. On the other hand, many artificial intelligence models which analyse the image data automatically have been proposed. For example, AlphaGo can classify image situations into classes by deep learning and acquire the most optimum strategy by machine learning.

Aim

The final purpose of system we propose automatically constitutes the input data from the video image of table tennis matches, and extract rule knowledge of strategy from the input data by the learning type clustering method. We call this system as AI sports, AI table tennis. In this paper, we first develop the image processing program that extract the input data from the video image by manual. With the image processing program, the input attributes are divided into record attribute and rally attribute. In particular, the data of the rally attributes are entered in a window that pops up step by step according to the trajectory of the ball. We discuss here the relation between the characteristics of the player and the ball coordinates based on the input data.

Method and results

We analysed the video of 16 matches from the third round to the final match in the table tennis women's singles tournament of the Rio de Janeiro Olympics held in 2016. The total number of rallies of this video was 407 times, and the total number of ball trajectory was 7,434 times. However, since the ball trajectory can't be recorded due to the up images of the players and coaches, the number of rallies was 372 and the ball trajectory was 6862. In particular, we analysed the video at women's table tennis singles semi-final and discussed the players strategy using the relationship between the characteristics of the players and the coordinates of the ball.

Conclusions

Since the final purpose of the system is to extract rule knowledge from the video image by the learning type clustering method, in the future it is necessary to formulate ddi-Boosting as the learning type clustering method using fuzzy clustering.

Key words

Strategy of Table Tennis, Image Processing, Learning Type Clustering Method, AI Sports.

The study and development of real-time data collection and analysis system for table tennis training

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Introduction

The rising of the computer technology promotes the development of scientific sports training into a new stage. For the purpose of monitoring a series of motion data of table tennis players and getting analysis of athlete's training, we have designed and developed a real-time data collection and analysis system.

Method

Software section of this research is based on C# language and hardware section is based on an acceleration sensor installed at the end of a table tennis racket. The sensor contains a Bluetooth module for wireless data transmission. It provides more than 6 hours of power supply with the miniature battery. When the sensor monitors the player's hand movements, the signal was transmitted to the computer database through Bluetooth or Wifi after the A/D conversion.

The movement displacement of table tennis player can be calculated by integrating the acceleration of motion as the following[1]:

$$S = \iint a \, dt$$

According to Newton's second law, we can get the athlete's action force and calculate the work rate of athlete as the following:

$$V = \int a \, dt \quad [2]$$

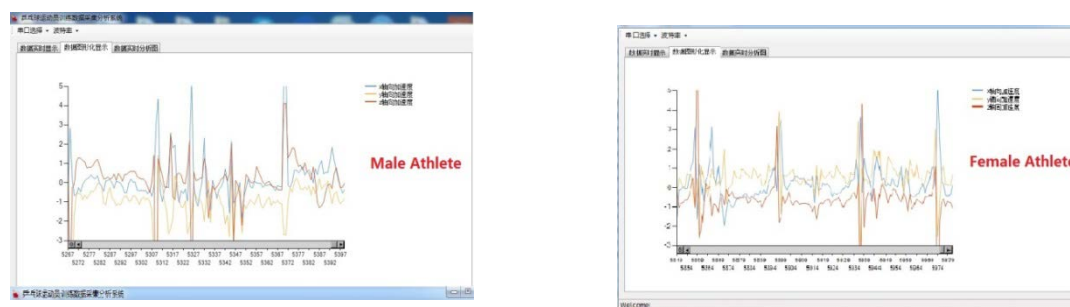
$$F = m * a + G$$
$$W = \int F(t) * V(t) \, dt \quad [3]$$

Discussion

The purpose of the experiment we carried out was to prove that the equipment and the software can monitor the training of table tennis effectively. Figure 1 presents the racket acceleration value of female and male athlete respectively. The wave of male athlete was so densely packed together, and the peak value of female athlete with larger spaces was not as irregular as male athlete. It's probably because the precision of the male athlete is better than the female. It's hard to find the subtle difference between the two athletes unless we use our equipment made by

high precision sensor. According to the original acceleration data, we can also calculate the position shift and work to evaluate the ability of athletes in other aspects.

Figure 1



Conclusion

Monitoring results include the speed of swing, 3D trajectory of hand movement, power and energy consuming of players which the system can display visually in the form of graphs and curves. Furthermore, we established specialized training information databases to provide the data support for the subsequent analysis. As a kind of markedly efficient form that could claim real scientific sports training, our design is of great practical value. The random error is a major factor that affects accuracy and researchers will work it out on the next task.

Key words

Real-time acquisition, Training monitoring, Acceleration sensor.

Surface Electromyographic Analysis of Selected Shoulder Girdle Muscles in Elite Table Tennis Players with and without Shoulder Impingement Syndrome during Forehand Topspin

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Introduction and aim

Shoulder injuries are very common in sports such as table tennis in which the athletes' upper limb operates higher than shoulder level. On the other hand, weak or inappropriate shoulder muscle activity can be related to incidence of an injury.

The purpose of this study was to compare the activation of selected scapulohumeral muscles in table tennis athletes between healthy and shoulder impingement syndrome group during a strike of forehand topspin.

Materials and methods

For this purpose, thirty National-Level male table tennis players from 20 to 28 years old were selected purposefully and divided into shoulder impingement syndrome groups (n=15) and healthy subjects (n=15). The surface electromyographic activity of selected muscles from scapulothoracic and glenohumeral joints were recorded during the strike of forehand topspin.

Results

The results showed that the level of the activity of the serratus anterior muscle ($P = 0.007$) and supraspinatus muscle ($P = 0.001$) in the shoulder impingement syndrome group was significantly lower than the healthy subjects and the level of upper trapezius muscle activation in the shoulder impingement syndrome subjects was significantly higher than the healthy group ($P = 0.009$). However, no significant differences were observed in the activation level of lower trapezius ($P = 0.301$), anterior deltoid ($P = 0.314$) and biceps brachii muscles ($P = 0.291$).

Discussion and conclusion

The results of this study showed that patients with impingement syndrome demonstrated unnatural and changed levels of muscle activity in scapulohumeral articulation during the forehand topspin strike. The findings support the theories that shoulder impingement may be related to changes in the activity level of scapulothoracic and glenohumeral muscles.

Keywords

Surface Electromyography, Shoulder Impingement syndrome, Table Tennis.

Posters

Health and innovation

The investigation of spectator satisfaction in the 2017-2018 season China Table Tennis Super League – taking Jiangsu, Zhejiang and Shanghai as an example

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Introduction

As the biggest event of table tennis club league in China, China Table Tennis Super League is confronted with problems such as the poor scene atmosphere and box office, a low attendance rate for games without famous players, which have directly affected the quality of the league. In terms of players' performance in the league, it is a high-level professional league comparable to the NBA.

Aim

This article aims to explore the spectator's attitudes towards the League. It is helpful for us to clarify spectator's demand, thus work out the corresponding coping strategies to optimize the structure and arrangement of the events.

Method

A questionnaire survey is conducted on a total of 120 spectators in Jiangsu, Zhejiang and Shanghai. Investigate from the following aspects: the performance of the league players, the facilities for the league, the activities and sponsors of the league, etc.

Results

Firstly, we can find that middle-aged men are the main members of the league's spectators. They are of relatively high income, of enthusiasm for table tennis, and frequently participate in this sport in spare time; Secondly, the most spectators, who get the league information through the Internet and television, hold gift tickets. While merely a few people are buying their own league packages or a single ticket. Thirdly, the attractive scene, the enthusiasm for table tennis and to accompany family and friends are the main reasons that spectators come to watch the league. Few people appear on the scene to support home clubs or favourite player. Finally, overall spectator satisfaction is not high. Spectators regard insufficient media propaganda and poor arena atmosphere as the main problems. Most of them agree that the host and cheerleaders can improve the scene atmosphere, but they would be much more involved if more chances were given to interact with star players.

Discussion and conclusions/expected outcome

China Table Tennis Super League needs to broaden channels of publicity, change marketing strategies, improve club culture, foster star players and develop related peripheral industries with star effect. In addition, as players they need to pay more attention to the league and actively participate and play the best in the events.

Key words

China Table Tennis Super League, spectator, satisfaction.

The Point Characteristics and Effect Analysis of Serving and Receiving Service Combination Point When Xu Xin Versus Mizutani Jun

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Introduction

In the Rio Olympic Games table tennis competition in 2016, the Chinese team once again won all the gold medals. The Japanese men's team led by Mizutani's once again entered the finals in this match, causing a huge impact on the Chinese team. Therefore, the study on the characteristics of technology use and coping strategies when Chinese table tennis main players play against Japanese is urgent.

Aim and theoretical framework

To reveal the characteristics and effects of the serve and receiving service combination point of both sides. Analysed the technique of the world's best male's table tennis players Xu Xin and Mizutani Jun from 2009 to 2016 in total 13 important games.

Method

Literature review, combination point record, mathematical statistics.

Results

The advantage is obvious that Xu Xin serve to No. 2、5, the scale is highest that effective attack has formed in the third shot when the combination point 2-9 has showed in Xu Xin's service round; Mizutani Jun 's receiving service focused on Xu Xin's disadvantage in the backhand position. Mizutani Jun serves mainly in short, combined half out of table, interspersed attack to the bottom line. It's common things that Mizutani Jun lose score when combination point 6-9、5-9、3-3 showed, these are Mizutani Jun 's weakness. The advantage is obvious that Xu Xin use the technique of backhand twist to No. 9 in receiving service, using the technique of forehand control lose a lots of score. On the whole, Xu Xin backhand scored lower than forehand and sideways position, gradually appear an unbalanced situation on forehand and backhand.

Discussion and conclusions/expected outcome

Xu Xin need be on guard ahead of time in third shot on 1, 6, 7, 9 position in his service round, through training to strengthen the combination point 5-9、2-1; Xu Xin need grasp Mizutani Jun's stroke mode under combination point 6-9、5-9、3-3 in his receiving service round; Xu Xin need enhance his backhand rally ability, optimizing his Pen-hold backside drive technique.

Key words

Combination point record method; serve; receiving service; effective attack.

Recreational exercise ameliorates craving and enhances inhibitory control of methamphetamine dependency

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Introduction

Results from behavioural and neurophysiological studies confirmed the relationship between aerobic exercise and inhibitory control. However, the effects of recreational exercise program on substance abuser have not been studied.

Aim

The study was designed to investigate the impact of recreational exercise program on inhibitory control of methamphetamine (MA) dependents.

Method

Participants: Sixty-three of 72 eligible participants were randomly assigned into two groups, and 50 participants completed the entire trial ($n = 25$ for each group). All participants' craving levels were assessed at baseline as well as at 3, 6, 9, and 12 weeks following the beginning of the treatment, and inhibition was assessed at baseline and at 12 weeks.

Intervention: Participants in the exercise group were engaged in an exercise program that involved three 30-min sessions per week of moderate intensity recreational exercise (i.e., table tennis, basketball etc.) for 12 weeks.

Outcome Measures: The craving level of MA was measured using a visual analogue scale (VAS). Standard Go/Nogo and MA-related Go/Nogo tasks were employed to assess ordinary and MA-specific inhibition.

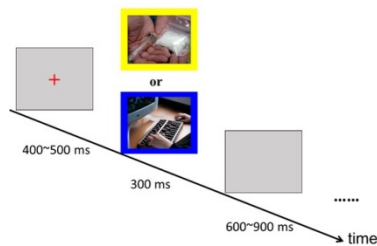


Fig. 1. MA-related Go/Nogo tasks

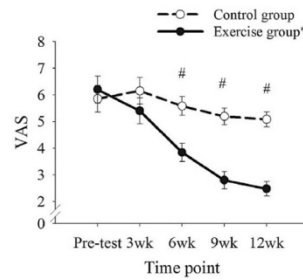


Fig. 2. Visual Analogue Scale (VAS) score of craving level as a function of group and time point (mean \pm SE).

represents a significant difference between the recreational exercise and attentional control groups, $p < 0.05$.

*represents a significant difference within each group, $p < 0.05$.

Results

1. The craving analysis revealed significant main effects by group [$F(1, 49) = 10.54$, $p < 0.01$] and time point [$F(4, 196) = 26.03$, $p < 0.001$] and an interaction between group and time point [$F(4, 196) = 9.48$, $p < 0.001$]. Follow-up comparisons revealed that the scores from week 6 - 12 were lower than those at the first and second assessment ($p < 0.01$), and the minimum scores were observed at 9 and 12 weeks ($ps < 0.001$).
2. In MA-related Go/Nogo task, main effects of condition [$F(3, 144) = 68.45$, $p < 0.001$] and site [$F(2, 96) = 49.26$, $p < 0.001$] were observed. Two-way interactions of site and condition [$F(6, 288) = 17.46$, $p < 0.001$] and time point and group [$F(1, 48) = 13.33$, $p < 0.01$] were also revealed. Follow-up comparisons showed larger N2 amplitudes in the Nogo-MA condition during the post-test in the exercise group compared with those of the control group in Fz ($p < 0.05$), but this was not observed in the Nogo-Neutral condition.

Discussion and conclusions

1. A 12-week recreational exercise program at moderate intensity attenuated MA cravings, with the beneficial effects persisting from 6 weeks to the end of the treatment.
2. The exercise training affects both neutral and MA-related inhibitory control as assessed behaviourally and neuroelectrically among people with MA dependence.

Key words

Recreational exercise, ERP, Methamphetamine.

Posters

High Performance

Choking under Pressure in Racket Sport: A brief Overview

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Introduction

This article deals with the topic of performance loss under psychic strain.

Aim and theoretical framework

The cognitive mechanisms which underlie “choking under pressure” are revealed; these are if an athlete consciously observes his own movement execution (“explicit monitoring”) and if an athlete is distracted by irrelevant environmental stimuli or useless thoughts. A special focus is put on increased monitoring, which has been studied quite extensively in recent years.

Methods and results

This brief review article based on 15 literature sources brings to light that competitive players in racket sports are vulnerable against both choking processes. On the one hand, tactical skills are affected by pressure when the working memory of the athlete is busy due to a distraction from the outside. On the other hand, the technical skills, which are normally handled in the head outside of the working memory, suffer from stress when these underlying processes are brought back into consciousness.

Discussion and conclusion

Sticking to the intention to give practical advice, finally, methods of avoiding choking are presented. In this context, it is interesting that a drop in performance can occur because pressure makes an athlete getting distracted by the wrong thoughts and emotions, but, somewhat in contrast to this, a well-dosed amount of distraction might be protective against explicit monitoring. In this sense, traditional anti-choking methods like the idea of creating realistic and stressful competition scenarios in training, are put forward alongside rather new or alternative ideas such as Billie Jean King's postulate that pressure is a privilege or Beckmann and colleagues' advice for right-handers to clench the left hand into a fist in stressful situations.

Key words

Working memory - simulating competition-like conditions - well-dosed distraction - pressure as a privilege.

Swedish table tennis player's dual career experiences

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Introduction

The objective of this study was to investigate perceived demands, resources, barriers and coping strategies among Swedish table tennis players who combine their sport and education.

Aim and theoretical framework

So-called "Dual career" for athletes should benefit both their athletic and academic career and provide future career possibilities. But to combine sport and education can be demanding for student-athletes when they need to focus and deal with different areas of life (EU guidelines, 2012). In this study the athletic career transition model (Stambulova, 2003) and the holistic athletic career model (Wylleman, Reints & De Knop, 2013) were used to describe perceived demands, resources, barriers and used coping strategies in different areas of life among the Swedish table tennis students. More specifically the holistic athletic career model describes an athletes career transitions from childhood all the way to retirement in different dimensions of life. The athletic career transition model explains an athlete's dynamic balance between coping resources and barriers, which will determine the outcome of the transition depending on the result of effective or ineffective coping.

Method

Five interviews were conducted with table tennis students between 22-27 years. The interviews were based on the holistic athletic career model (Wylleman et al., 2013) and the athletic career transition model (Stambulova, 2003).

| Participant | Gender | Age | Grade | Current competition level |
|-------------|--------|-----|-------|---------------------------|
| P1 | Male | 22 | 2 | National |
| P2 | Male | 24 | 3 | National |
| P3 | Male | 27 | 3 | National |
| P4 | Female | 23 | 3 | National |
| P5 | Female | 24 | 3 | National |

The table tennis students were contacted by the researcher after asking responsible teacher at the university program for permission. Before the interviews took place the participants received a information letter about purpose of the study, ethic principles, confidentiality and how gathered data will be analysed. All interviews were transcribed and the researcher selected

relevant data for further analysis. With the relevant data the researcher created five category profiles based of the athletic career transition model and the holistic athletic career model. The athletic career transition model was used to describe perceived demands, resources, barriers and coping strategies. The holistic athletic career model was used to describe different dimensions of life.

Results

The table tennis students perceived demands within different areas of life. The biggest demand was searching for a balance in their dual careers. The table tennis students perceived both internal and external resources. The biggest support was within social aspect as they mentioned supporting friends and the biggest barrier were within the athletic dimension for example coach problems. The most common coping strategy was within the academic dimension and one was videotaped lectures the school provided for the students at the program.

Discussion and conclusions/expected outcome

The table tennis students in this research studied at a university program that provided dual career support, which provided 4 years of education and videotaped lectures to make it more convenient to combine education and sport. Although the table tennis students got one extra year to study they still perceived lack of free time like previous studies on dual careers. On the other side that the table tennis students perceived coach problems was a bit unexpected, and they were hoping for a solution in the near future.

Key words

Table-tennis students, coping, dual career, experience, transition.

A Case Study exploring the yips phenomenon in an elite table tennis player

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Introduction

Research of yips in Racket Sports are few. In review research of Philip (2015), "The yips in sport", there are two only and not in psychology. However, from experience, certain number of table tennis players have tendency of yips. Through case study of psychological support for yips tendency players of racket sports, we need exploring, finding, and focusing viewpoints of psychological aspect of yips phenomenon.

Aim and theoretical framework

In recent years, opportunity of seeing the word "narrative approach" has been increasing. It is one of approach to relate with patients in medical setting. The narrative approach is not one which just only press story of medical staffs on patients, but one which explore story of patients and respect it. Such as changing story of medical side is very important at the situation of patients care (Kishimoto, 2015). In case of athlete support, support staff and player see through together by which story the player is involved and where player's own story come to a deadlock, and build together new story. I will report what stories existed behind yips phenomenon and how the yips was changing as new story was building.

Case process

One day, a junior girl player and her coach came to Sport Counselor (hereinafter: SpC). SpC talked with the player one to one in the calm room. She said that half a year ago I got little yips like phenomenon on forehand shot, and within a month I could not swing forehand enough in practice. She researched herself about yips eagerly, and got various coping strategies. In spite of them, her yips phenomenon had been staying there. She sometimes participated in a game, then her yips phenomenon became more serious. In the psychological support sessions, she talked me too about her history, family, coaches, and so on. In this way, she looked intertwined stories behind yips phenomenon carefully, and based on that, she made herself own prospect for future. 3 months after when she came to SpC first, she participated in a game almost without collapse.

Discussion and conclusions/expected outcome

I consider that in this case listening player's talk by SpC let stories which exist behind psychological factors relating yips phenomenon (ex. tension, anxiety, fear, impatience) revealed, and so, possibility of coping with yips increased.

Key words

Table tennis, yips, psychological support, story.

A review of technique and tactic analysis theory and methods in table tennis in China

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Introduction

From 1988 to 2016, China table tennis team has won 54% of Olympic medals, including 28 gold medals, accounting for 87.5% of the total number of gold medals. One of the most important reasons to be able to achieve the lasting victory, is that, China table tennis team always paying high attention on scientific research and scientific- technological support. There among, the technique and tactic analysis plays a quite important role. The purpose of this paper is to summarize the technique and tactic research methods and results, which is of great significance to improve the scientific training level of table tennis.

Methods

The main research method of this paper is literature review. Take "table tennis" as theme, the author retrieved the literature from 1986 to 2017 in CNKI with a total of 20681 search results. The second search was conducted based on "technique and tactic" with a total of 582 items. The paper was written based on a brief overview of all the 509 articles from 2008 to 2017.

Results

The development of Chinese table tennis technique and tactics analysis method has gone through a long road from the experience-oriented qualitative analysis, to the combination of qualitative and quantitative, to the present quantitative analysis. The main evaluation method and idea is still the three-phase evaluation method, the usage rate reached 61%. The commonly used indexes are conventional indexes such as scoring rate, usage rate, error rate, and contribution rate and so on. More detailed analysis of the content involved in type of technique, rotation characteristics, placement, lines and tactical types. Such descriptive statistical methods and means are the most common and dominate. In the past decade, there had a lot of innovations on analysis method which can be classified into four categories: (1) To construct new evaluation theory and models according to number of shot. (2) To create new computing indicators and formulas. (3) Analysis methods based on computer simulation and video analysis. (4) Analysis methods based on mathematical model and data mining.

Conclusions

With the gradual deepening of scientific research, especially the interdisciplinary research, the exploring on new analysis theory and methods will keep going and more deeply, the understanding on the characteristics of technique and tactics used by the players during the competition will be more and more comprehensive.

Key words

Table tennis; Technique and tactic; China.

Practical Performance Analysis in Table Tennis – A Review: Best practice examples of the two most successful countries of the last Olympics: China and Japan

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Introduction

In table tennis, many different approaches to scientific founded match analysis have been developed since the first ones in the 1960s.

Besides different theoretical performance analysis approaches in table tennis, e.g. calculation of performance indices, more and more countries are putting more effort into practical performance analysis to support their national teams.

This paper presents two 'best practice' examples describing performance analysis procedures of the two most successful countries of the last Olympics: China and Japan.

Best practice: China – Olympics Games 2008 & 2012

Practical performance analysis in China is very comprehensive. Their framework includes the following steps: A fast real-time data collection, a more detailed after match data collection, the outline match analysis and a complete match analysis. These already before the Olympics existing data and analyses are of course used in the direct preparation before matches, but more important also during the period of intensive training before the big competition. While during the period of intensive training (40 days), the Chinese team are likely to spend much time discussing the tactical features of their opponents, who were categorized into three levels.

Best practice: Japan – Olympic Games 2012

The best practice example of Japan is more focused on the competition itself. During the 2012 Olympic Games, 136 matches played at the stadium of the table tennis event were analysed for use by the Japanese national table tennis team (Tamaki, Saito, Yoshida, Yamada, & Ozaki, 2012; Yoshida, 2013). For the analysis, a computer program was developed to optimise the analysis procedure. This program was designed to conduct shot number based analysis and an in-depth analysis of the played shots (hereinafter referred to as 'detailed analysis'). Data were collected by seven individuals. Four individuals collected data for the shot number based analysis at the stadium and fed back the results immediately after the matches. Three individuals collected data for the detailed analysis by observing videos in Japan and fed back the results by the morning following the matches.

Conclusion

The given best practice examples of the leading nation China and, the probably most improving nation in the recent years - Japan - showed the heavy impact of performance analysis on the practical work of the leading nations. Despite this high level of development of game analysis, only a few nations make serious efforts to introduce it to their national teams as a routine in practical work.

Key words

Practical performance analysis, game analysis, software.

The technique and tactic analysis of HIRANO Miu

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Aim

This study selects 15 games of HIRANO Miu in 2017 in the international major events and analyze, the main technical indicators of the HIRANO Miu in the competition. The purpose of this paper is to count the score and usage of HIRANO Miu in the competition, and to make a combined analysis of technique and tactics.

Method

The paper involves various analysis methods including literature material, expert interview, "4 stages" assessment, logical analysis methods.

Results

- a. HIRANO Miu has a record of 9 wins and 6 losses in 15 matches. The record against the left-handed players was two wins and four losses, while the record against the right-handed players was seven wins and two losses.
- b. The average score rate of the HIRANO Miu in serve and attack was 50.53%, the evaluation of which was good, and the average use rate was 68.45%, the evaluation of which was high.
- c. The average score rate in long rally I was 53.95%, the evaluation of which was passed. The average use rate is 31.55%, the evaluation of which is low.
- d. The average score rate of HIRANO Miu in reserve and attack is 44.82%, and the evaluation is good. The average value is 69.85%, and the evaluation is high. In the four games against Ding Ning, her scoring rate of the level in that stage was two passes and two failed.
- e. The average score of HIRANO Miu in long rally II is 42.97%, and the evaluation is good. The average use rate is 30.17%, and the evaluation is low. In the six games against the left-handed players, the scoring rate of this stage assessed two failed and four passes. The remaining nine games against the right-handed athletes were evaluated as five excellent, one good and three passes.

Conclusion

- (1) HIRANO Miu performed better against right-handed players than against left-handed players.
- (2) HIRANO Miu's serve is of high quality, the scoring site of the serve is mainly backhand bottom line and forehand ball of short balance.
- (3) The HIRANO Miu is weak and unstable in the long rally I, but the utilization rate is not high, so the effect on the result of the competition is not great.
- (4) Ping Ye's performance is positive in the reserve and attack, and the result of the service is good, but there are quite a lot of mistakes in connection in 4th shots.
- (5) When HIRANO Miu faced left-handed athletes, they all showed disadvantages in the long

rally II. The state of the right-handed player is superior to that of the left-handed player in this stage.

Key words

Table tennis, HIRANO Miu, technique and tactic.

Comparative Analysis of the German and Hungarian Men First League Play-Off Matches

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Introduction

The Hungarian male table tennis was world leading at the end of the 1970's but after that the next decades were a long fallback. New nations came up and nowadays the most dominant European nation in the men's table tennis is the German team. The current most promising Hungarian male talents are living and playing in Germany and they prepare in German table tennis centres because these can guarantee them the most competitive preparation.

Aim and theoretical framework

The study compares some quantitative aspects of the semi-final and final matches of the Table Tennis Bundesliga and the Hungarian Extra League. These matches are representing mostly the playing level of the two leagues and the core assumption of the study is that there are significant differences between the two leagues match indicators which have a strong relationship with the level of the players. (e.g. length of rallies, rate of points won from own service or from returns or placement and type of returns and services) The so called three phase model was used to evaluate the players efficiency.

Method

Five matches were chosen from both leagues to analyse them. These ten matches were played by the most successful players of these leagues' regular season before the play-off. The following indicators were measured in the analysis: the number of strokes during a rally, the duration of the rallies, the pause between the rallies, the type and placement of the services, the type and placement of the returns, the winning ratio of the players' services and returns.

Results

The average age of the Hungarian League's players in the play-off is much higher than the players in the German league's play-off which indicate the playing style of the players too. We expect that the Hungarian top players are playing a more old fashioned style with longer rallies, more passive returns and later timing at hitting the balls like the top players in the German league.

Discussion and conclusions/expected outcome

As the Hungarian teams have not enough financial resources to pay for the elite players of Europe they can count only for the former Hungarian national team players from the 1990's and 2000's. However, they don't play such a modern style like the top of the world which means that the current top Hungarian U21 players who to assimilate to the best players of the world have to go abroad and have to play in foreign leagues like the German one.

Key words

Table Tennis Bundesliga, Hungarian Extra League, three phase model, quantitative indicators of table tennis.

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Player Load, Acceleration, and Deceleration patterns during two weeks of training in Table Tennis athletes

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Introduction

Numerous methods are available to monitor and quantify overall training load and provide coaches and sport scientists with ways to quantify load for a specific session or during a competitive event. Combining information about intensity and duration of training can represent a simple method able to evaluate training load. Heart rate based methods can provide such information and be a reliable source of quantification for cardiovascular load and training intensity in table tennis. However, since table tennis is a sport where the contribution of the cardiovascular system to performance is partly describing the physiological demands, more work is necessary to quantify other aspects such as the movement demands of players. An integrative approach to quantification of playing and training load can provide a better framework to understand the demands of playing table tennis at different age groups, develop better training activities and reduce the chances of injuries.

Aim and theoretical framework

The aim of this work was to determine training load of young table tennis players integrating cardiovascular data with movement characteristics.

Method

Training loads and acceleration/deceleration profiles were prospectively analysed from twelve male table tennis athletes [age (mean \pm SD) 15.3 \pm 2.3yr, stature 169.2 \pm 8.6cm and body mass 58.7 \pm 8.8 kg] during October 2017. The data set includes every training session attended (~198) for the Senior, Junior and Cadet players for the Qatar national team. Heart rate and movement characteristics were collected using a wearable inertial measurement unit (Polar team pro, Polar electro, Finland) The IMU collects data at 200Hz for the accelerometer and 1Hz for heart rate data. Data are synchronised by the software (Polar Team Pro, Polar Electro, Finland) and exported for analysis using Excel at 1Hz sample rate. Heart rate data were used to quantify training load using the method described by Edwards (1996).

Results

The individual weekly players' Edwards TL resulted in being significantly higher on average per session for senior (217 AU) players when compared to both junior (191 AU) and cadet (180 AU) players ($P < 0.05$). Relative TL/min was also significantly higher for the senior players (0.29-0.40 AU/min), when compared to the junior and cadet table tennis players ($P < 0.05$). Findings indicate that movement patterns of acceleration and deceleration contribute significantly to the players' total training workload, with the number of high-speed decelerations significantly different to high-speed accelerations ($P < 0.05$) across all age-categories. The average number of acceleration/deceleration movement patterns (32-97 movements) and the average amount of

distance covered during training sessions were higher (608-792m/session) for the Senior athletes when compared to both Junior and Cadet athletes.

Discussion and conclusions/expected outcome

In summary, it was established that Senior table tennis players train at a higher intensity compared to their Junior and Cadet counterparts. Senior players also displayed a higher amount of high-speed movement patterns and distances covered. This indicates that progression of training load is achieved in different training groups by the coaching staff. Furthermore, as the style and level of play changes with ageing, data also suggest that demands are higher, in particular when movement patterns are taken into consideration. For this reason, training quantification should take into account various factors affecting internal and external load to design appropriate training content for each age group. More studies are needed in this field to define safe and effective training guidelines for table tennis players.

Key words

Racquet sport; Training monitoring; Performance Movement patterns; Training Load.

Tracking center of mass displacement in a novel speed test for evaluation of badminton-specific movements – a predictor of performance?

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Introduction

Badminton is the world's fastest racket sport, with the shuttlecock easily reaching velocities over 100m/s. Badminton is characterized by multiple intense actions consisting of fast accelerations, decelerations and many explosive movements with changes of direction over short distances. Standardized speed and agility tests have previously been used to determine explosive exercise capacity. However, these tests have been accused of being too simplistic, not resembling the highly-specialized movement patterns that characterize badminton. On this basis, a novel speed test for evaluation of badminton-specific movements (BST) was developed by Madsen et al. (2015). The test is designed to mimic match play with a sensor placed in each corner of the field, in which the player must perform 20 actions in a randomized order. The BST is sport-specific and can discriminate between different badminton skill levels. Elite players exhibit faster completion times than less-skilled and novice players.

Aim and theoretical framework

Elite fencers have been shown to decrease the height of their center of mass (CoM) more than novice fencers during lunging, to increase stability, weight shifting ability and balance. The same tendency is expected among badminton players, why the aim of this study was to investigate whether the movement of the center of mass could be used a badminton performance predictor.

Methods

Twenty-one international elite badminton players participated in the study (Thirteen males and eight females) and performed the BST four times. Whole-body kinematics were collected at 240 Hz using 15 highspeed infrared cameras (Oqus 700+, Qualisys AB, Gothenburg, Sweden). CoM movement analysis was conducted using Visual3D (C-Motion Inc., USA). The average CoM trajectory was computed and compared to the static reference position. In addition, total power, peak CoM velocity and postural sway was analyzed as secondary parameters. Relationship between completion time and the investigated parameters were tested using two-tailed Pearson Correlation tests.

Results

Significant results were found between the average vertical CoM displacement and performance when comparing genders, with male players lowering their CoM 7 cm more, relative to the standing height, than their female counterparts. A significant correlation was found among the male players between total power and completion time. All male players exhibited greater total power during the test and higher peak CoM velocities than female players.

Discussion and conclusions/expected outcome

Though all results revealed significant differences when comparing genders in all investigated parameters, no correlations were found in CoM displacement when isolating genders. The test has demonstrated the ability to quantify performance by tracking 3D-movements in badminton. Future kinematic testing should include novice and non-skilled players to improve the strength of the correlation analysis.

Key words

Badminton, performance, center of mass, motion capture.

Posters

Sport Science

Momentum, Hot Hand, and Flow in Net Sport: A brief Overview

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Introduction

Momentum, hot hand, and flow are terms that are mentioned periodically at competition sites as well as in academic institutions dealing with sport. Phenomenologically, it seems from time to time that these concepts, including also the notion of a “run” in the course of a game or match, are three, or four, of a kind.

Aim and theoretical framework

Having a particular view on net sport, the various psychological terms revolving around the same observation are briefly outlined in this article. Thereby, the specific focus is on causes and mechanisms which help to understand the occurrence of winning streaks and losing streaks.

Method and Results

In this short review article with 15 references, first, a positive momentum is distinguished from a negative momentum. It is pointed out that a continuous winning streak (positive momentum) seems to be accompanied by a steady decline of the fear of competition whereas the fear spreads noticeably more explosively when the player experiences a losing streak (negative momentum). In the search for causes that could account for the emergence of a momentum, Albert Bandura's concept of self-efficacy is identified and outlined. From this perspective, the experience of mastering challenges successfully with the help of one's own abilities gives a player confidence in tackling tasks again and again. Occurrences which may signal a starting point or turning point in the course of a match are called “momentum starters”. However, it becomes clear that such small incidents like a spectacular rally which could be won by a player do not automatically result in psychological tailwind. Rather, such turns for the good must be “recognized” by the athlete and used actively to push himself or herself. Besides, the classic question is addressed whether or not a “hot hand” can be called a general phenomenon. Finally, seeing the focal phenomenon from the perspective of psychological flow research, it is pointed to Mihaly Csikszentmihalyi's notion of an autotelic personality. This refers to rather autonomous people who place little value on rewards from the outside what frequently enables them to solve skilfully difficult situations.

Conclusion

All in all, this article points to the possibility that players in net sport can make winning streaks reality more often when they are trained psychologically.

Key words

Prospect theory - self-efficacy - momentum starter - autotelic personality.

Development of a cloud table tennis scoreboard

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Introduction

The cloud scoreboard is a simulation of the traditional scoreboard. It is compatible with the Windows, iOS, and Android operating systems without the need to install software. The analog digital count score flap and the electronic scoreboard can display scores on a full screen.

Aim and theoretical framework

The purpose of this study was to develop a cloud scoreboard that functions like a traditional scoreboard and enables the referees to use it easily.

Method

The following System Specs were used: Host: WIN2008; Web: HTML5 and CSS3; scripts: JavaScript; Program: ASP; Database: ACCESS and MYSQL. The system has two functions. A is a digital analogue scoring vane function. This function changes the score by sliding it up and down. The turning action is the same as that for a traditional scoreboard. B is a stop function, which operates on the same 60-second display clock as in an actual game. The referee does not need to watch the time. The player can see the seconds directly count down. The clock can also be stopped early.

Results

We found 20 international referees for test System, they were given a 10-minute demonstration on how to operate the system. Each then practiced on their own for 10 minutes. The results showed that most referees could readily use the scoreboard and work with the scoring gestures.

Discussion and conclusions/expected outcome

This system can be used on mobile phones and iPad. The cloud scoreboard does not require installation of an APP. The use of cloud computing can improve the level of competition.

It is hoped that in the future, scores can be synchronized to a live screen, thus enabling more players and online visitors to know the score of a game.

Key words

Cloud computing, scoreboard, time-out, table tennis.

Gender differences of young table tennis players in anthropometric characteristics, motor abilities and specific table tennis tasks

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Introduction

The development of a table tennis player is a multidimensional process during which, except for monitoring and accepting the biological development, it is also required to know the anthropological characteristics of children which are the predisposition for learning table tennis technique and tactics.

Aim and theoretical framework

The aim of this research was to establish the differences between male and female young table tennis players, aged 10-11 in anthropometric characteristics, motor abilities and specific table tennis tests.

Method

The study included 83 players, 52 boys (training experience 2.67 ± 0.85 years) and 31 girls (training experience 2.97 ± 0.93 years). The participants were measured by the 15 standard anthropometric measures by the International Biological Programme. For the assessment of motor abilities, 24 tests were measured which best define latent dimensions: agility, coordination, frequency of movement, explosive strength, speed, repetitive strength and endurance. Also, 6 specific table tennis tests included (ball balance on the racquet, alternate shots using forehand and backhand, dribbling of the ball using a racquet, shooting target on the ground, hitting the ball and shooting target on the table from an indirect service).

Results

Research data were analysed by descriptive statistics and Student's T-test. The results showed significant differences in anthropometric measures skinfold triceps ($p=0.03$) and skinfold abdomen ($p=0.02$), girls had higher average values, while boys had higher average values in knee diameter ($p=0.03$). In motor tasks boys had higher average values in standing long jump ($p=0.01$), squats in 30 seconds ($p=0.00$), push ups ($p=0.02$) agility test ($p=0.01$), lateral agility ($p=0.00$), boomerang test ($p=0.03$) and the "number eight" movement test ($p=0.02$). Girls had higher average values in tests of flexibility, stand and reach on the bench ($p=0.01$) and external arm circumduction with a bar ($p=0.00$). The significant differences in specific tests were obtained in ball balance on the racquet ($p=0.01$) in favour of girls while boys had better results in hitting the ball ($p=0.03$).

Discussion and conclusions/expected outcome

The obtained differences between young table tennis players are in the accordance with previous findings of the morphological and motor development of pre-puberty children, according to which girls are superior to boys in flexibility and have higher values of subcutaneous fat tissue. The motor efficiency of boys compared to girls is reflected in the higher repetitive strength, higher explosive strength of the legs and arms, agility and coordination.

Key words

Young table tennis players, gender differences, anthropometric characteristics, motor abilities, specific table tennis tasks.

Aerobic endurance test for Table Tennis: A correlation study between Cooper's test and Critical frequency test amongst Swedish-ranked players

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Introduction

Table tennis is a complex sport, using different physical abilities where both aerobic and anaerobic endurance is important. Anaerobic endurance is vital during short-time intense periods, which occurs during ball rallies, while the aerobic endurance system is used in between helping the player to maintain active and fully focused throughout the whole match. The Swedish Olympic committee provides with a physiological profile where the aerobic endurance of the table tennis players is tested with Cooper's test. The Cooper's test is not sport specific and thereby a sport specific aerobic endurance test has been developed, since player performance should be measured precise and sport specific. The sport specific aerobic endurance test is named Critical frequency test and is performed with a mechanical ball thrower.

Aim and theoretical framework

The purpose of this study was to evaluate the strength of the correlation between Cooper's test and Critical frequency test with the player's national ranking. A second aim was to compare the strength of the correlation between Cooper's test and Critical frequency test with the player's national ranking.

Method

14 subjects participated in this correlation study. Their aerobic endurance was measured with two different tests. The Cooper's test was performed on a treadmill where their time to complete 300m in seconds was gathered. The Critical frequency tests were performed at two different intensities, 48 and 56 balls/minute respectively, where their time to exhaustion in seconds was gathered.

Results

A strong correlation was found between Cooper's test and subjects group ranking, based on their national ranking ($r=0.600$ and $r^2=0.360$, $p=0.023$). A weak non-significant correlation was found between Critf test and subjects group ranking at 48 respectively 56 balls/minute (48: $r=-0.341$ and $r^2=0.116$, $p=0.233$) and (56: $r=0.022$ and $r^2=0.0005$, $p=0.940$). A r -value of <0.4 was considered a weak correlation, $0.4 - 0.6$ as moderate and $0.6 >$ as strong.

Discussion and conclusions/expected outcome

The results in this study showed a strong correlation between Cooper's test and subjects group ranking. This means that in table tennis players ranked from 20-2700 in Sweden, the Cooper's test could be used, in order to evaluate player performance. However, the Critf test could be questioned since a weak non-significant correlation was found. Future research is needed to

evaluate the Critf test in this area, on a more homogenous group concerning the ranking list in Sweden.

Key words

Table tennis, Sport-specific endurance test, Aerobic endurance.

Analysis of Chinese Elite Women Table Tennis Players' Mental State during Competitions Base on the Change of Heart Rate

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Introduction

With the continuous development and progress of table tennis, the difference between the high-level athletes in the technical level is getting smaller and smaller, mental state plays an important role in high-level competitions. Modern table tennis is not only the competition of athletes' technical and tactical level, but also the contest of psychological quality. This study attempts to explore the psychological characteristics of Chinese elite women table tennis players by analysing their heart rate during competitions, and to find an effective solution to help them coping with the mood swing better.

Method

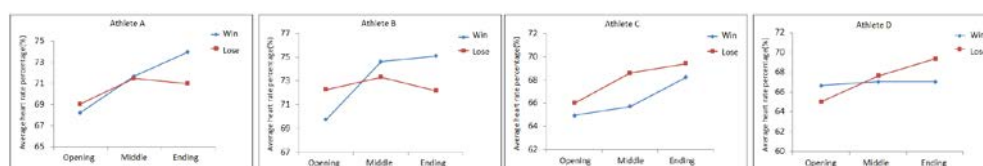
Use MIO wrist heart rate monitor (the recording frequency is once per second) to trace 4 Chinese elite women table tennis athletes, collect 40 matches (148 games) heart rate data, through analysis the change of their heart rate at different stage (Opening:0-4, Middle:5-8, Ending:>9) of a game to explore their mental state's changing characteristics.



The data were exported in excel. Heart rate data were intercepted according to the video recording. The heart rate data were calculated by the percentage of the average heart rate (average heart rate/maximum heart rate×100%).

Results

As the competition progressed, the heart rate of different athletes showed individual trend through comparison of the lose games and win games. As shown in the following figure, at the end stage, some athletes in the losing games have a relatively low heart rate compare to the win games, which reminds athletes to give themselves more positive psychological hints when they at a disadvantage, while someone has the opposite situation, which reminds athletes to slow down the rhythm and take a deep breath when they at a disadvantage, these methods can help them to have a better performance.



Discussion and conclusions

Athletes' mental state can be analysed to a certain extent by monitoring the changes of heart rate during competitions. In the games, the changes of heart rate of elite table tennis players during different stages have certain characteristics and large individual differences. Personalized analysis is very important to elite athletes. Analysing the changes of elite table tennis players' heart rate during the competition is helpful to the coaches.

Key words

Table tennis, high level athletes, heart rate, competition, mental state.

Current situation and the reasons for scoliosis of table tennis athletes

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Introduction

The aim of this study was to acquire and analyze the information of age, scoliosis, cervical activity of table tennis athletes, to describe the status of spine abnormality and explore related factors.

Method

Select 201 table tennis athletes (128 males, 73 females) from juvenile class of China Table Tennis College and junior national team to participate in this study, their ages range from 9 to 24. All subjects were assessed by curvature of the scoliosis, and the three-dimensional mobility of the cervical vertebrae.

The detect equipment is Spine Scan TM electronic spine meter manufactured in Israel. The indicators included: ATI (Torso angle) of the scoliosis, measurement of cervical three-dimensional mobility (horizontal, sagittal and frontal plane angle changes), including maximum anterior and posterior curvature of the neck ($^{\circ}$), left and right neck Maximum degree of flexion ($^{\circ}$), left and right neck rotation Maximum activity ($^{\circ}$).

Use SPSS19.0 software package to statistical analysis, and the analysis method is variance analysis.

Results

There were significant differences in the scoliosis of the male table tennis athletes in different age groups ($P < 0.05$). As for males, the scoliosis of the 13-year-old group was significantly higher than other age groups. There were significant differences in the lateral scoliosis between male and female athletes ($P < 0.05$). The lateral scoliosis increased with age, while the higher age athletes of the junior national team showed lower curvature of the scoliosis. On the degree of cervical vertebra activity of male athletes, there were significant differences between anterior and posterior flexion of cervical spine ($P < 0.01$), and 14-year-old group showed a large difference on it. The cervical activity decreased as the age increased, while the higher age group of the junior national team showed higher cervical activity.

Discussion and conclusions

1. The training of table tennis may lead to scoliosis, and the age of 13 is the sensitive period of male athletes.
2. There is gender difference in scoliosis.
3. Appropriate intervention and training could relieve table tennis athletes' scoliosis and improve their performance.

4. Athletes' cervical activity is related to table tennis training, and unjustified training will lead to cervical activity reduced. Male athletes should pay more attention to anterior and posterior flexion of cervical spine, especially at the age of 14.

5. The cervical activity is a limiting factor for the improvement of table tennis athletes.

Key words

Table tennis, athletes, scoliosis, cervical activity.

Problem solving skills of cadet table tennis players

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Introduction

Due to its complexity (ball speed, spin, rubber effect, etc.) table tennis is believed to be one of the best sport to stimulate brain and promote quick thinking and problem solving.

Aim and theoretical framework

Since table tennis is one of the best sports promoting problem solving skills which was already been discussed in various scientific studies, we wanted to understand if variables like gender, playing style, dominant hand or number of team members have any effect on problem solving skills. Therefore, the purpose of this study was to investigate the problem solving skills of cadet table tennis players

Method

Seventy-Eight volunteer athletes with mean age of 14.12 ± 4.27 participated in this study. The average table tennis playing duration of the athletes was 5.68 ± 4.23 . Problem Solving Inventory for Children (PSIC), which was developed by Serin et al. (2010), was used in order to understand the problem solving skills of athletes. The reliability coefficient of the scale was found as 0.903. Non-parametric tests were used in the binary and multiple comparisons.

Results

The results showed no difference in problem solving skills according to the sex, dominant hand, play style (attack, block, and defence), and the number of players in the teams.

Discussion and conclusions/expected outcome

Although, the results did not show any significant difference between the various variables, other studies have demonstrated significant effect of table tennis experience on problem solving skills

Key words

Problem Solving, Table Tennis, Cadet Players.

Outward Emotional Reactions and Subsequent Performance in Table Tennis

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Introduction

Emotions play a crucial role in table tennis. Between the rallies, you can frequently see changes in the observable behaviour in terms of gestures, verbalizations, or facial expressions.

Aim and theoretical framework

Although most research has focused on the subjective experience of an emotion, the behavioural component appears promising since it tackles a shortcoming in the existing literature: the investigation of emotions during actual competitions (Uphill, Groom, & Jones, 2014). The goal of this study was to assess the impact of outward emotional reactions on the subsequent sport performance.

Methods

15 table tennis matches, involving 20 players (7 females) with a mean age of 16.70 ($SD = .73$) were recorded during the finals of the youth National Championship in Greece. Based on the footage including 1007 points and, hence, 2014 reactions, two coders classified the outward emotional reaction after each point into neutral, positive, or negative based on their subjective perception. By using the Generalized Sequential Querier (GSEQ) a sequential analysis was conducted to compute the transitional probabilities of the different types of outward emotional reactions to the outcome of the subsequent point.

Results

The two coders agreed in 92.44% ratings of the outward emotional reactions. The same results pattern was revealed when a reaction was coded as positive or negative in the analysis when identified as such by both coders or by only one coder. The results show that a neutral outward emotional reaction after losing a point was more likely to be followed by losing the next point ($p < .05$). On the contrary, a neutral reaction after winning was more likely to be followed by winning the next point ($p = .05$).

Discussion and conclusions/expected outcome

This study can be seen as an explorative attempt to investigate the behavioural component of emotions in table tennis. The results highlight the relevance of potential determinants of

outward emotional reactions. On the one hand, staying neutral after losing can be related to a low level of commitment, thereby, impairing performance. On the other hand, staying neutral after winning can be related to a high level of concentration.

Key words

Emotional reactions, performance, table tennis.

Towards Investigating Athletic Talent Development Environments in Underserved Communities in the United States

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Introduction

This presentation will focus on the content of PhD project of the first author who has had extensive experiences of working in American schools within underserved (i.e., poor) communities. In spite of lacking resources, some of these schools are able to contribute into developing high performance athletes in various sports (including racket sports) and empowering them to achieve the success against the odds. These real life examples served as an inspiration to investigate such athletes' career pathways and environments in which they had grown up.

Aim and theoretical framework

The aim of this project is to acquire knowledge regarding the challenges and barriers faced by athletic talent development environments in underserved communities (UATDEs) and how successful UATDEs manage to help athletes achieve athletic and personal success against the odds. The study is based on the holistic ecological approach (Henriksen, 2010; Henriksen & Stambulova, 2017), and particularly on the athletic talent development environment (ATDE) model. The model was previously applied to study ATDEs in Scandinavia with its high social and economic equality. Conversely, in the United States, with its large income gap, many underserved communities struggle to produce elite athletes, and little investigation has been conducted surrounding such environments.

Project design and method

The project will consist of three studies. Study 1 will focus on exploring career pathways to athletic success and related environmental and personal factors in American athletes with low SES background through a series of interviews. Another series of interviews will be used in Study 2 to examine key stakeholders' perspectives on challenges faced and strategies implemented in UATDEs. In Study 3, the case study approach will be used to investigate two successful UATDEs within American communities and identify shared features responsible for their talent development success.

Expected results

It is expected that Study 1 will reveal that athletes at the UATDEs were forced to deal with hardship and overcome a number of challenges that made them more resilient compared to those from affluent circumstances. From Study 2 it is expected to identify a spectrum of complicated issues (e.g., lack of funding, less access to practice time, lower moral, high stress and low levels of communication and support) that the UATDEs deal with. The anticipated results from Study 3 are that successful UATDEs have unique but also shared features that may form the basis for developing UATDE frameworks as an expansion of the holistic ecological approach.

Key words

Talent development, socio-economic status, talent development environments in underserved communities.

The Relationships between Perceived Motivational Climate, Imagery and Training Behaviours

Aleena Edwards, Bangor University, Wales, UK

Introduction

The purpose of this study was to examine whether the functions of imagery mediated the relationship between motivational climate and training behaviours in Caribbean National athletes.

Aim and theoretical framework

The theoretical framework of the achievement goal theory (Nicholls, 1989) was the source of theoretical underpinnings. Paivio's framework on functions of imagery as a whole was also looked at to find out how the different types of imagery may be related to a specific climate or how an athlete use it to aid him in his performance in relation to the training attitudes and behaviours.

Method: A total of 95 English speaking Caribbean athletes ($n = 60$ males and $n = 35$ females) competing at international ($n = 48$) and national ($n = 47$) levels, participated in this study. Participants ranged from 18 - 36 years of age ($M = 23.46$ years; $SD = 4.32$), had been competing in their respective sport for an average of 10 years ($SD = 5$), and self - reported an average of 15 hours ($SD = 8.10$) per week in training. Participants spent an average of 4.7 years ($SD = 7.76$) with coach and reported an average of 13 total contact hours ($SD = 6.95$) with their respective coach in sessions weekly. A total of 10 sports were represented in the sample including volleyball ($n = 32$), hockey ($n = 16$), netball ($n = 6$), basketball ($n = 8$), badminton ($n = 6$), table tennis ($n = 8$), track and field ($n = 12$), gymnastics ($n = 2$), swimming ($n = 3$), and cycling ($n = 1$). Athletes completed a demographic information questionnaire, along with three inventories: PMSCQ-2, SIQ-2 and TABQ.

Results

Descriptive Statistics conducted on alpha coefficients, means, and standard deviations for each subscale of the Perceived Motivational Climate Sport Questionnaire - 2 (PMSCQ -2), Sport Imagery Questionnaire - 2 (SIQ -2) and Training Attitude and Behaviour Questionnaire (TABQ). All subscales demonstrated acceptable internal reliability (Cronbach's $\alpha > .70$). Correlations were conducted between all study variables. Though small significant ($p < .01$) positive correlations appeared between both motivational climates (mastery and performance) subscales and some imagery and effort extra subscales ($p = .07$)

Discussion and conclusions

Overall the initial findings indicated that there were no existence of direct relationship between the perceived climate (i.e. mastery and performance) and effort and coping traits in training

behaviour. It is suggested that perceived climate in particular inter team member rivalry was positively associated with effort extra and cognitive general mediated this initial relationship.

Key words

Motivational climate, imagery, athletes.

Workshop 26 of April

Workshop – Jörgen Persson, Halmstad, Sweden

One of the all-time greatest players in the Wonderful World of International Table Tennis and the Hometown hero; Mr. Jorgen Persson will perform a live clinic discussing recent development in Table Tennis training. He will look beyond the horizon to give us an insight in training methods and technical skills that he believes will be necessary to acquire for young players aiming for the top. The traditional building blocks, in many ways the cornerstone qualities to manage for top coaches and players are in focus; we are looking forward to examine; The Technical skills - Practical pathways to Mental Strength - Game related physical development and Tactical awareness. The melt down of all this will be the base of an entertaining - showman style clinic at the Halmstad University.

Health and innovation

Sports for all

Lars Kristén, Center of Research on Welfare, Health and Sport (CVHI), Halmstad University, Sweden

Daniel Ellerman, Swedish Parasports Federation, Stockholm, Sweden

Alexander Öhgren, Swedish Parasports Federation, Stockholm, Sweden

Marie Chellén Paulson, Project Swing Ping Pong, Borås, Sweden

Ulrika Wiland, Halland Federation of Vision Impaired, Sweden

Peter Malmberg, Halland Parasports Federation, Sweden

Introduction

Demonstration workshop: One of the challenges in “Sports for all” is to work proactively with sport and health as well as with leisure activities with a view to developing the physical, mental and social capabilities of people with disabilities. The workshop will present practices, research and development projects within the field of adapted physical activity and Para sport e.g. Para-Table Tennis, Show Down and Swing Pingis. New innovative techniques will be presented how this exciting game can be played for all people with different physical and psychological abilities.

Aim

The aim of the workshop is to increase understanding of the opportunities for sports for people with disabilities.

Keywords

Adapted physical activity, Parasports, People with disabilities.

Peak Performance

A biomechanical and psychological approach to table-tennis assessment

Lina Lundgren, Rydberg Laboratory of Applied Science (RLAS), Halmstad University, Sweden

Xavier Sanchez, Center of Research on Welfare, Health & Sport (CVHI), Halmstad University, Sweden

James Parker, CVHI & RLAS, Halmstad University, Sweden

Local athletes: Wille Kindblad (Halmstad Table Tennis Club), and Magnus Pohjolainen (Falkenbergs Table Tennis Club)

Introduction

Table tennis (TT) is a sport characterised by fast movements with high demands on both cognitive and motoric functions. One interesting component is the effect mental and physical fatigue may have on both speed and accuracy of the forehand topspin stroke. This session is a demonstration workshop wherein we showcase some examples of how to use technology to assess psychological and physical characteristics underpinning table tennis performance.

Aim and theoretical framework

This workshop aims to showcase practical implementation of sports biomechanics and sport psychology into the testing and training of TT athletes.

Method

We will show how technology, such as radar, accelerometer, and eye tracking devices etc. can be used to assess movement characteristics that underpin performance outcomes for athletes.

Discussion and conclusions/expected outcome

The use of data to determine future training strategies are one of the emerging areas where sports sciences and the traditional practice meet. It is important for the athlete and the coach to keep track of such development, and understand the implications that data may have on the development of successful training strategies. This workshop goes into the realm of #knowyournumbers.

Keywords

Athlete assessment, sports technology, table tennis.

Sport Sciences

Mental skills training for athletes: applied sport psychology

Emil Andersson, Halmstad University, Sweden

Pétur Már Harðarson, Halmstad University, Sweden

Jesper Lindström, Halmstad University, Sweden

Jonathan Haag, Halmstad University, Sweden

Introduction

Psychology is central in the performance of table tennis as well as other racket sports. One challenge for the athletes could be to cope with the stress and pressure that comes with big tournaments. One of those moments are the last minutes right before competition where it is crucial for the athletes to have some coping strategies to use in that situation.

Aim

The aim of this workshop is to present some alternatives how the athlete can cope with the central pregame stress. The technology allows us to bring certain situation closer to the athletes that make it possible for them to prepare for a stressful situation in advance.

Method

Assisted by modern technology, such as cameras, green screen and video, we will recreate a potential stressful situation that can occur during the last minutes before a competition starts.

Conclusion

The workshop provides the participants with the ability to practice their coping skills in a competitive environment which is otherwise hard to achieve during regular practice. Examples of how you can apply modern sport psychology in a racket sport context will be provided.

Key words

Applied sport psychology, coping with stress, elite athletes, information technology, table tennis.

Keynote III

The relationship between participation in table tennis and cognitive function

Tsung-Min Hung, National Taiwan Normal University, Taiwan

Executive functions (EFs) refer to a subset of goal-directed processes that include cognitive flexibility, inhibition, working memory, planning, reasoning, and problem solving. Researches have shown that EFs are more important for school readiness than is IQ. EFs can predict math and reading competence throughout all school years and EFs remain critical for success throughout life, marriage, and for mental and physical health. Given the importance of EFs, finding ways for improving EFs have become a priority for scientists and educators. A considerable amount of research has indicated that participation in physical activity (PA) is beneficial to cognitive function, executive functions in particular. Most of these efforts have targeted on PA programs emphasizing on improving either cardiovascular or muscular fitness. However, meta-analytical studies have indicated that exercise interventions that combined both cardiovascular and resistance forms generated a superior effect on cognitive aging than either form of exercise alone. Moreover, open skills PA such as table tennis, which require individuals to invest higher cognitive effort in response to immediate external stimuli that arise from an unpredictable environment, could provide an extra benefit to EFs. This notion is supported by previous research in human subjects, which has indicated that multimodal interventions focusing on participation in activities that are cognitively, physically, and socially demanding may derive more cognitive benefits for older individuals. Animal studies have also indicated that increased cognitive, physical, and social enrichment in living environments can stimulate the proliferation of precursor cells and hippocampal neurogenesis and enhance the expression of brain-derived neurotrophic factor (BDNF), which can have diverse functions in brain development and plasticity. Taken together, studies have provided preliminary evidence supporting the cognitive benefit of open skills PA. These findings not only shed light on the understanding of mechanism linking PA and cognitive functions, but also provide useful implication for promoting table tennis as a cognitive enhancement tool.

Key note IV

Diamonds in rough – Guidelines to identify and develop high potential in youth racquet sport players

Irene Renate Faber, Saxion University of Applied Sciences, Department Research Centre for Health, Social Work & Technology, Enschede, The Netherlands

Finding and guiding youth players with the potential to become an elite player is challenging. Racquet sports national associations try to select high potential youth players at an early age (10-12 years) to support them in their route to excellence. For this reason, trainers or scouts estimate a youth player's full potential using observations of current performance and performance outcomes. At such a young age, selections based on performance alone are, however, influenced to a large extent by individual differences in growth, maturation, development and learning curves, training experiences, competition participation and environmental factors. These factors can create temporary advantages or disadvantages for performance at these young ages, but probably do not reflect a youth player's full potential which hinders the interpretation of the observational findings. These problems remain (partly) when monitoring players during their development for the selection of training facilities and competition.

In the period from 2012 to 2017, research explored the opportunities to better estimate a player's potential and to identify crucial indicators in individual pathways for success. For this purpose a mixed method approach was used including a systematic review and a qualitative study to explore the scientific databases and the perspectives of racquet sports players and coaches, respectively. Additionally, quantitative research was used to test hypothesis about the value of tests measuring perceptual-motor and cognitive skills with regard to talent identification and development purposes. Finally, the selection routines of coaches / trainers within different context were evaluated concerning the existence of a relative age effect in racquet sports.

The results revealed that talent development in racquet sports should be considered as a multidimensional process in which the potential of a youth player can only be described in relation with the task and the player's context. It seems that intellectual and perceptual abilities and coordinative i.e. perceptual-motor skills are essential natural abilities in racquet sports. Moreover, monitoring sports motivation, engagement in coping strategies, experience of burn-out, perceived stress and recovery are highlighted as important features in talent development. Instruments focusing on these aspects are suggested to be of added value for coaches and trainers for the identification and monitoring of high potential youth players. Finally, it has been shown that the selection routines of coaches can create a relative age effect in racquet sports, especially in the context with a high amount of players and high-level competition. These results provided new insights and implications to better set up the guidelines for talent development programs in racquet sports.

Invited speaker I

The table tennis parent as an expert in talent development?

Johan Fallby, Sport Psychology Consultant, Stockholm, Sweden

Competition is fierce for those who aim at becoming a top player in table tennis – often small details make the difference between success and failure. Although the work produced by talent development researchers and practitioners is gradually identifying the number of factors that increase the probability of success, conclusive information is still far from reached (for discussion see for example Collins & MacNamara, 2018; Schorer, Wattie, Cobley, & Baker, 2017).

A critical aspect identified by researchers and practitioners is the role parents can play in setting the stage for their child to increase the probability to achieve success; this gives an interesting opportunity to clubs, coaches and parents alike to explore and learn from it. It is actually possible to say that a parent can be “an elite sport parent” – as the player who wants to reach the elite level in their sport.

To become an elite table tennis parent demands, at a minimum, knowledge about talent development research and practice, self-awareness, and patience. Not unlike the skills that are demanded by the player itself. However, coaches and clubs cannot demand that parents have a bachelor degree in table tennis before they can help their child to develop. What can they then demand, or at least hope for?

It is impossible at an early age to tell who will become an elite table tennis player. Therefore, it is necessary for a table tennis parent to understand the factors that will increase the probability of their child to develop into a top player in the future (Fallby, 2015). Only then they can call themselves develop as sport parent expert. Those factors include, for example, *individual factors* of the parent such as self-awareness of own behaviour, skill in receiving and giving feedback or knowledge of table tennis. At an *organizational level* parents can contribute through thoughtful interaction with coaches and other parents to create the positive performance environment. The *interaction with their child* should incorporate social support and rightful demands on effort to give opportunity to increase the child's self-determination as well as knowledge of themselves and table tennis in general.

Invited speaker II

History and background of rubber treatment and possible consequences of actual proposal to change Law of Table Tennis 2.4.7

Konrad Tiefenbacher, Dipl.-Phys., Wassing Messtechnik GmbH, Osanbrück, Germany

Introduction

It was discovered in the 1970s that additional daily application of organic liquids enhances the performance of table tennis rubbers. Since then regardless of health risk related to the application a wide spread culture of daily use of chemical substances had been established in table tennis by athletes to tune the rubbers.

With growing awareness of health risk of chemicals in the last decades the ITTF as the sports governing body introduced several rules changes in order to ensure that nothing harmful is related to the sports and to follow Olympic Agenda 21. The last major rule's change to ban any after treatment of authorised rubbers dated 2008 finally broke the culture of open use of liquid chemicals. But this rule has the weak point of a lack of verifiability.

There are continual rumours on unfair competition especially in top level sports which now led to a seemingly logical proposal of a further change in Laws of Table Tennis to be decided this year's WCC in Halmstad Sweden.

Aim and theoretical framework

It is the purpose of this study to deliver facts for the discussion on the Laws change proposal

Method

Information from diverse sources are put together:

- Background of history of rubber treatment, according rules and racket control test methods from speed glue up to today
- Physical effects of different treatments in high level competition
- Chemical analysis and evaluation on harmfulness of speed glue and booster substances used in the past, actually and probably in future
- Detailed review of the wording of the actual proposal and evaluation of psychological effects and motivations as reaction on the new rule.

Results/Discussion and conclusions/expected outcome

Simple wording of proposal No. 3 to the AGM 2018 to change Table Tennis Law 2.4.7 suggests benefit for the table tennis world to create a situation with fair competition and the exclusion of harmful substances from table tennis.

But looking in detail on the wording of the proposal and opposing it with history of rubber treatment, racket control test methods, physical effects of several treatments, treatment methods/substances used it turns out that such a rules change will not improve the situation in table tennis.

Contrary it is very probable that harmful substances will return to the world of table tennis to be regularly used by top level athletes and even worse by all players in any competition level and age as it has been the case decades ago. This would then mean a step backwards to fulfil Olympic Agenda 21.

Key words

ITTF, table tennis, racket coverings, rubber, treatment, performance, equipment culture, unfair competition, harmful, unhealthy, Olympic Agenda 21, AGM, Laws of Table Tennis.

Workshops 27 of April

Health and innovation

Orchestrating a neurofeedback intervention in table tennis: Playing with emotional regulation and attentional control

Arne Edvardsson, Center of Research on Welfare, Health and Sport (CVHI), Halmstad University, Sweden

Introduction

Neurofeedback (NF) training is way to change an individual's brain activity for the better. NF strengthens the brain's own ability to regulate itself and increases healthy neuroplasticity. The fast developing NF technology has been used to strengthen several different psychological functions and states (e.g., attention, wellbeing) in both healthy and clinical populations.

In sports and music NF has shown promise for reducing performance anxiety, improving creativity and decreasing reaction times. In clinical population (e.g., anxiety disorders) NF have been shown to be effective for improving individuals ability to keep focus on task at hand, increase emotional regulation skills and improve recovery.

Table tennis is a high-speed sport where fast reactions, ability to refocus after every point and well-regulated emotions are essential parts of the game. A method for improving cognitive/attentional focus and regulating emotional responses should be a useful tool for improving psychological skills.

In a previously conducted pilot case studies with a professional musician and two athletes, NF and heart-rate variability biofeedback where combined in an intervention programme. The interventions was based on the Wingate five step approach which is a biofeedback Cognitive Behavioral Training model for improving performance and coping with anxiety. Subjective reports from the clients suggested that NF helped them with lowering anxiety, improving sleep and having creative insights. These preliminary results are in line with what has previously been reported in the literature regarding sport. What lessons can be learned when preparing for setting up a NF intervention for table tennis players?

Aim and theoretical framework

This workshop discusses how a neurofeedback intervention best could be set up for improving important psychological skills essential in the game of table tennis (e.g., attentional control, emotional regulation, recovery).

Method

A model is proposed for an NF intervention, in conjunction to table tennis players' normal training routine, to improve attention, reduce anxiety, increase emotional regulation and increase creativity.

Results

It is hypothesized that the NF training in table tennis will help improve scores on reaction times, attentional skills, emotional regulation skills and sleep improvements.

Discussion and conclusions/expected outcome

Bridging knowledge from different scientific, sport and performance domains can increase our understanding of psychophysiology, psychology and organizational interplay. Discussing intervention models and learning from different fields is essential to creating future health and performance interventions.

Key words

Neurofeedback, anxiety, performance, sport psychology, wellbeing, sleep improvements, creativity.

High Performance

Mental/Cultural implications and expectations for table-tennis technical development, with special emphasis on a proposed, 3rd, TT-system: "The MG- ship style"

Mahmoud Ghuneim, Jordan

Introduction

The last and unique table tennis sport technical revolution was clearly innovated by Sweden in the mid-late eighties of the last century. It was such a breakthrough that resulted in switching the domination of the game from one corner of the globe to the other, literally from China to West Europe.

Since that 1989 legendary historic WTTC-event [Sweden/China: 5set/0] until present times, very limited particular specially-distinct development, in the very "basic" technical aspects of TT-sport game-play, was really introduced on the world-wide scenery; the question is: why?

To counter-attack such a dramatic situation, the Chinese (and other Asians) adopting "military-patterned" practice and training systems, managed later to regain dominator control over the sport. It was just by pushing athlete's speed and power to the extreme limit, not with any definite "innovative" change in basic structure of the game.

Actually, Asian TT legendary schools adopted the Western style without creating special new form of player's management with the TT racket equipment and ball.

Based on my strong belief that TT sport is now on the verge of new technical developmental era by innovating a 3rd style, next and distinctive to legacy "Shake-hand" and "Pen-hold" styles.

I wish to demonstrate such new, 3rd style, named " the MG-Ship " style, as fruits for my last 10 years research work including my participation with 14th ITTFSSC2015-China and 15th ITTFSSC2017-Germany. The presentation should also discuss the style-change process, both from athlete/coach/researcher cultural and mental perspectives.

Case study: "Moregardh Truls"- Sweden (WTTC- Juniors- 2017 - Finalist) as claimed [by myself] the 1st world-level top player embracing the new, 3rd style, namely "the MG-Ship style".

Key words

Table Tennis, Style, MG-Ship, Moregardh Truls.

Sport Sciences

A guide to fitness testing in racquet sports

Samuel Andrew Pullinger, Aspire Academy, Sport Science Department, Doha, Qatar

Introduction

Table tennis is a dynamic, asymmetric racket sport and one of the fastest ball games played around the world in terms of ball speed and time between strokes (Kondric et al., 2013; Lees, 2003). The modern sport of table tennis is a complex and invasive racket sport that is characterised by an intermittent activity profile multifaceted in its skill, physiological and cognitive demands with success highly dependent on the interaction of these (Girard & Millet, 2009; Kondric et al., 2007).

Table tennis is a sport which lacks research identifying the characteristics and competencies required to excel at table tennis from a young age to elite senior competitions. The table tennis community has general disagreements regarding the most important physical performance characteristics and the most useful performance tests to utilise to assess players. As no attempt has been made to provide information regarding how to test athletes, I want to provide a workshop which will help coaches provide basic or in-depth scientific support to athletes in table tennis through monitoring and assessing physical functions. If we look at the specific physical demands of the sport, excellent power, speed, agility and well-developed aerobic and anaerobic capacity are required to excel. My overall aim is to provide you with a comprehensive overview of the science of table tennis, by defining a performance model and identifying directions for future research to fill the knowledge gaps you may have. I will show you how to perform various tests and explain in detail as to why these might be important.

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