3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science

19 Jun 2010

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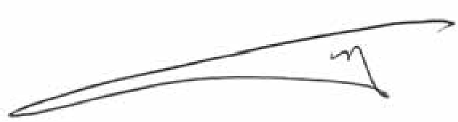
Message from the President

Hong Kong Association of Sports Medicine and Sports Science

I am very delighted to welcome you for coming to the 3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science at The Chinese University of Hong Kong. This year, we are very happy to have Prof Stephen Wong from the Department of Sports Science and Physical Education, The Chinese University of Hong Kong, to host the event.

The HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science is an excellent platform for both postgraduate and undergraduate students working in sports medicine, rehabilitation and exercise science research to share their research ideas, to gain experience in delivering presentation, and to gain exposure to the local community in sports. It is also an excellent opportunity for students from different disciplines to share their wealth of knowledge and ideas. We are confident that the conference will be rewarding and fruitful for all participants.



Dr. Patrick YUNG

President,

The Hong Kong Association of Sports Medicine and Sports Science

Message from the Conference Chairman

3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science

It is my pleasure to invite you to participate in the 3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science. The Department of Sports Science and Physical Education of The Chinese University of Hong Kong is once again honoured to host this conference.

The second HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science was successfully organized in 2008. The conference proved to be an overwhelming success and clearly highlighted the depth of academic talent and research ability of our local students in the areas of sports medicine and sports science. This year, the conference once again aims to provide further opportunity for our students to present their research works, discuss issues with fellow students and to meet new colleagues from different groups in local institutes working in sports related research. This conference will serve as an ideal opportunity for postgraduate students to present their research in a comfortable and friendly environment. It will no doubt prove to be a valuable learning experience and prepare them for similar occasions on a larger scale in the future.

We expect the exposure to the local community and interactions with other experts in sports science and sports medicine to stimulate our students to enrich their work and to further present their work in international conferences, and even publish their work in international journals.

Prof. Stephen H. WONG

Chairman, Conference Committee

3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science, 2010

Prof. Ron MAUGHAN

Professor of Sport and Exercise Nutrition
School of Sport, Exercise and Health Sciences,
Loughborough University

Ron Maughan obtained a BSc (Physiology) and PhD from the University of Aberdeen, and held a lecturing position in Liverpool before returning to Aberdeen where he was based for almost 25 years. He began as a Clinical research Fellow in the Department of Surgery and progressed to a personal Chair in Human Physiology in the Department of Biomedical Sciences. He is now Professor of Sport and Exercise Nutrition at Loughborough University.

Professor Maughan is a Fellow of the American College of Sports Medicine and received that organisation's Citation Award in 2007. He is also a member of the Physiological Society, the Nutrition Society, the Biochemical Society, and the Medical Research Society. He chaired the Human and Exercise Physiology group of the Physiological Society for 10 years and was a member of the Council of that organisation. He is Chair of the Sports Nutrition group established by the IOC Medical Commission in 2002. He has acted as an adviser to UK Sport, UK Athletics, The FA, FIFA, the Irish Sports Council and to various other sporting bodies. In 2006-07 he was adviser to the House of Commons Select Committee enquiry on Human Enhancement Technologies in Sport.

Research Interests
On moving to Loughborough, Professor Maughan established a new Masters Degree program in Sport and Exercise Nutrition and a distance learning MSc program in Sports Nutrition. His research interests are in the physiology, biochemistry and nutrition of exercise performance, with an interest in both the basic science of exercise and the applied aspects that relate to health and to performance in sport.

Dr. Susan SHIRREFF

Reader
School of Sport, Exercise and Health Sciences,
Loughborough University

Susan completed her first degree in Physiology at Aberdeen University in 1993. Following this she completed a PhD in Exercise Physiology in the area of Post-exercise Rehydration in 1996. After lecturing for 5 years at Aberdeen University -during which time she spent some months working at the Copenhagen Muscle Research Institute - Susan moved to Loughborough University to continue her research and teaching interests.

Susan is a member of The Physiological Society, The American College of Sports Medicine, The Nutrition Society, the British Association of Sport and Exercise Sciences and The Medical Research Society. She is the theme leader of the sport and Exercise Nutrition Theme of the Nutrition Society.

Research Interests
Susan has research interests in sport and exercise physiology and nutrition. Current research projects focus on thermoregulation and water balance, sweating and salt balance and on recovery from disturbances to homeostasis.

Susan teaches in the area of her research interests, but also in broader areas of physiology and nutrition related to sport and exercise.

Prof. Stephen H. WONG
Professor
Department of Sports Science and Physical Education,
The Chinese University of Hong Kong

Professor Stephen H. Wong obtained a B.Ed.(Hons) from Liverpool University, and an M.Sc. and a Ph.D. from Loughborough University. He is currently a Professor in the Department of Sports Science and Physical Education of The Chinese University of Hong Kong (CUHK). Prof. Wong is also the Associate Dean of Faculty of Education and Dean of Students of the United College in CUHK.

Prof. Wong is a Fellow of the American College of Sports Medicine and a Registered Nutritionist of the Nutrition Society. He is the Chairman of Hong Kong Physical Fitness Association and the Council Member of the Hong Kong Association of Sports Medicine and Sports Science.

Prof. Wong's research interests include nutritional and metabolic aspects of exercise, fluid replacement and exercise performance, and promotion of physical activity and health.

Dr. Parco SIU
Assistant Professor
Department of Health Technology and Informatics,
The Hong Kong Polytechnic University

Dr. Parco Siu obtained a BSc(Hons) in Biology from The Hong Kong University of Science and Technology, MPhil in Sports Science from The Chinese University of Hong Kong, PhD in Exercise Physiology from West Virginia University School of Medicine, and Postdoctoral Fellowship in Molecular Cardiology from Harvard Medical School.

Dr. Siu is a Fellow of American College of Sports Medicine and Chartered Biologist (U.K.). He has received several awards including the National Student Research Award (American College of Sports Medicine), Young Investigator Award (Society for Experimental Biology and Medicine), Beginning Investigator Award (American Physiological Society), and Honorable Mention of Visiting Scholar Award (American College of Sports Medicine).

He is now an Assistant Professor in Department of Health Technology and Informatics of The Hong Kong Polytechnic University. His research interests include muscle biology, exercise physiology/sports medicine, aging, pressure ulcer, neuromuscular disorder, spaceflight, heart disease/failure, and diabetes mellitus.

Excessive tibial rotation is restored after anatomical double bundle anterior cruciate ligament reconstruction

Mak-Ham LAM[1,2], Kai-Ming CHAN[1,2]

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[2]The Hong Kong Jockey Club Sports Medicine and Health Sciences Centre, Faculty of Medicine, The Chinese University of Hong Kong

Introduction

Anterior cruciate ligament (ACL) injury leads to knee instability, mainly anterior-posterior (AP) and rotational direction. Clinically, knee rotational laxity before and after ACL reconstruction is often examined subjectively by pivot shift test, which is a combined movement of valgus and external rotation. The objective biomechanical way to evaluate functional rotational stability during high demanding movement is still not widely adopted in clinical setting.

Several kinematics studies, which intact knee was used as a control, investigated patients with unilateral ACL injury. On treadmill running, tibial rotation increased with speed in both injured and normal knees1. Waite and coworkers[6] reported that low demand activity such as walking and running did not produce sufficient stress to initiate knee instability in ACL deficient knee. In a study to evaluate functional stability after ACL reconstruction, tibial rotation was found not to be restored after single bundle ACL reconstruction with hamstring graft during a pivoting movement[4].

In-vitro studies showed that anatomical double bundle ACL reconstruction restored both translational and rotational stability[9]. However, there is limited in-vivo study that investigates rotational stability by objective assessment after anatomical double bundle ACL reconstruction. The purpose of the current study was to investigate the range of tibial rotation of ACL deficient and reconstructed knees during a high demanding task. We hypothesized that there would be a significant excessive tibial rotation in ACL deficient knee and the stability would be restored by anatomical double bundle ACL reconstruction.

Methods

Ten male subjects (age = 27.2 ± 4.7yr, height = 1.76 ± 1.00m, body mass = 69.1 ± 9.2kg) with unilateral ACL injury were recruited in the study. ACL rupture was confirmed either by magnetic resonance imaging or clinical examination. All subjects reported instability during sports and were suggested to receive surgical treatment. All injuries were sport-related and all subjects participated at least one time per week of their sports before the injury. The university ethics committee approved the study. Informed consents were obtained from each subject before the study.

All subjects were assessed before and after ACL reconstruction with mean follow-up of 329 ± 187 days. An optical motion analysis system with eight cameras (VICON, UK) was used to record three dimensional movements of lower extremities at 120Hz frequency. Synchronized force-plate (AMTI, USA) data was collected at the centre of the capture volume at 1080Hz. A fifteen-marker model[2] was adopted to collect lower limb kinematics during the movement. Skin reflective markers with 9mm diameter were placed at anatomical landmarks including anterior superior iliac spines, sacrum, greater trochanter, femoral epicondyle, tibial tubercle, lateral malleolus, heel and fifth metatarsal head on both limbs.

Before performing the movement, a standing trial was recorded for each subject in anatomical position. This calibration file provided a definition of zero degree for all segmental movements. Both deficient and intact knees were tested individually. The subjects were asked to jump from a 40cm-high platform and land with both feet on the ground, with only the testing foot on the force-plate. After the foot contact, the subjects pivoted 90 degrees to the lateral side of testing leg, which also acted as the core leg during pivoting. The subjects were instructed to run away after completing the pivoting movement (Figure 1). The evaluation period was defined from the first foot contact to the take-off of the testing leg. Three dimensional coordinates of every marker were exported from the VICON software. Together with the anthropometric measurements, the joint kinematics was then calculated[2]. All calculations were conducted using self compiled program (MATLAB, USA). Force-plate was used to determine the evaluation period when the vertical ground reaction force exceeded 5% of body mass. The main dependent variable in the current study was the range of tibial rotation angle during pivoting movement, which was a period defined from the lowest tibial internal rotation after landing to the highest tibial internal rotation[5].
A paired t-test was employed to determine if statistically significant difference existed in range of tibial rotation between the two limbs pre-operatively and post-operatively, and within the injured limb before and after the anatomical double bundle ACL reconstruction. Power analysis was also conducted if there was no significant difference between reconstructed knee and the intact knee after reconstruction. The level of significance and study power were set at 0.05 and 0.8 respectively.

Results

During the pivoting movement, the tibia internally rotated to a maximum degree (Figure 2). For the range of tibial rotation, there was a significant increase in the deficient knee (12.6 ± 4.5 degree) when compared to the intact knee (7.9 ± 3.1 degree) before reconstruction. This excessive tibial rotation significantly decreased to 8.9 ± 3.0 degree for the reconstructed knee and did not differ to that of intact knee (8.2 ± 2.6 degree) after ACL reconstruction (Figure 3). Since there was no significant difference between reconstructed knee and intact knee after reconstruction, power analysis was conducted (true difference: 2 degrees; correlation: 0.27) and statistical power was reported to be 0.81 between the two groups.

Discussion

In this study, the excessive tibial movement for ACL deficient knee and the reduction of this movement after ACL reconstruction were demonstrated. It was hypothesized that there would be a significant excessive tibial rotation on ACL deficient knee and it would be restored by anatomical double bundle ACL reconstruction. The result of the current study supported the first hypothesis. Moreover, the study power between both limbs after ACL reconstruction was above the pre-set value and so the second hypothesis was also supported in this study.

Our findings supported previous studies[5,8] that showed knee rotational laxity and instability of ACL deficient knee. In a swine study[8], the passive clinical internal-external knee rotation stress test was shown to give excessive laxity of ACL deficient knee when compared to intact knee. In another study[5] with similar protocol to the present study, the tibial rotation of deficient knee was significantly higher than that of intact knee. While those subjects were instructed to walk followed by the pivoting movement, our subjects were instructed to run instead. We believed that the task in our study provided a higher rotational stress to the knee. Moreover, in our study, all the subjects were assessed prospectively before and after ACL reconstruction. The variations between study and control groups were limited to affect our result as intact knee was used as a control.

ACL reconstruction aims to reconstruct the original ACL with normal kinematics in both AP and rotational direction. However, in vitro[7] and in vivo[4] studies showed that tibial rotation was not restored by single bundle ACL reconstruction. One of the reasons suggested that only anteromedial (AM) bundle was replicated, resulting in insufficient rotational control to the knee. In the current study, all subjects were treated with anatomical double bundle ACL reconstruction, in which both AM and posterolateral (PL) bundles were reconstructed to mimic the original ACL anatomy. In addition to the AM bundle, PL bundle provided an important role in the stabilization of the knee against a combined rotatory load[3]. When evaluating double bundle ACL reconstruction with a high demanding activity, the significant decrease in range of tibial rotation of the reconstructed knee suggested the effectiveness of rotational control of PL bundle.

Conclusion

It was concluded that there was excessive tibial rotation in ACL deficient knee during a dynamic functional pivoting movement in this study. The reconstructed knee successfully improved functional knee rotational stability as demonstrated by the restoration of excessive tibial rotation during a pivoting movement before and after anatomical double bundle ACL reconstruction.

Acknowledgement

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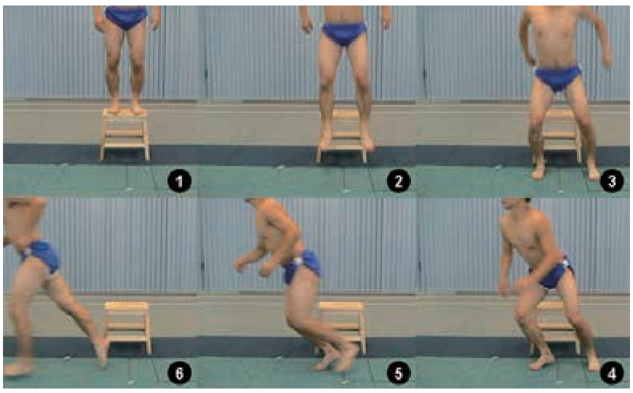

Figure 1. The video sequence (1, initial position; 2, jumping; 3, landing; 4, pivoting; 5, push-off; 6, running) of the high demanding jump-landing and pivoting task.

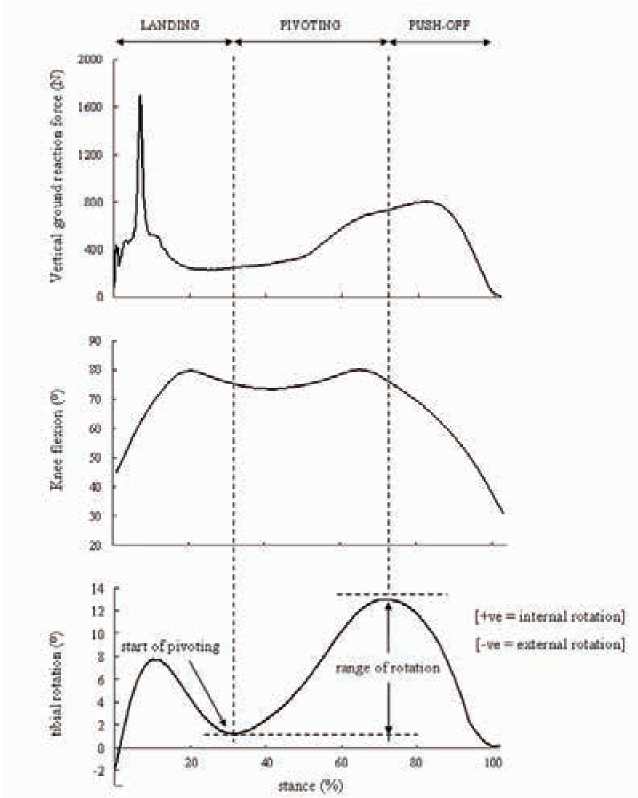

Figure 2. Ground reaction force, flexion angle and tibial rotation during the entire stance phase of the high demanding task.

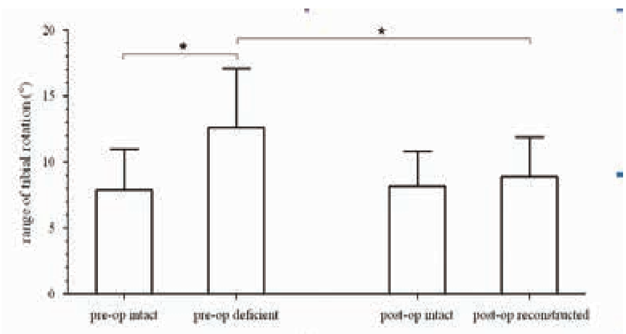

Figure 3. Range of tibial rotation during pivoting movement before and after ACL reconstruction. Asterisks (*) indicate a significant difference.

The use of NSAID is associated with self-reported running performance in recreational marathon runners

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Introduction

Nonsteroidal anti-inflammatory drugs (NSAIDs) are prescribed as analgesics which provide relief from pain and inflammation. In athletic population, NSAIDs are frequently used in relation to muscle and soft tissue injuries [1-4]. However, inappropriate use of NSAID has been demonstrated to be related to adverse effects such as gastric injury and ulceration [5], influence in renal function or renal damage [6], risk of bleeding [7], and hyponatremia in athletes [8]. The sports events that observed to have prevalence of NSAIDs use included basketball, softball, gymnastics, rowing, swimming, and cycling [9]. The prevalence of NSAIDs usage in marathon runners was reported recently by some researchers [6; 10-11]. There is an intuitive thought that better-performing, aggressive marathon runners might have higher tendency to adopt NSAID use but this assumption has not been evidently tested. On the contrary, it might be possible that elementary and/or poor-performing runners are more susceptible to be influenced by the myths on the effects of NSAID under injury condition as they acquire little professional knowledge in the field of marathon running. Although studies on the use of NSAID has been extensively documented in marathon runners in western countries, the prevalence and perceptive reasons of NSAID usage have not been comprehensively examined in the Chinese marathon runner population. Thus, the present study aimed to examine the perceptive reasons for the use of NSAID in Chinese recreational marathon runners. This study also sought to determine the relationship between NSAID use and self-reported running performance in recreational marathon runners.

Methods

A questionnaire-based survey was conducted one to two weeks prior to the 2009 Standard Chartered Hong Kong Marathon in February 2009. Participants aged 18-60 years who were going to compete in the full marathon race of 2009 Standard Chartered Hong Kong Marathon and with successful completion of at least one full marathon race in the past five years were recruited in this study. Participants were also recruited during the training sessions in local running clubs one to two weeks prior to the marathon race. All questionnaires were performed on a voluntary and self-administered basis. Questionnaires were completed and returned on-site immediately. The questionnaire included four sections: 1) personal information, 2) running performance, 3) sports injury, and 4) NSAID usage and the related information. According to the screening criteria, the valid questionnaires are finally included in our analysis. The SPSS 15.0 statistical package was used for data analysis. Chi-square (χ^2) statistics were used to examine association among variables. Median split technique followed by χ^2 analysis was applied to further examine the stratified data. The level of significance was accepted at $p<0.05$.

Results

The collected personal information, self-reported running performance and training background, prevalence of sports injury, and NSAID usage were summarized and presented in Table 1. Of the 201 participants, 174 (87%) were male and 27 (13%) were female. For the use of NSAID, 53 participants (26%) reported that they had taken NSAID in the previous three months. Fifty-three participants (26%) reported that they had used NSAID in the previous three months. Of these, 22 runners (42%) indicated that treatment of sprain injury was the main reason for taking NSAID and 48 runners (91%) reported incidence of sports injury in the past three months. A significant association was found between the incidence of sports injury and NSAID usage according to 2 analysis ($p<0.001$). The NSAID usage-related information in the 53 runners who reported NSAID usage were summarized and presented in Table 2. Among the 53 runners who reported NSAID usage, physician was the major source (70%) in obtaining NSAID while 26% of the users indicated that they acquired no or limited knowledge on the side effects of NSAID. NSAID usage was found to be significantly associated with self-reported personal best run time as well as weekly training mileage ($p<0.05$). In the fast runner group stating less than 4 hours of personal best run time, 32.4% of them reported NSAID usage. In contrast, only 20% of the runners who stated more than 4 hours of personal best run time reported NSAID usage.

Table 1. Running Information and NSAID Usage in Chinese Recreational Marathon Runners

		Marathon runners (N=201)	
		Number of respondents	%
Sex	Male	174	87
	Female	27	13
Age (yr)	18-30	32	16
	31-40	78	39
	41-50	67	33
	51-60	24	12
Marathon competition completed in the past 1-year (times)	0	21	10
	1-2	114	57
	3-4	42	21
	≥5	24	12
Self-reported personal best marathon run time (hr:min)	<3:00	10	5
	3:00-3:30	47	23
	3:31-4:00	48	24
	4:01-4:30	57	28
	4:31-5:00	26	13
	>5:00	13	6
Self-reported weekly training mileage (km)	≤25	52	26
	26-40	51	25
	41-60	45	22
	>60	53	26
Incidence of sports injury in the past 3-month	No	57	28
	Yes	144	72
NSAID usage in the previous 3-month	No	148	74
	Yes	53	26

Table 2. NSAID Usage-related Information in Chinese Recreational Marathon Runners Who Reported NSAID Usage in the Previous Three Months

		NSAID users (N=53)	
		Number of respondents	%
Incidence of sports injury in the past 3-month	No	5	9
	Yes	48	91
Capable to identify the name(s) of NSAID taken	No	27	51
	Yes	26	49
Aware of side effects of NSAID	No/limited knowledge	14	26
	Average/moderate knowledge	25	47
	Good/excellent knowledge	14	26
Source of NSAID[#]	Physician	37	70
	Pharmacy	23	43
	Friends	16	30
	Coach	2	4
	Internet	0	0
Pattern of NSAID usage[#]	When necessary	46	87
	Before competition	12	23
	After competition	7	13
	During competition	2	4
	Everyday	2	4
Perceptive reason for taking NSAID[#]	Sprain injury	22	42
	Muscular pain relief after exercise	16	30
	Pain prevention during exercise	11	21
	Orthopaedic pain	9	17

[#] Participants were allowed to select more than one item

Discussion and conclusion

In the present study, our results show that the prevalence of NSAID use is 26% in Chinese recreational marathon runners in Hong Kong. These data suggest that NSAID usage is related to sports injury based on the findings that large proportion (91%) of NSAID users report previous sports injury and the significant association between sports injury and NSAID usage. In addition, significant associations for NSAID usage with self-reported personal best marathon run time and weekly training mileage are revealed. These findings support the hypothesis that NSAID usage is related to running performance which probably is attributed to the large volume of running in regular training sessions.

In conclusion, the Chinese recreational marathon runner population who perform at high level and are with previous incidence of sports injury are associated with the use of NSAID. These findings are probably helpful for the sports team physicians and coaches to determine the high-risk NSAID drug-users among marathon runners population and to promptly provide appropriate professional advices regarding the treatment/injury prevention and training programme of the athletes.

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The clinical and functional outcome of combined anterior cruciate ligament and posterior cruciate ligament reconstruction

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Introduction

The purpose of the present study is to evaluate the clinical and functional outcome of simultaneous arthroscopically assisted reconstruction of anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) using bone-patellar-tendon-bone (BPTB) and hamstring autografts in chronic ACL & PCL deficient knees.

Methods

Seven patients (6 males and 1 female) with chronic ACL & PCL injuries underwent one-stage ACL and PCL reconstruction. Function of the operated knee was evaluated according to the International Knee Documentation Committee (IKDC) & Lysholm score. Knee range of motion was assessed by goniometer and pain was assessed by Visual analog scale (VAS). Knee stability was evaluated by Anterior Drawer, Posterior Drawer, Lachman test and KT 1000 arthrometer. The average follow-up period was 21 months (range 6-36 months). All diagnoses of ACL and PCL disruptions were confirmed by physical examination, magnetic resonance imaging, and arthroscopy. Before surgery, all patients were prescribed with a rehabilitation program on maximizing knee range of motion and emphasizing the quadriceps muscle training. All patients were also placed on an aggressive, well-structured rehabilitation program postoperatively.

Results

Mean postoperative Lysholm score was 83.3 ± 7.8 (range, 72.0 to 93.0). Four had a good (84-94) results, three had a fair (65-83) results and none displayed poor results. Mean postoperative IKDC score was 72.2 ± 13.2 (range, 57.5 to 87.4). Six of 7 (86%) patients subjectively rated their knee function as normal or near normal in comparison with preinjury status. Six of 7 (86%) reported no pain during moderate or strenuous activities. The mean pain VAS score was 0.4 postoperatively. For the range of motion, none of the patient had extension lag, 5 patients gain full flexion and 2 patients lost 5-10° of flexion when compared with contralateral side. None of the patient require post op MUA. Postoperatively, 6 of 7 (86%) knees had Grade I or 0 Anterior Drawer and Lachman test results, with one had a grade II in both test results; all patients had Grade I or 0 posterior drawer test. the mean postoperative corrected anterior side-to-side difference values in 7 knees was 1.5 mm. The mean postoperative corrected posterior side-to-side difference was 2.5 mm.

Discussion

Combined rupture of both anterior and posterior cruciate ligaments often results in significant functional disability and requires surgical treatment.[1,2] Several studies have reported the effectiveness and safety of arthroscopically assisted reconstruction of both cruciate ligaments.[3,4,5] However, there are still debates on the timing of surgery, the choice of grafts and the post-operative rehabilitation because the surgical outcomes like the anterior-posterior laxity and range of knee motion is less predictable than isolated ligament reconstruction.

Regarding on the timing of surgery, knee stiffness is a major concern. In acute injuries, ligaments have good healing potential, but may cause arthrofibrosis if surgery is performed during the acute phase. Therefore, most authors recommend a delay of surgery or two stage reconstruction unless there is an absolute surgical indication such as vascular or neurological injury.

Some surgeons would advocate one stage reconstruction of combined ligament injuries in order to achieve a correct rotation axis and regain a stable knee. And this is our treatment of choice. The mean time of injury to operation is 4.5 months in our study. During the preoperative period, patients have participated in preoperative rehabilitation program, aiming to achieve full and pain free ROM before reconstruction and to reduce the risk of postoperative arthrofibrosis.

Several studies have recommended allogenous tendon grafts for combined ligament injuries because of the advantages such as the lack of donor site morbidity, reduction of operating time and the strength of the larger grafts.[5,6,7] But the disadvantages of allograft materials such as the disease transmission, cost, and delayed graft remodeling should also be considered. And also allograft materials are not always available in Hong Kong. Therefore, we have used the autograft for ligament reconstruction. We have chosen BPTB graft for ACL reconstruction and hamstring tendon graft for PCL reconstruction.

Another reason for our successful treatment outcome regarding our study is the standard post-operative rehabilitation. The complex reconstruction procedure aims to achieve satisfactory ligamentous stability and function.
During the early healing period, gravity and active contraction of the hamstring muscles can have a posterior drawer effect and potentially lead to stretching of PCL graft through tibial shear forces.[8, 9 10] That is the reason why we have adopt a more conservative in early postoperative rehabilitation, protecting the PCL reconstruction by bracing the knee in nearly full extension for 4 weeks, and then started a range of knee motion exercise between 0 and 90° of knee flexion for following 2 weeks. Patients continued to obtain a range of motion of between 0 and

120° by 8-10 weeks after surgery.

When graft healing was mature, our subjects follow aggressive rehabilitation regimes including early passive and active mobilization and range of movement exercises which have been proposed in an effort to improve and accelerate functional recovery. [6,9,10] The total time of recovery for our patients was about 9-12 months.

We feel that an initially slow recovery of satisfactory range of movement is worth to pay in order to avoid graft attenuation leading to residual laxity that may compromise function. We have achieved promising functional outcomes without complications like neurovascular injuries, graft site mobidity and arthrofibrosis noted in our study.

Conclusion

The results showed that one stage reconstruction of combined ACL & PCL deficiency using autogenous graft is a safe and effective treatment option.

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Three-year prospective injury surveillance study of Hong Kong elite able-bodied and disabled foil fencers

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Introduction

Fencing is a sport that constantly demands fencers to display high agility, fast response and excellent limbs-trunk coordination. The repetitive, asymmetrical and impulsive nature of fencing renders fencers to sustain a range of upper limb and lower limb injuries (Moyer, 1994;Nystrom, 1990; Roli, 2008). Wheelchair fencing sport, using identical weapons as the able-bodied counterpart, has been developed after World War II. Each wheelchair fencer competes in a wheelchair fastened to a frame (Strange, 2008). They are arranged in a distance to ensure the pace of bouts. Due to the elimination of lower extremities contribution, wheelchair fencers rely on their arms and trunks to perform all the necessary techniques. As many wheelchair fencers may have deprived trunk control, the mechanical loadings on their arms are colossal. Given the above, it is conceivable to expect high incidence of upper limb injuries among this athlete group. However, there is no systematic injury surveillance study to investigate the injury patterns of able-bodied and wheelchair fencers. The aim of this study is to investigate the Injury patterns of Hong Kong elite able-bodied fencers and disabled foil fencers. The findings from this first prospective study might help identify common musculoskeletal injuries in the two athlete groups. It also helps sports clinicians to develop specific injury prevention programs.

Methods

A 3-year prospective study on the incidence of injuries among Hong Kong elite able-bodied and disabled fencers were conducted over the period of Nov 2006 to Oct 2009. Consented fencers were interviewed every two months through face-to-face interview by team physiotherapists to collect data about training duration, match duration and injuries (including types, location and severity of injuries). Only sport-related Injuries during practice or competition were analyzed in this study. Three categories to describe the severity of injury namely mild injury (7 days or less of lost participation), moderate injury (8-21 days of missed participation) and major injury (22 or more days of missed participation) were used (Ferrara and Buckley, 1996). Causes of injury (traumatic or overuse) and recurrence of incidence (newly-acquired or recurrent injury) was also recorded to rule out the possible mechanism of injuries. Incidence of injury (injury per 1000 hrs athlete exposure) for able-bodied and disabled fencers during training and competition were compared by independent t-tests.

Results

18 disabled and 12 able-bodied Hong Kong elite foil fencers were recruited. 14 disabled and 10 able-bodied fencers had successfully completed the 3-year surveillance injury study (Table 1). 95 and 62 injuries, which accounts for an overall injury incidence of 3.9 injuries/1000 hours (95% CI: 3.08-4.63) and 2.4 injuries/1000 hours (95% CI: 1.81-3.01), were reported in the disabled and able-bodied fencers respectively (Table 2). Disabled fencers showed a statistically significant higher incidence of injury ($p<0.05$). Although most of the injuries were newly-acquired (77.9% in disabled; 80.5% in able-bodied fencers) and traumatic (61.1% in disabled; 75.8% in able-bodied fencers) in nature, the injury patterns between two studied groups varied greatly. Higher number of upper extremities injuries was found in disabled fencers (73.8%). The most prevalent diagnoses among disabled fencers were elbow strain (32.6%) and shoulder strain (20.0%) (Figure 3). Shoulder injuries led to longer absence days from practice / competition (Figure 4) and especially affected disabled fencers without active trunk control (Figure 5 & 6). 4 out of 7 of the disabled fencers without active trunk control were absent from the competition/match for more than 28 days due to partial-thickness tear of shoulder tendon. Similar to other studies (Harmer, 2008; Moyer, 1994; Nystrom, 1990; Roli, 2008), able-bodied elite foil fencers were more susceptible to sustain lower extremity injuries (69.4%) like hamstrings strain (22.6%), ankle (14.5%) and knee sprain (11.3%) (Figure 7). Conditions such as hamstrings tear, anterior cruciate ligament rupture and fracture ankle were the major injuries among able-bodied fencers and caused long absent from practice / competition (Figure 8).

Table 1. Demographic data of able-bodied and disabled fencers (Disabled fencers include 2 lower limb amputee, 6 Spinal Cord Injury, 2 Cerebral Palsy, 3 poliomyelitis and 1 congenital limb deficiency athletes)

	Disabled fencers (n=14)	Able-bodied fencers (n=10)
Age	33 ± 9	28 ± 6
Gender	Male: 7, Female: 7	Male: 12; Female: 0
Years of fencing (yrs)	14.7 ± 5.3	12.9 ± 5.2
BMI (kg/m²)	19.8 ± 3.5	18.6 ± 3.1
Ambulatory level	walker: 7; wheelchair user: 7	-

*Table 2. Total exposure time, number of injuries and injury incidence of the Hong Kong elite able-bodied and disabled fencers during the year of 2007-2010. *Significantly higher incidence of injuries in disabled fencers as compared to that of able-bodied fencers.*

	Total Exposure (hr)	Number of injuries	Injury incidence (95% CI) per 1000 player hrs
Able-bodied fencers (n=10)	25699	62	2.4 (1.81, 3.01)
Disabled fencers (n=14)	24664	95	3.9* (3.08, 4.63)

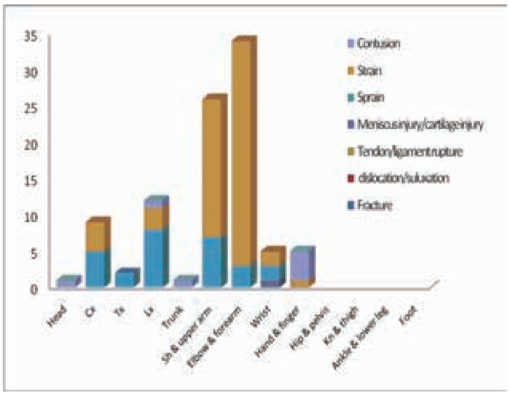

Figure 3. Type of injuries in disabled fencers

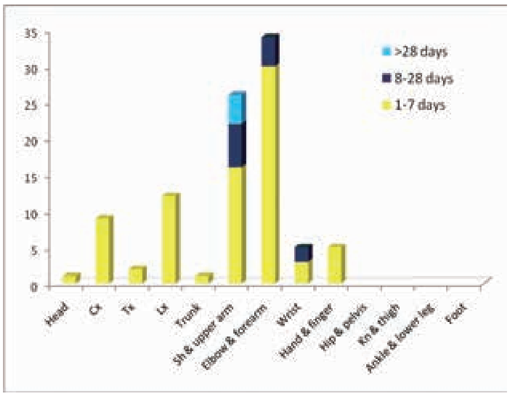

Figure 4. Severity of injury in disabled fencers

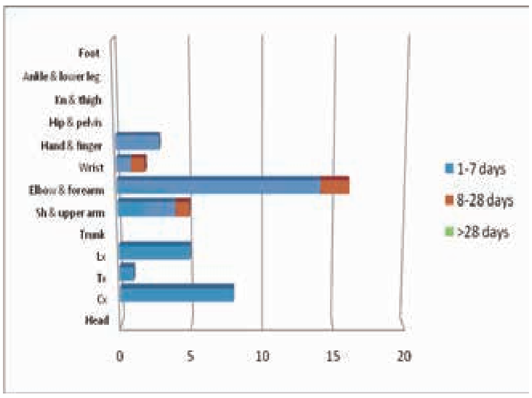

Figure 5. Injured body part and severity of injury as sustained by Class A (with trunk control) disabled fencers

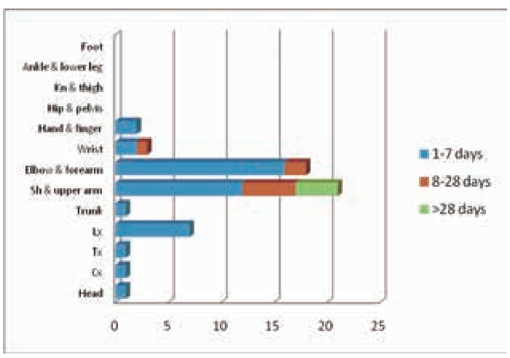

Figure 6. Injuried body part and severity of injury as sustained by Class B (without trunk control) disabled fencers

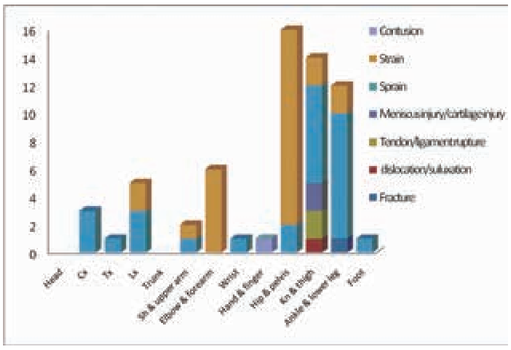

Figure 7. Types of injuries in able-bodied fencers

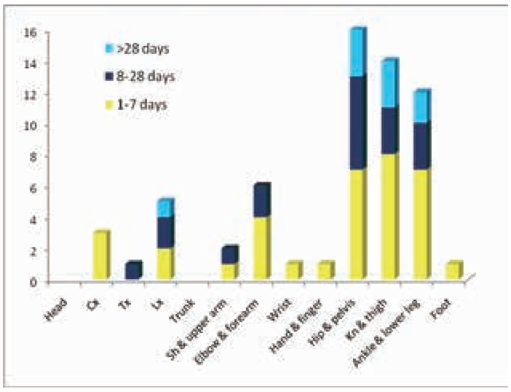

Figure 8. Severity of injury in able-bodied fencers

Discussion

Even though the rules of competition, skills and equipments are very similar in both able-bodied and disabled fencing, the injury patterns of the able-bodied and disabled fencers varied greatly. Disabled fencers were more vulnerable than able-bodied counterparts in sustaining musculoskeletal problems. Besides, highly disabled fencers without active trunk control athletes seem to have higher incidence of upper limb injuries. Such higher upper limb injury rate among the disabled fencers may be related to the truncated "kinetic chain". Groppel (1992) stated that different body parts can be visualized as a system of chain links. The force generated by a part of the body will be successively transferred to the other body parts. The sequential activation of the kinetic chain is usually initiated from the ground where the lower extremities of the body create a ground reaction force. The sequential activation proceeds from the legs, through the hips, trunk, the scapulothoracic and glenohumeral joints, eventually reach the distal part of the arm. Any alternation in the movement patterns that do not properly activate all portions of the kinetic link system can increase the risk of injury and affect the overall performance (Groppel, 1992; Kibler, 1994). In wheelchair fencing, the eliminated footwork impairs the movement sequence of fencing motion. Further hindering of upper limb movements would be expected among highly-disabled fencers who have compromised trunk control. In order to generate sufficient attacking speed, disabled fencers may be subjected to higher upper limb strain and moment that lead to higher risk of upper limb injuries.

Conclusion

The results imply that specific injury prevention strategies/programs should be tailored for both able-bodied fencers and disabled counterparts. Future studies on fencing biomechanics, motion sequence analysis and investigation of injury mechanism among different fencers are warranted.

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The difference in radiological lower limb alignment between ACL-intact and ACL-deficiency knees in the Chinese population

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Introduction

The prevention of non-contact anterior cruciate ligament (ACL) has received increasing attention in sports Traumatology. In order to prevent non-contact ACL injuries, one must understand its injury mechanism and identify the risk factors that contribute to the injury [1, 2]. Identifying the extrinsic risk factors such as footwear, weather condition and field surfaces can help to design programmes to prevent ACL injures in athletes during pre-season training and completion [3, 4]. On the other hand, understand the anatomical, hormonal and biomechanical intrinsic risk factors of ACL injury may help to design neuromuscular training that prevent ACL injuries in elite athletes [5].

One of the intrinsic risk factors for ACL injury is the anatomical alignment difference in the lower extremities. Its association with ACL ruptures has received substantial interest by many biomechanics scientists. Studies in the past have shown an increase incidence of ACL tear in women athletes in various sport activities [3, 6-7], with one of the reasons being anatomical difference. At present, there is conflicting opinion in the literature regarding the relationship between lower extremity alignment and the risk of ACL injury. Particularly, there is no data studying the Chinese population. The purpose of this paper aims to find out whether there is any lower limb anatomical difference between ACL-intact and ACL-deficiency knees in the Chinese population.

Methods

Between January 2010 to April 2010, 24 subjects with ACL-deficiency knees and 19 subjects with ACL-intact knees had their lower limb anatomical alignment measured at two local hospitals in Hong Kong, Caritas Medical Centre and Kwong Wah Hospital. All subjects involved are Chinese ethics. Epidemiological data including gender, age, dominant side and injury side, and body mass index were recorded [Table1].

Bilateral AP standing scanogram and knees X-rays (standing lateral view and tunnel view) were taken for both ACL-deficiency and ACL-intact groups of subjects. Measurements were taken on the dominant side for ACL-intact knees and on both sides for ACL-deficiency knees. With these radiological measurements, difference in lower limb anatomical alignment between ACL-intact and ACL-deficiency were compared first. The other set of data in the ACL-deficiency knee allowed the comparison of anatomical difference between the ACL-injured and uninjured knees.

From the bilateral lower limb AP standing scanogram, radiological parameters including I) lower limb mechanical axis, II) tibio-femoral angle, III) neck-shaft angle were measured. The posterior tibial slope measurement was obtained from the standing lateral knee X-rays. Finally, the notch width index (NWI) was determined by dividing the NW measurement over the FW measurement obtained from a tunnel knee X-rays.

Results

The mean mechanical axis of ACL-intact and ACL-deficiency group were -0.5° and -1.3° respectively, with a negative value meaning the knee was in varus alignment. The mean tibio-femoral axis of ACL-intact and ACL-deficiency group were 6° and 4° respectively. The posterior tibial slope for ACL-intact and ACL-deficiency knees were 12° and 13° respectively [Table 2]. No statistically significant difference in lower limb mechanical axis (p=0.43), tibio-femoral angle (p=0.07) and posterior tibial slope (p=0.42) between 2 groups were found. However the analysis of NWI showed statistically significantly smaller values in the ACL-deficiency group compared to the ACL-intact group (p=0.02), with a mean value of 0.26 and 0.29 respectively.

For the ACL-deficiency subjects, measurements seem to be comparable on both sides [Table 3]. No statistical significant difference in anatomical alignment is found between the injured and uninjured limb in terms of mechanical axis (p=0.94), tibio-femoral angle (p=0.49), posterior tibial slope (p=0.71), neck shaft angle (p=0.85) and intercondylar notch width index (p=0.74).

Discussion

In this study, the results did not support any anatomical difference in lower limb alignment between the injured and uninjured knees. ACL injury is unlikely to cause changes in lower limb alignment. Nevertheless, this study revealed a smaller notch width index in the ACL-deficiency group; but other lower limb alignment parameters including the mechanical axis, tibio-femoral angle, neck shaft angle and posterior tibial slope were similar in both ACL-intact and ACL-deficiency groups.

Difference in measurement of notch size is seen between our study and western studies [8, 9]. A few reasons might account for the difference. Firstly the method for obtaining a tunnel or notch view and the knee position during X-ray taking was not standardised. This would affect the measurement values significantly [10]. Secondly, difference in body height and difference ethical population studied would cause differences in measurement value as well [11].

In the literature, larger Quadriceps angle (Q-angle) might be observed in female athletes, but this is only one of many anatomical differences observed [12], and no true correlation between Q-angle and ACL injury rate was observed [13-15]. Significantly higher varus knees alignment was observed in Chinese and Japanese subjects when compared to Caucasian [16,17]. It was proposed that high valgus tibial osteotomy might be performed in an unstable ACL-deficient knee with a varus thrust to minimise the risk of an ACL reconstruction failure. However, no significant anatomical difference was observed between the ACL-intact and ACL-deficiency knees in our locality.

Previous study showed that high tibial osteotomy resulted in an increase in posterior tibial slope, which can lead to anterior knee instability [18]. It has been estimated that a 10o increase in posterior tibial slope can result in a 6mm increase in anterior tibial translation, which lead to three-fold increase in the ACL load [19]. With evidence showing a significant difference in the measurement of posterior tibial slope between medial and lateral tibial plateau [20, 21], using MRI for measurement would obtained more accurate measurement.

Conclusion

This study first presented various lower limb anatomical alignments in ACL-intact and ACL-deficiency knees in the Chinese population. A smaller notch width index is found in the ACL-deficiency group. We believe that further research with better confined variables is needed to determine the exact relationship between anatomical risk factors and non-contact ACL injury in the Chinese population.

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Table 1. Subjects' epidemiology

	ACL-deficiency	ACL-intact
No of subjects	*24*	*19*
Gender (M: F)	*20:2*	*15:4*
Age	*26 (18-39)*	*27 (24-31)*
BMI (kg/ m²)	*24.4 (17.5- 34.7)*	*22.4 (16.8 - 28.2)*
Non-contact sport injuries	*Soccer (11)* *Basketball (6)* *Others (7)*	-
Injury side	*Left (13)* *Right (11)*	-
Dominant side	-	*Right (15)* *Left (3)*

M: Male; F: female
BMI: body mass index

Table 2. Compare lower limb alignment measurement between the ACL-intact and ACL-deficiency group

	ACL-deficiceny (Injured limb)	ACL-intact (dominant limb)	P value (CI at 95%)
Mechanical axis (deg)	-1 (-9 to 4)	0 (-7 to 2)	0.43 (-2.604 to 1.135)
Tibio-femoral angle (deg)	4 (0 to 9)	6 (1 to 10)	0.07 (-2.974 to 0.128)
Posterior tibial slope (deg)	13 (2 to 19)	12 (6 to 19)	0.42 (-1.498 to 3.515)
Hip neck-shaft angle (deg)	127 (109 to 143)	129 (120 to 138)	0.26 (-6.147 to 1.704)
Notch width Index	0.26 (0.21 to 0.32)	0.29 (0.23 to 0.34)	0.02 (-0.048 to -0.012)

The mean measurements with the range in brackets are shown. All measurements in degrees are rounded-up to the nearest degree.

Table 3. Compare lower limb alignment measurement between the injured and uninjured limbs in the ACL-deficiency group.

	Injured knee	Uninjured knee	P value (95 % CI)
Mechanical axis (deg)	-1 (-9 to 4)	-1 (-8 to 2)	0.94 (-0.996 to 1.080)
Tibio-femoral angle (deg)	4 (0 to 9)	4 (2-9)	0.49 (-0.989 to 0.489)
Posterior tibial slope (deg)	13 (2 to 19)	13 (4-25)	0.71 (-1.503 to 2.170)
Hip neck shaft angle (deg)	127 (109 to 143)	127 (110 to 144)	0.85 (-1.593 to 1.926)
Notch width index	0.26 (0.21 to 0.32)	0.26 (0.21 to 0.33)	0.74 (-0.009 to 0.006)

The mean measurements with the range in brackets are shown. All measurements in degrees are rounded-up to the nearest degree.

The biomechanics of Jun Fan Jeet Kune Do-the straight lead

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Introduction

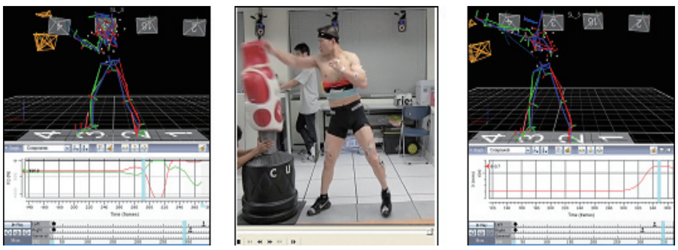
Martial arts are popular worldwide. Martial arts exercises are good to health and promote fitness if do it properly[1]. Jeet Kune Do is a martial arts system and philosophy developed by martial artist and actor Bruce Lee in 1965. Lee developed Jeet Kune Do as a response to the shortcomings he found in traditional martial arts. In 2004, the Bruce Lee Foundation decided to use the name “Jun Fan Jeet Kune Do (振藩截拳道)” to refer to the martial arts system that Lee founded. The straight lead was a key element in Bruce Lee’s development of his own personal style. It was designed to be uncomplicated, economical, and brutally effective but is not as simple as it might seem[2,3]. Thus, to conduct a research on JFJKD straight lead is to study a research on the basic, fundamental principles of JFJKD.

Methods

The punching time, maximum wrist joint centre (WJC) velocity, maximum rear leg anterior ground reaction force (GRF), sequence of ‘Three-point landing’ and anterior displacement of joints pattern during Straight Lead (SL) and Push Step Straight Lead (PS) of JFJKD were studied through the following three systems. (1) Reflective Marker Motion Capture (VICON System with 16 camera truss setup), forty one body markers (1cm diameter) was used for the joints motion analysis. Software Nexus 1.6 and Upper limb plug-in-gait model were used to collect and explore data. The sampling rate is 200Hz. (2) Force Plate system (KISTLER Type 9281 EA) was used for the ground reaction force detection. The sampling rate is 1000 Hz. (3) High speed camera ((BASLER, 100 Hz) was used for motion capture and movement analysis. All systems were synchronized during study. Nine JFJKD practitioners (age=33.7±11.6 yrs, years of training=6.4±1.9) as subjects were recruited.The hitting target was a 70kg weighted, 1.51m height plastic dummy. Forty-four SL and forty-four PS successful trials of data were analysed.

Results

A. Punching Time



Punching time: the total time from movement initiation (**ST**, a time point that change of equal vertical GRF (Fz of force plate) from left and right lower limbs to rear leg greater than lead leg) to the contact of the target by reflective marker placed on metacarpal joint of middle finger (**CON**) and follow-through (**FT**, a time point that no further anterior displacement of wrist joint centre after hit the dummy). Retrieve data from Vicon Nexus System. Since the sampling rate of the VICON system is 200Hz, one frame stands for 0.005sec. Figure out time point of ST and FT. The mean punching time results of the trials of SL and PS of the nine subjects were analyzed with the use of descriptive statistics. *The mean punching time of SL was 0.38(0.07) sec. and PS was 0.51(0.09) sec.*

B. Maximum wrist joint centre (WJC) velocity

The data was captured from the Vicon Nexus system, the mean maximum WJC velocity of SL and PS of the nine subjects were analyzed with the use of descriptive statistics. *The mean maximum wrist joint centre velocity of SL was 5.9(0.8) m/sec. and PS was 6.7(0.8) m/sec.*

C. Maximum rear leg anterior Ground Reaction Force (GRF)

The peak anterior ground reaction force (Fx) data was captured from the Vicon Nexus system and divided by the subject’s body weight. The mean results of each subjects were then analyzed with the use of descriptive statistics. *The mean Maximum body weight percentage of rear leg anterior Ground Reaction Force during punching of SL was 0.42(0.10) and PS was 0.65(0.08).*

D. Sequence of ‘Three point landing’ of PS

Figure (I)

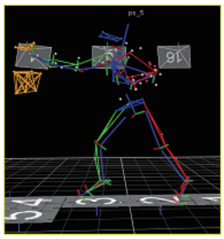


Figure (II)

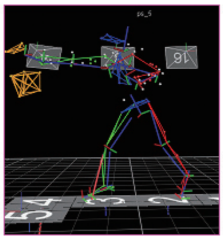
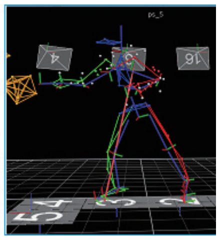
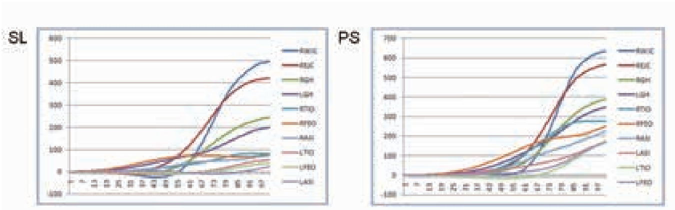


Figure (III)



In Figure (I), after the movement initiation, the lead hand is moving rapidly towards the dummy with the complementary pushing movement of rear leg which generates a strong forward propulsive force during punching. The lead leg and the rear leg are still moving in the air while the lead hand is hitting the dummy already. This is the first point of ‘three-point landing’. In Figure (II), the lead hand is keep moving forward with increasing elbow and shoulder extension, the lead foot is landing on the force plate no.3 as we can see the generation of vertical GRF (red arrow) showed in the Figure (II). This is the second point of ‘three-point landing’. In Figure (III), the lead hand is no longer hitting the dummy, the lead foot is keep increasing GRF and the rear foot is just on landing (showed with red arrow). This is the third point of ‘three-point landing’. The forty-four trials of PS were analyzed one by one through the Vicon Nexus system with Notation Analysis. The results were 75% successful rate.

E. Anterior Displacement of joints:



Abbreviation	Full Name	Anterior Displacement of joints (SL)	Anterior Displacement of joints (PS)
		(10 - the longest displacement; 1 - the shortest displacement)	
RWJC	Wrist joint centre of lead arm	10	10
REJC	Elbow joint centre of lead arm	9	9
RGH	Glenohumeral joint centre of lead arm	8	8
LGH	Glenohumeral joint centre of rear arm	7	7
RTIO	Ankle joint centre of lead leg	6	6
RFEO	Knee joint centre of lead leg	5	5
RASI	Anterior Superior Iliac Spine of lead side	4	4
LTIO	Ankle joint centre of rear leg	3	3
LFEO	Knee joint centre of rear leg	2	1
LASI	Anterior Superior Iliac Spine of rear side	1	2

The anterior displacement pattern of SL and PS were almost the same. The results showed that there was minimal retract movement in both SL and PS since most of the joints displacements were positive in nature. The subjects utilize not only the upper limb but also the whole body to deliver the punch.

Discussion

The special features of JFJKD are fast, strong side forward, long range stance, thumbs up; hand move first in the initial punching phase; 'three-point landing' in the hitting target and follow through phases; power generate from the ground, non-telegraphic movement and broken rhythm in fighting[2,3,4,13]. The lead hand is the nearest weapon to the opponent; it shortens the time of punching. With minimal retract movement in both SL and PS, the punch became non-telegraphic; the subjects use as many joints throughout the punching movement as possible, the hand gets to the target faster and the rest of the body catches up. The Maximum rear leg anterior GRF during punching of SL and PS found was higher than walking and pitching but comparable to running, braking and propelling[11,12]. When the subject strike on the dummy, the dummy will gives back an 'equal and opposite force', this force travels through the subject's body in a direct line to the base of support "stance". If the base of support is not strong and allows force to be lost he cannot utilize the ground and opponent reaction force. The aim of "Three-point landing is to maximize the generated force which produced from the ground (Newton's third law), body (hip and trunk rotation) and limbs (shoulder abduction/external rotation and elbow extension) to the hitting target. Landing the lead foot first instead of the lead hand will dissipate the force produced. The subject's correct sequence rate was 75%, it may imply that the technique is difficult or there is room for improvement of the technique among the subjects.

Conclusion

It was an exploratory study. Various means of biomechanics analysis of Straight Lead and Push Step Straight Lead were studied. Those results were comparable to the characteristics of Jun Fan Jeet Kune Do. Further research need to conduct to prove its punching power and efficiency and to other martial arts.

Acknowledgement

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The relationship between Taekwondo training duration and lower limb muscle strength in adolescents

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Introduction

Previous studies suggested that Taekwondo (TKD) practice could improve muscle strength in both elite and recreational athletes but there is little information on the duration of practice and muscle strength in the adolescent population. Therefore, the objective of this study was to find out the relationship between duration of TKD practice and lower limb muscle strength in adolescents.

Methods

20 experienced TKD practitioners aged 14-19 years were tested. The subjects practised TKD from 3 to 15 hours per week. Isokinetic knee and ankle muscle performance of the dominant leg was tested with the Cybex Norm dynamometry at 2 different speeds (60^{o}/s and 240^{o}/s). The peak torques of knee extensors and flexors, ankle dorsiflexors and plantarflexors at both testing speeds were recorded. Pearson's coefficient (p=0.05, 2 tailed) was calculated to examine the relationship between the duration of TKD practice and knee muscle strength.

Results

Significant correlation was found between the 'hours of TKD practice per week' and peak torque of ankle dorsiflexors at 60o/s (r=0.506, p=0.023). There were also significant correlations between the 'hours of TKD practice per week' and peak torque of knee extensors (r=0.639, p=0.002), knee flexors (r=0.472, p=0.036) and ankle dorsiflexors (r=0.542, p= 0.014) at 240^{o}/s. No statistically significant correlation was found between the hours of TKD practice and peak torque of knee extensors and flexors at 60^{o}/s, and peak torque of ankle plantarflexors at all speeds.

Discussion

The present study demonstrated that training time was associated with higher knee extensor and flexor muscle strength. Only fast testing speed could detect the possible strengthening effect in TKD practitioners, which could be explained by the velocity specificity in TKD training. Frequent practice of TKD was also correlated with better ankle dorsiflexor muscle strength at both fast and slow speeds. This might be due to the fact that during TKD training, ankle dorsiflexors of the supporting leg were used to control postural sway while ankle dorsiflexors of the kicking leg were activated to protect the ankle from spraining when hitting the target. There was no significant correlation between the duration of TKD practice and ankle plantarflexor muscle strength. It could be attributed to the high pre-training muscle strength in the calf.

Conclusion

There is a positive correlation of hours of TKD practice with knee extensor, flexor and ankle dorsiflexor muscle strength.

Functional ability between different categories of wheelchair fencer

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Introduction

Classification in disabled sports is referred to the way in which athletes are grouped for competition, and it is different from classification in able-bodied sports (Tweedy, 2002; Vanlandewijck, 2006; Vanlandewijck & Chappel, 1996). For examples in able-bodied sports, power lifting is classified by body weight, master runners are classified by age, but classification in disabled sports is based on an athlete's ability and disability characteristics. The objective of classification is to provide some valid tests or assessments for grouping athletes with a disability or multiple disabilities and make each sport on a 'level playing field'. Classification for disabled sports aim at promoting equitableness and fair competition. However, in the recent year, there are a lot of controversies about the validity of classification system among the Paralympics sports (Firth, 1999; Gil-Agudo, Del Ama-Espinosa, & Crespo-Ruiz, 2010; Tweedy, 2003; van Eijsden-Besseling, 1985; Vanlandewijck, et al., 2004).

Wheelchair fencing is an official sport of Paralympics since the first Olympic Games for the disabled athletes in Roma 1960, including two functional classes among three weapons during each summer game. As many other Paralympics sport, WFC is a point score system and provides a guideline to the classifiers to evaluate the ability of the wheelchair fencers, in which a fencer has higher score, he/she will be classified into a higher category (IWFC, 2009). Therefore, fencers who are in the higher category should have better trunk abilities than the lower category fencers. In the WFC system, classifiers required to assess the wheelchair fencer's trunk strength, range of movement and balance according to six functional tests which imply that is a key factor to identify fencer's ability (IWFC, 2009). Hence, the present investigation tempted to apply the biomechanical methods to determine the difference of the trunk movement abilities (trunk angle and trunk speed) between the two category groups (category A and B)

Methods

Eight male and six female Hong Kong elite wheelchair fencers participated in this study. They all had over 3 years of fencing experience and five males and four females were belonged to the category A, while three males and two females were belonged to the category B. These classifications were based on their participation on previous international competition which was approved by the IWFC.

During the test, subject was required to perform a lunge toward (attack) the tester and a fast return (defence) away the tester with the maximum speed (Figure 1 and 2).
There were five trials per movement and only the fastest result being used for statistical analysis. Moreover, the fencing distance between subject and the tester during the assessment was normalized and the experimental setup were as Figure 3 and 4 respectively, which is a standard procedure, followed the official rule of International Wheelchair Fencing Committee.

Although wheelchair fencing technique can be very dynamic, however the trunk movements were mainly focus on forward and backward in sagittal plane, hence, the analysis was done in two dimensions. In present study, motions were videotaped by utilizing a Sony 3CCD (DCR-TRV950E) digital video camera recorder and the motion data were further computed by Peak Motus® Motion Measurement System (Peak Performance Technologies).
Statistical analysis was run by the SPSS version 16.0 (SPSS Inc., Chicago, IL). Due the small simple size, the tested variables were computed by the non-parametric Mann-Whitney method to compare the differences between category A and B, furthermore, the tested variables were 1) Maximum Velocity of Trunk 2) Maximum Angle of Trunk in Lunge and Fast return as Figure 5a and 5b.

Results

Table 1 showed that there are no significant differences between category A and B fencer on maximum lunge velocity, lunge angle and fast return velocity, whereas category A fencer could perform significant larger fast return angle contrast to category B fencer.

Discussion

The purpose of the WFC aimed to classify fencer's functional abilities with a serial of assessments. Hence, classified participants should have functional differences between category A and B. In present study, the maximum trunk velocity and angle in lunge and fast return were assumed as the functional determinants for justifying the outcome of the WFC. However, the results showed that the maximum fast return angle was the only differences between category A and B fencer in entire tested determinants.

Lunge and fast return are two of the fundamental movement in wheelchair fencing which respect for attack and avoid to be hit respectively. Hence, the ability to perform a fast and far in this two fundamental movements was critical to wheelchair fencer. When the wheelchair participants perceive this ability, it will encourage the training quality and the competition tactic strategy of victory. Nowadays, WFC is an integrated classification which allows athletes with different disabilities like amputee, polio, cerebral palsy and paraplegics to compete together (IWFC, 2009), so the range of their impairment affects performance could be very broad. Nevertheless, our result showed that category A and B fencer in present study could perform similar abilities. The present investigator doubted that it may due the sports specificity for wheelchair fencing; participants have to perform movement on the wheelchair, so that the lower limb ability will cause negligible limitation for wheelchair fencing whereas trunk control will be a weighty indicator. More and more, although the maximum speed and angle of trunk movement were assumed as an important functional determinant in this study, it didn't represent this is a sensitive indicator to descript the differences between these two categories of fencer, because there is much additional research remains required like sitting balance or the functional agility on wheelchair.

Conclusion

This study was the first literature to explore the trunk ability differences between category A and B fencer in wheel-chair fencing, and the result showed that category B fencer could perform a similar trunk performance in most of the tested parameters as category A. This result may provide information to International Wheelchair Fencing Committee for the need of research on WFC to clarify the differences between these two categories of participants.

Acknowledgement

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Table 1. Non-Parametric Mann-Whitney U test

	Max. Lunge Velocity (m/s)	Max. Lunge Angle (degree)	Max. Fast Return Velocity (m/s)	Max. Fast Return Angle (degree)
Z	- 0.535	- 1.535	- 0.601	- 2.469
Asymp. Sig.	0.593	0.125	0.548	0.014*

* P < 0.05

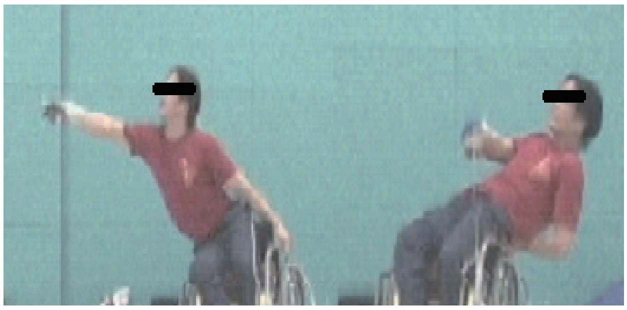

Figure 1. Lunge(attack)   *Figure 2. Fast return(defence)*

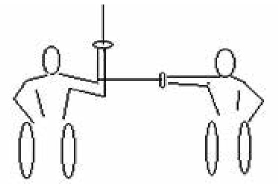

Figure 3. Fencing distance normalization

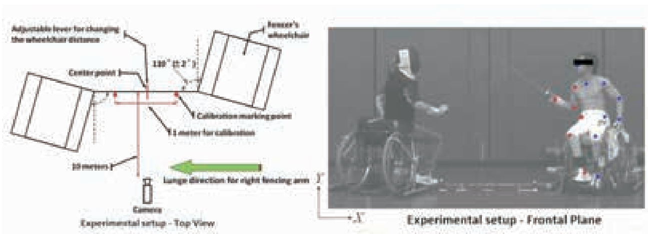

Figure 4. Experimental setup

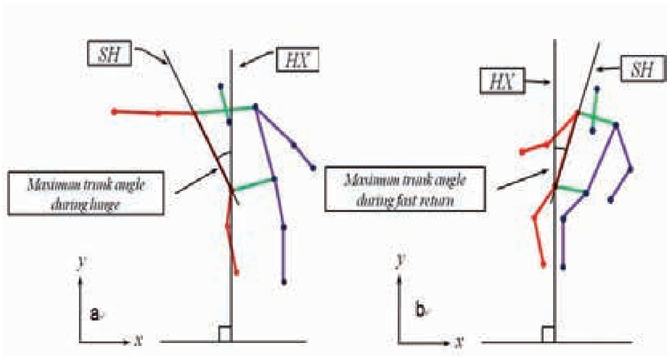

Figure 5. Definition of maximum trunk angle and velocity. In the trials, sterna notch was defined as a reference point to calculate the trunk speed (a) Lunge (b) Fast return. The segmental model used in present study is defined as SH: the line from the shoulder of the fencing arm to the lilac crest of the fencing arm; HX: the vertical line perpendicular to the ground through the hip joint. Furthermore, the angle of experimental result would minus the angle of initial position for normalization.

The effect of Taekwondo training on lower limb muscle strength, joint sense and balance in adolescents

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Introduction

Taekwondo (TKD) is a popular sport worldwide and there are more than 20,000 people practicing it in Hong Kong. Its training emphasis is on kicking and single-leg stance movements that require high level of postural control. Despite its popularity and high demand on balance, studies on the physical benefits of TKD are scarce and no study has investigated the effect of TKD training on balance performance in youngsters. This study was, therefore, conducted with the aims to compare (1) the single leg standing balance performance, (2) knee joint proprioceptive sense, and (3) lower limb muscle strength of adolescent TKD practitioners with non-practitioners.

Methods

21 adolescents (11-14 years old) who received regular training in TKD were recruited and divided into 2 groups: short-term training (1-4 years of TKD experience) and long-term training (5-9 years of TKD experience). 10 age and sex matched sedentary individuals were also recruited as control. Single leg standing balance was measured with the SMART EquiTest® computerized dynamic posturography machine. Knee joint proprioception was measured with the passive positioning-active repositioning test of the dominant leg. Concentric isokinetic knee extension strength of the dominant leg was also tested using the Cybex Norm dynamometer at an angular velocity of 180°/s. One-way ANCOVA was used to compare the variables of interest among the 3 groups with sex and age as the covariates. Alpha was set at 0.05. Significant results were further analyzed with post-hoc Bonferroni test.

Results

The results revealed a significant difference in center of gravity sway with unilateral stance ($F_{2,28}=4.888$, $p=0.016$) and knee joint repositioning error ($F_{2,28}=9.015$, $p=0.001$) among the 3 groups. Post-hoc contrasts revealed that both short and long term TKD practitioners swayed significantly less than the control subjects when standing on the non-dominant leg with eyes open ($p=0.016$ and 0.012, respectively). However, only long term TKD practitioners showed significantly less knee joint repositioning error than control subjects ($p=0.001$). In addition, there was no significant difference in isokinetic knee extensors strength among the 3 groups.

Discussion

The present study demonstrated that TKD practitioners had better balance control in single leg standing. This could be explained by the fact that TKD training puts great emphasis on kicking techniques, especially the acrobatic jump kicks. Practitioners need to land and balance on one leg after kicking. Long term training in TKD could also improve the knee joint position sense which plays an important role in postural control. However, the improvement in balance performance might not be associated with knee extensor muscle strength. The isokinetic concentric knee extensor strength at 180°/s was similar between TKD practitioners and non-practitioners.

Conclusion

One year of TKD training could improve single leg standing balance in young adolescents but longer term of training is needed so as to improve knee joint position sense. The improvement in balance performance is not associated with knee extensor muscle strength. Further study is required to find out which sensory, motor or musculoskeletal system(s) contribute to the better balance performance in short term TKD practitioners.

A model-based image-matching motion analysis technique for measuring ankle kinematics from video sequences of sports events

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Introduction

Motion analysis techniques have been used extensively in the field of sports science and sports medicine. These techniques provided valuable information on the joint kinematics during various sporting motions. Motion analysis techniques must have good validity and reliability to ensure that the data obtained are highly accurate and highly repeatable. In 2005, a newly developed markerless motion analysis technique named the model-based image-matching (MBIM) technique was developed by Krosshaug and Bahr. Its validity for measuring knee joint kinematics and ankle joint kinematics were confirmed by Krosshaug et al. (2007) and Mok et al. (2009) respectively. However, since the MBIM technique requires manual skeleton matching, it depends on the researcher's ability to accurately match the orientation of each segment. As a result, measurement differences may exist within and between researchers. Before considering the MBIM technique as a reliable motion analysis tool, a detailed matching instruction must be developed and its reliability must be assessed. Therefore, the aim of the present study was to assess the intra-rater and inter-rater reliability of the MBIM technique using a standard matching protocol proposed by our research team in measuring ankle joint kinematics.

Methods

Three cadaveric below-hip specimens were prepared for testing. Each specimen was mounted on a jig in an upright position. Four high speed cameras (Casio EX-F1, Japan) were used to record the ankle motion in 30Hz with 640x480 resolutions from four different views. A static calibration trial in the anatomical position served as the offset position to determine the segment embedded axes of the shank and foot segment. The line connecting the knee joint center and the ankle joint center was the longitudinal axis of the shank segment (X1). The anterior-posterior axis of the shank segment (X2) was the cross product of X1 and the line joining the lateral femoral epicondyle and medial femoral epicondyle. The medial-lateral axis of the shank segment was the cross product of X1 and X2 (Wu et al. 2002).

Full-range plantar-flexion/dorsiflexion, inversion/eversion and shank circular motion were performed by moving the shank segment on the ankle joint manually. The ankle joint kinematics was analyzed using the MBIM technique (Krosshaug et al. 2005). Using a commercialized animation software Poser (Poser4, Curious Lab, US), a virtual environment was built and matched with the video images in every camera view by adjusting the camera calibration parameters. A skeleton model (Zygote Media Group Inc, USA) was customized to match the anthropometry of the specimen. The skeleton model was matched frame by frame starting with the shank segment, followed distally by the foot and the toe segments. The joint angle time histories were read into Matlab (MathWorks, USA) with a customized script for data processing.

Two researchers, A and B, performed the manual skeleton matching process five times on each specimen. The researchers were with good human biomechanics knowledge and were trained to implement the skeleton matching with the same instructions (Table 1). In each frame, the skeleton model has to be matched such that it is in an anatomically accurate position and is contained within the image boundary (Figure 1). For plantar- flexion/dorsiflexion, inversion/eversion and internal/external rotation of the ankle joint, anatomical landmarks and joint orientations were used as indications of the direction of movement. Lastly, the motion of the skeleton model was reassessed for the whole video and adjusted frame by frame to ensure a smooth matched motion.

Intra-rater reliability was assessed by comparing the results of the five matching trials on each specimen performed by each researcher. Inter-rater reliability was assessed by comparing the first matching trial performed on the same specimen between the two researchers. A work distribution graph is shown on Figure 2. Intra-rater and inter-rater reliability were assessed with interclass correlation (ICC), two-way mixed measures assuming the interaction effect is absent (Hopkins, 2000).

Results

The ICC coefficients for intra-rater reliability demonstrated excellent correlation (ICC coefficient > 0.978) between the kinematic data analyzed by the same operator (Table 2). For inter-rater reliability, the ICC coefficient also demonstrated excellent correlation (ICC coefficient > 0.981) between the kinematic data analyzed by the two operators (Table 3).

Discussion

The aim of the present study was to assess the intra-rater and inter-rater reliability of the MBIM technique in measuring ankle joint kinematics. It is important to evaluate the repeatability of this technique since a manual skeleton matching process is required. Our research team has developed a standard protocol for analyzing ankle joint kinematics using the MBIM technique. Our protocol uses anatomical landmarks and joint orientations as indicators of joint movements (Table 1) to ensure matching accuracy.

Following our protocol, the average ICC coefficients for the intra-rater reliability were greater than 0.978 for all ranges of motion and the average ICC coefficients for the inter-rater reliability were greater than 0.981 for three cadaveric specimens. These results imply that different trained researchers can produce the same results with excellent repeatability.

The MBIM technique is newly introduced and has the potential to be developed as a new on-field markerless motion analysis tool because calibrated capture volume and skin markers are not required. This technique can be used to analyze the kinematics of foot and ankle injuries from videos captured during televised sport events.

Conclusion

This study presented a model-based imaging-matching motion analysis technique in measuring ankle joint kinematics with excellent intra-rater and inter-rater reliability. This technique can reliably produce ankle joint kinematics profile from uncalibrated video sequences and can be used as an on-field markerless motion analysis tool to analyze real-game sporting motions.

Acknowledgement

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Table 1. Matching instructions given to researchers for the skeleton matching

	Item	Instructions
1.	General	(a) Within image boundaries
		(b) Anatomically correct
		(c) Smooth motion
2.	Plantar flexion/dorsiflexion	(a) Identify the long axis of the shank segment
		(b) Identify the long axis of the foot segment
3.	Inversion/eversion	(a) Identify the plantar foot
		(b) Regard foot segment as a rectangular board
4.	Internal/external rotation	(a) Identify the patella position
		(b) Identify the anterior edge of shank

Table 2. Intraclass correlation for the intra-rater reliability

	Intraclass Correlation					
	Plantarflexion/dorsiflexion		Inversion/eversion		Internal/external rotation	
Researcher	A	B	A	B	A	B
Specimen 1	0.999	0.998	0.997	0.993	0.957	0.968
Specimen 2	0.997	0.999	0.999	0.999	0.991	0.987
Specimen 3	0.997	0.996	0.992	0.995	0.986	0.983
Average	0.998	0.998	0.996	0.996	0.978	0.979

Table 3. Intraclass correlation for the inter-rater reliability of the kinematic data.

	Intraclass Correlation		
	Plantarflexion/dorsiflexion	Inversion/eversion	Internal/external rotation
Specimen 1	0.987	0.972	0.956
Specimen 2	0.998	0.996	0.992
Specimen 3	0.996	0.994	0.995
Average	0.994	0.987	0.981

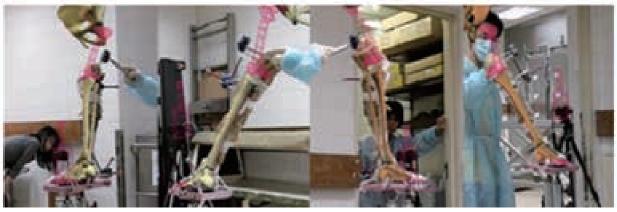

Figure 1. Matching of the skeleton model by the MBIM technique.

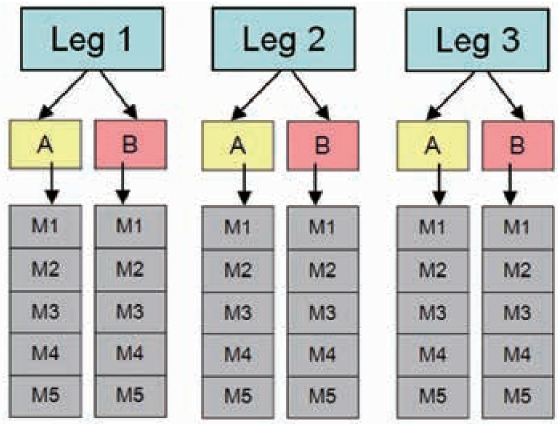

Figure 2. Work distribution of researcher A and B on skeleton matching

Biomechanical analysis of ankle supination sprain injury in sports

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Introduction

Ankle sprain is one of the most common injuries encountered at sport events, 20% of the sports injuries are ankle sprains (Fong et al, 2007). A precise description of the injury situation is a key component to understanding the aetiology and mechanism of injuries of any particular injury (Bahr and Krosshaug, 2005).

Injury incidents are occasionally recorded unintentionally during television broadcasting. Those video recordings provide valuable information for deducing joint kinematics of specific sport injury, as well as, contributing to the study of injury mechanism. From the previous studies, qualitative analysis of joint biomechanics was achieved on ankle injuries based on visual inspection (Andersen et al, 2004). However, quantitative description on ankle joint biomechanics was not reported in those studies because no tool was capable to deduce the three dimensional (3D) joint kinematics from uncalibrated video recordings. Quantitative analyses on injury cases were available under rare circumstances due to coincidental calibrated video setting (Zernicke et al, 1977; Fong et al, 2009). However, body marker tracking system or calibrated video setting are normally not available in all usual situations. In order to develop a novel biomechanical analysis to produce continuous estimates of joint kinematics from video recordings, Krosshaug and Bahr (2005) introduced a Model-Based Image-Matching (MBIM) technique for investigating human motion from uncalibrated video sequences.

The purpose of this paper was to investigate the possibility of applying MBIM technique on calculating the ankle join kinematics of three typical ankle sprain cases from take-off stepping, cutting and running motion.

Methods

Three ankle supination sprain cases from high jump, tennis and hockey were chosen for analysis because of their difference in injury motion and circumstances. The first case was recorded from high jump event in Beijing Olympics Games 2008. The player sprained her left ankle during the take-off stepping. The second case was recorded from male tennis match in Vienna 1995. The player sprained his left ankle during a cutting step with back-hand volley. The third case was captured in male hockey match in Beijing Olympics Games 2008. The player sprained his left ankle during running under opponent body contact (Table 1). The inclusion criteria were that the player was unable to continue the match or competition after the ankle supination motion, and the injury motion was captured by at least two video cameras. The video recordings were transformed from their original format into uncompressed AVI image sequences (Adobe Premiere Pro 1.5, Adobe, US). Then the sequences were de-interlaced using Adobe Photoshop (version CS4, Adobe Systems Inc., San Jose, California, US), and the image sequences were synchronized and rendered into 1 Hz video sequences by Adobe AfterEffects (version CS4, Adobe Systems Inc., San Jose, California, US). The matchings were performed using 3D animation software Poser® 4 and Poser® Pro Pack (Curious Labs Inc., Santa Cruz, California, US). The surroundings were built in the virtual environment according to the real dimension of the sport field. The models of surroundings were manually matched to the background for the each frame in every camera view. The skeleton model from Zygote Media Group Inc. (Prove, Utah, US) was used for the skeleton matching. The skeleton was scaled with respect to the height and the standing post of the player. The skeleton matching started with the shank segment and then distally matched the foot and toe segments frame by frame. The joint angle time histories were read into Matlab (MathWorks, USA) with a customized script for data processing. Joint kinematics was deduced by the Joint Coordinate System (JCS) method (Grood, 1983).The ankle joint kinematics results were filtered and interpolated by Woltring's Generalized Cross Validation Spline package (Woltring, 1986) with 15Hz cut-off frequency.

Results

Figure 1 presents the curve of the ankle joint kinematics of players during the ankle supination sprain injury. Table 2 tabulated the maximum inversion angle, the maximum inversion velocity and the duration from touchdown to maximum sprain.

For case one, the player was performing take-off stepping in high jump trial and the injury happened. The maximum inversion angle reached 142 degrees at the point. She twisted her torso for overcoming the bar, leading to her ankle was internal rotated with larger degrees comparing with the other two cases. For case two, the player was performing cutting motion with backhand volley in the tennis match. Sudden plantarflexion was observed at the point of heel touch down. After the full plantar foot contact, increase in inversion and internal rotation were observed until the inversion reach the peak value, 94 degrees. After the peak inversion, the ankle kept internal rotated and plantarflexed. For case three, the player was performing running. He was under the pressure from the opponent. His left foot slightly stepped on the opponent's foot and the ankle supination motion was triggered. The maximum inversion reached 78 degrees. Internal rotation was observed at the point of peak inversion.

Discussion

Concluding the three selected cases, the ankle kinematics profile could be divided into the two parts, phase 1 and phase 2 shown in Figure 1. Phase 1 was the pre-sprain phase, from 0 sec to 0.8 sec. In this phase, the ankle internal rotation inversion angles were increasing. Phase 2 was the post-sprain phase, the inversion angle decreased and the ankle kept internal rotated.

The maximum supination sprain motions were shown in Figure 2. Compared with the previous biomechanical ankle sprain case report (Fong et al, 2009), the three analyzed cases were higher in severity. The maximum inversion angle and maximum inversion velocity were higher. The duration from heel touchdown to maximum sprain was similar. Increase in inversion and internal rotation appeared in pre-sprain phase (phase 1). Plantarflexion was again found to be not necessary in ankle supination sprain injury.

Conclusion

Internal rotation of ankle joint was found at the point of maximum sprains. However, plantarflexion was found not always existing in injury situations. The results from the MBIM technique would contribute to the understanding of biomechanical injury mechanism of ankle supination sprain injury.

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Table 1. Description of the injury situation and the video sequences

Case no.	Sport event	Gender	Motion	No. of views	Sampling frequency	Video Resolution
1	High Jump (Olympic 08)	Female	Take-off stepping	3	50Hz	1280x720
2	Tennis (Vienna 95)	Male	Cutting	2	50Hz	320x240
3	Hockey (Olympic 08)	Male	Running	2	50Hz	1280x720

Table 2. The descriptive data of ankle joint kinematics of three injury cases

	Case 1	Case 2	Case 3	Fong et al. (2009)
Max. Inversion angle	142°	94°	78°	48°
Max. Inversion velocity	1752°/s	1488°/s	1397°/s	632°/s
Duration (TD to Max.Sprain)	0.06s	0.12s	0.08s	0.08s

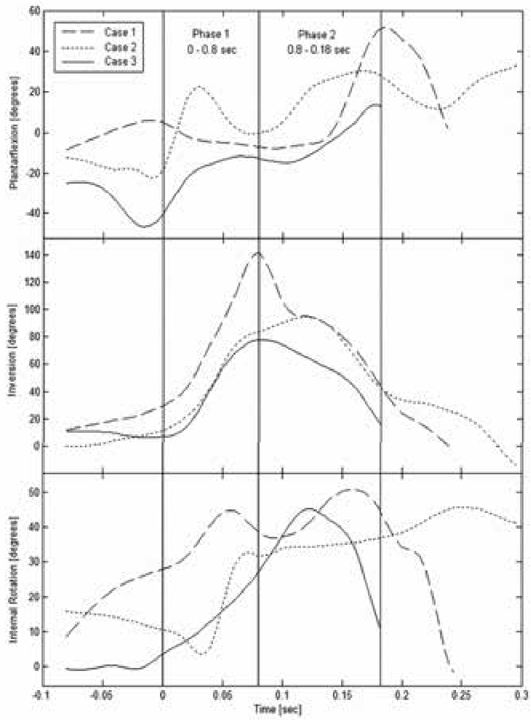

Figure 1. Ankle joint kinematics of the player during the ankle supination sprain injury. Time zero represented the point of heel touchdown.

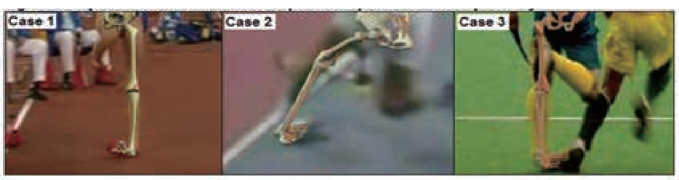

Figure 2. Captures of maximum ankle supination sprain motion respectively.

Factors influencing pre-service teachers' perception of teaching games for understanding: a constructivist perspective

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Introduction

With the evolution of learning theory from behaviorism through cognitivism to constructivism, a shift from a behaviorism teaching approach to a constructivist approach was conducted in past decade. Although pre-service teachers' resistance to a constructivist approach was well-documented, there is a need to investigate the issues that influence their responses to constructivist approach (Rodriguez & Berryman, 2002). Therefore, the purpose of this study was to identify factors influencing pre-service teachers' perception of a constructivist teaching approach - TGfU.

Theoretical framework

Piaget's (1970) cognitive constructivism and Vygotsky's (1978) social constructivism provided a theoretical framework to steer the research purposes and design. According to cognitive constructivism (1970), Individuals construct new knowledge from their prior personal knowledge and experience. Social constructivism (Vygotsky, 1978) emphasizes the role of culture and context in developing the interpretations of reality. Furthermore, Cobb (2005) suggested that these two perspectives interacted.

Methods

By adopting a qualitative approach, 20 pre-service PE teachers (F=8, M=12) were recruited for individual semi-structured interviews. Deductive data analysis was utilized to identify unique themes with broad aspects of influencing factors (Patton, 2002).

Results

Several individual factors including game knowledge, teacher beliefs, prior teaching experience were identified to influence pre-service teachers' perception of TGfU. Pre-service teachers reported that knowing the game is the fundamental requirement for them to learn TGfU and the rich game knowledge and experience helped them to understand the TGfU concepts. Meanwhile, Several pre-service teachers stated that they were open minded and wanted to be updated in their teaching which make them interested in new instruction models while two pre-service teachers did not express a strong need to use the TGfU approach in teaching because of their comparatively conservative beliefs and visions. Furthermore, pre-service teachers' prior PE learning experience with the skill-oriented model in their younger years became a barrier to their learning of TGfU while the peer teaching experience provided them the opportunity to try out the TGfU model.

On the other hand, findings indicated that some social factors such as government policy, school context, and support from peers, teacher educators, and cooperative teachers also influenced pre-service teachers' perception of TGfU. Pre-service teachers reported that PE curriculum reform motivated them to look for new teaching approaches including TGfU to achieve the objective of new PE curriculum although a small handful of them reflected the limited impact of government policy on their response of TGfU. Meanwhile, the support from teacher educator and peers not only influenced pre-service teachers' perception of TGfU but also helped them in implement it effectively because teacher educator introduced TGfU to them and peers exchanged the teaching experience with them. Furthermore, most pre-service teachers responded that the traditional professional culture is dominant because few school teachers in Hong Kong apply the TGfU approach, which influenced their acceptance of TGfU negatively.

Finally, the research results showed that the coordination of individual and social factors influenced pre-service teacher perception of TGfU.

Discussion

Research results showed that cognitive and social constructivism can be applied to illustrate and analyze factors that influence pre-service teachers' perception of TGfU. Results of this study confirmed the constructivists' assumption by describing the influence of individual factors on pre-service teachers' perception of TGfU, including on game knowledge (prior knowledge), teacher belief (belief), and learning and teaching experience (prior experience). The social factors are in line with social constructivism, which suggests that knowledge is socially constructed and mediated by social interaction and culture on learning (Fosnot & Perry, 2005). The constructivist perspective suggests that cognitive constructivism interplays with social constructivism (Cobb, 2005), and is supported by our research results showing the interplay between individual and social factors.

Consistent with existing literature (Bechtel & O'Sullivan, 2007; Corthan, 2001;Ennis, 1994; Light, 2002; Pissanos & Allison, 1996; Rovegno, 1992), pre-service teachers involved in this study reported that their game knowledge, teacher beliefs, teacher support, professional culture and government policy have affected their acceptance of TGfU. However, this study has a unique feature in that peer-teaching has been described as facilitators or inhibitors in the acceptance of the new approach. As literature review on factors influencing teachers' acceptance of new approaches suggests, most studies have focused on in-service teachers, not on pre-service teachers. This could explain why the factor of "peer teaching experience" was solely emphasized in the present study: Peer teaching is incorporated into teacher preparation programs specifically as a method of preparing pre-service teachers professionally (Jenkins, Garn & Jenkins, 2005).

Conclusion

Consistent with cognitive and social constructivism, pre-service teacher response of TGfU is influenced by individual factors including teacher beliefs, game knowledge, teaching and learning experience as well as social factors such as government policy, teacher support, professional culture. Furthermore, these two groups of factors interacted. In order to promote pre-service teachers' inclination to use TGfU, a strong support system should be provided for them which would include teacher education program, teaching experience, and support from government policy, teacher educators, cooperative teachers and peers.

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Process-oriented evaluation of fundamental movement skills in children with cerebral palsy

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Introduction

Fundamental movement skills (FMS) are considered the essential basis for the development of more advanced and specific sporting skills[1]. High levels of FMS competence have been considered to be prerequisites to successful participation in sports and physical activities[2]. Since the ability to perform FMS has been identified as a potential factor that influences the physical activity behavior of children[3-7], it is important that this be measured using valid and reliable instruments7 for both typically developing children and children with disabilities.

The biological factors associated with a physical disability may retard the development of FMS in early childhood. The largest diagnostic group treated in pediatric rehabilitation is made up of children with cerebral palsy (CP)[8]. CP refers to a group of disorders that is caused by non-progressive disturbances in the developing brain, and is known to manifest in problems of movement and posture9. While the hallmark of CP is a delay in the development of gross motor function[10], low levels of participation in physical activities and recreation have also been observed[11-13].

FMS that are performed in an upright position include locomotor skills and object control skills[14]. Locomotor skills require overall movement of the body such as running and jumping[1,15]. Object control skills are more static in nature and involve applying force to or receiving force from objects such as kicking, catching, and throwing[16]. FMS may be measured using product-oriented or process-oriented approaches[14]. Product-oriented assessments are based on time, distance, or number of successful attempts resulting from the performance of a skill, while process-oriented assessments are concerned with how the skill was performed rather than the product result of the movement. Product-oriented measures appear to be more appropriate for children with CP since they emphasize an individual's output rather than their manner of performance based on a "normal" standard[17].

A product-oriented FMS testing strategy is crucial in further research that will examine the FMS proficiency of children with CP. As we target FMS training, validated testing procedures will be highly useful in providing outcome measures that directly relate to sports and activities that children engage in. This study aimed to validate a product-oriented measurement procedure that tests specific FMS among children with CP.

Methods

Participants

Participants included a convenience sample of 30 children with CP (17 female, 13 male) aged between 6 to 14 years (M = 9.83 years, SD = 2.5 years). Inclusion criteria were children with CP who were able to walk with or without walking aids and follow 2-step commands. Exclusion criteria included neurologic disease and any other medical conditions that limited participation. Parents provided written consent, and children gave verbal assent prior to study involvement. Ethical approval was granted by the Institutional Review Board (IRB) of the university.

FMS Assessment

Product-oriented scores

The testing procedures for the FMS assessment were adapted and modified from the protocols of the second edition of the Test of Gross Motor Development – 2nd Edition (TGMD-2)[15]. Performances of two locomotor skills and three object control skills were measured using product outcomes based on duration, distance, and number of successful attempts[14].

Process-oriented scores

TGMD-2 components that evaluate the five FMS being examined were used for process-oriented measurement. Each skill is performed for two trials, and skill performance is rated on a scale of 3-5 based on a number of qualitative criteria. The presence or absence of a criterion is scored 1 or 0. Developers of the tool have established high reliability, including internal consistency of items in the tool[15].

Criterion measure

Gross Motor Function Classification System (GMFCS) levels were used as the criterion measure. GMFCS is a classification system designed for children with CP using 5 levels that are based on differences in self-initiated movement and locomotion[10]. Level I denotes the ability to walk without any restrictions, while level II refers to walking with limitations when outdoors in the community. Level III refers to walking with assistive mobility devices, while levels IV and V describe mobility patterns where the children are in supported sitting and powered assistive technology are used.

Procedures

Individual testing sessions included the performance of the following tasks: catching, throwing, kicking, jumping for distance, and running. The sessions were conducted outdoors, on surfaces with non-slip rubber mats. Verbal instructions were given using a maximum of 2-step commands, followed by demonstrations. Five trials were done for catching, throwing, and kicking. Three trials were done for jumping and running. The data were analyzed using linear regression analysis, with GMFCS as the criterion reference. Alpha level was set at $p<0.05$.

Results

Eight product-oriented measures were taken to assess five FMS, and six were found to have a significant linear association with GMFCS levels (p<0.05). Table 1 shows the correlation coefficients (r) and the coefficients of determination (R2) between the product-oriented measures and GMFCS levels. It was found that product-oriented scores for catching, jumping, and running were able to predict a substantial variance in GMFCS levels. Three product-oriented scores were taken for kicking: number of successful attempts considering contact, number of successful attempts considering distance, and duration of performance from initiation to contact. Only the latter two measures were found to account for sizeable GMFCS variance in the participants. The product-oriented score for throwing was not found to predict the variance in GMFCS levels. The fit of the regression models were also assessed using analysis of variance (ANOVA) and were found to be significant for catching, running, two kicking measures (distance and duration), and one jumping measure (distance).

Table 1. Correlation coefficients, coefficients of determination, and regression model fit between product-oriented scores and GMFCS levels

FMS	Coefficients		Regression model fit
	r	R^2	*Sig. (ANOVA)*
Throwing	-.253	.064	.178
Catching	-.511*	.262	.004*
Kicking (contact)	.273	.074	.145
Kicking (distance)	-.375*	.141	.041*
Kicking (duration)	.511*	.261	.004*
Jumping (distance)	-.436*	.190	.016*
Jumping (duration)	.431*	.186	.065
Running	.686*	.470	.000*

*statistically significant at p<0.05

Table 2 shows the correlation coefficients and coefficients of determination that were observed for the process-oriented scores and GMFCS levels. Only the two process-oriented scores for locomotion (running and jumping) were found to have significant positive associations (p<0.05) and accounted for a substantial variance in GMFCS levels. The fit of the regression models were also found to be significant for these locomotion skills.

Table 2. Correlation coefficients, coefficients of determination, and regression model fit between process-oriented scores and GMFCS levels.

FMS	Process-oriented		Regression model fit
	r	R^2	*Sig. (ANOVA)*
Throwing	-.103	.011	.588
Catching	-.260	.067	.166
Kicking	-.220	.049	.242
Jumping	-.48*	.231	.007*
Running	-.440*	.194	.015*

*statistically significant at p<0.05

Discussion

One goal of outcome measurement is to evaluate the effects of interventions. However, rubrics for measurement of function and outcomes in children with CP are still inadequate[18]. GMFCS has been established as the principal classification system of functional ability in children with CP, and it has been used as the criterion measure for testing the validity of measures19. Measurement scales for spasticity20, manual dexterity21, and motor ability10 have been developed and validated against GMFCS, but no scale has been found to be adequate to measure FMS. Similar to other validation studies, we used the GMFCS as the criterion measure to test the validity of product-oriented measures for throwing, catching, kicking, jumping, and running skills. Our results showed that six of the product-oriented measures predicted a significant amount of variance in GMFCS, providing evidence that valid product scores have been identified in four skills for children with CP.

Process-oriented scores were found to predict significant variance in GMFCS only in locomotor skills, and demonstrated weaker associations with our criterion measure than those of product-oriented scores. This supports our proposition that product-oriented assessment may be more applicable in children with CP. However, it appears that further studies are needed to identify a valid measurement score for throwing skills. Neither product nor process scores were found to have significant associations with GMFCS, indicating the need to further examine valid methods of measuring this skill.

Conclusion

It has been argued that what an individual is able to do is more important than how the task is performed against a standard on which function is judged[17]. We used outcome measures that directly measured the task outcomes with explicitly observable data. Our findings demonstrated valid product-oriented measures for catching, kicking, jumping, and running. In the context of research, the use of tests is highly dependent on the purpose of a study[22]. The FMS measures that were validated in this study are geared for further research that would examine associations of FMS and physical activity levels of children with CP. As such, we emphasize that the measures depict the skills that children use in physical activities that may be in the form of sports and recreation.

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Effect of glycemic index and fructose content in breakfasts on substrate utilization during subsequent brisk walking

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SYMPOSIUM III

Introduction

It is well known that the energy used to sustain steady state aerobic exercise in humans is derived predominately from the oxidation of carbohydrate (CHO) and fat. The substrate utilization will undoubtedly be affected by CHO diets consumption before exercise, which resembles more closely the practice that athletes or normal people adopted.

Glycemic index (GI) was usually used to classify the different CHO diets. Some recent studies have found that low GI (LGI) meals consumption seemed to result in higher fat oxidation and lower CHO oxidation during subsequent high intensity exercise compared with when high GI (HGI) meals were consumed. However, to our knowledge, there were only a few studies used moderate intensity exercise protocol and inconsistent results were found among these studies. Therefore, further studies are still needed to clarify this effect.

Fructose can be regarded as a LGI food and glucose can be regarded as a HGI food. However, fructose beverages ingestion alone during one hour before exercise elicited similar substrate utilization during exercise at 60%, 70% or 75% VO_2max exercise intensity, compared with glucose consumption. The inconsistent results in substrate utilization during exercise coming from fructose and other LGI CHO might be explained by the special metabolism of fructose. Despite the fact that consumption of dietary fructose has increased in conjunction with rising intake of fructose-containing sugars nowadays. And more importantly, it has been suggested that the consumption of fructose may be related to the development of obesity, metabolic syndrome and diabetes. However, to our knowledge, no such studies are conducted to investigate the effect of fructose content in high CHO meals consumed during hours before exercise on substrate utilization. Therefore, the purpose of this study is to investigate whether both glycemic index and fructose content in breakfasts will affect substrate utilization during subsequent brisk walking.

Method

Participants

Eight healthy young male adults volunteered to participate in this study. Their age, height, body mass, body mass index (BMI), and maximal oxygen uptake (VO2max) (mean ± SD) were 21.7 ± 1.5 y, 171.3 ± 5.2 cm, 61.3 ± 5.2 kg, 20.9 ± 1.1 kg•m^{-2}, and 53.7 ± 3.7 mL•kg^{-1}•min^{-1}.

Protocol

The participants completed two preliminary tests to determine the walking speed equivalent to 50% of each subject's VO_2max. Then all participants completed 3 main trials in a randomized crossover design, and the duration between two trials was at least 7 days. The experimental protocol in main trial consisted of a 2-hr rest period followed by one bout of exercise and another 2-hr rest period. The exercise protocol was a 60-min brisk walking using the pre-determined speed that elicited 50% of individual's VO_2max. Finger blood samples, heart rate, and rating of perceived exertion (RPE) were collected at specific times. The blood lactate and glucose concentrations were determined immediately. Expired air samples were collected every 15 minutes during the whole experimental period. Rates of CHO and fat oxidation were calculated from VO_2 and VCO_2 values. Total CHO and fat oxidation amounts were estimated from the area under the rate of oxidation vs. time curve for each subject.

Prescribed Test Meals

Each participant had a 3-day food diary record and repeated the same diet before each main trial. In each main trial they consumed one of three isocaloric meals. All meals provided 1.0 g•kg^{-1} CHO, and their energy content and amount of macronutrients were also similar. The whole breakfasts provided 20% energy from fat, 17% from protein, and 63% from CHO. Among the energies provided by CHO in LGIF and HGIG meals, around 60% was derived from CHO in foods and around 40% from either glucose or fructose in the form of the beverages. The calculated GI for LGI, LGIF and HGIG breakfasts were 41, 39 and 72, respectively.

Statistical Analysis

Data were presented as Means ± SEM. Dependent variables of the three trials (LGI vs. LGIF vs. HGIG) were compared using a one-way analysis of variance (ANOVA) with repeated measures. Changes in concentrations of blood glucose, blood lactate, and changes in respiratory-exchange-rate (RER), heart rate and RPE were analyzed by a factorial (two-way, Treatment × Time) ANOVA with repeated measures. A Bonferroni correction method was performed at the location of the variance. Statistical significance was set at the 0.05 level.

Results

1. There were no differences in baseline measures among the three trials, such as body weight, BMI, blood glucose concentration, blood lactate concentration, heart rate and RPE.
2. Blood glucose response to the HGIG meal was the highest during the postprandial period among the three trials and peaked at 30min (Figure 1). The incremental area under the blood glucose response curve (IAUC_glucose) during postprandial period was also highest in HGIG trial (Table 1, $P<0.05$, compared with LGI & LGIF trial).
3. Blood lactate response to the LGIF meal was the highest during the postprandial period among the three trials and peaked at 45min (Figure 2). The incremental area

under the blood lactate response curve (IAUC_lactate) during postprandial period was also highest in LGIF trial (Table 1, P<0.05, compared with LGI & HGIG trial).

4. During exercise the total CHO oxidation amount and the highest CHO oxidation rate were lowest in LGI trial (Table 1, P<0.05, compared with LGIF & HGIG trial).

5. During exercise the total fat oxidation amount and the highest fat oxidation rate were highest in LGI trial (Table 1, P<0.05, compared with HGIG trial).

6. During exercise there were no differences in total energy expenditure, exercise intensity, heart rate and RPE among the three trials.

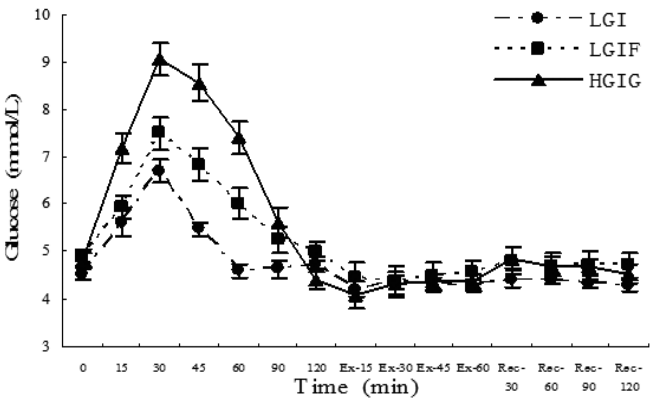

Figure 1. Blood glucose responses during the experimental period

LGI: low-GI meal; LGIF: low-GI meal including fructose; HGIG: high-GI meal including glucose;

Ex-15, 30, 45, 60: 15, 30, 45, 60 minutes during exercise;

Rec-30, 60, 90, 120: 30, 60, 90, 120 minutes during recovery period;

*: P<0.05, compared with LGI trial; #: P<0.05, compared with LGIF trial;

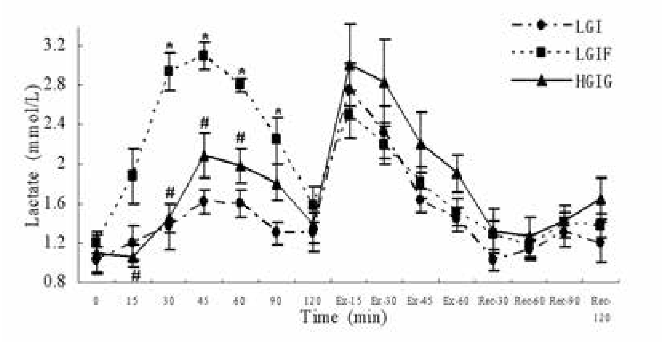

Figure 2. Blood lactate responses during the experimental period

LGI: low-GI meal; LGIF: low-GI meal including fructose; HGIG: high-GI meal including glucose;

Ex-15, 30, 45, 60: 15, 30, 45, 60 minutes during exercise;

Rec-30, 60, 90, 120: 30, 60, 90, 120 minutes during recovery period;

*: P<0.05, compared with LGI trial; #: P<0.05, compared with LGIF trial;

Table 1. Comparison of IAUC and substrate utilization among three trials

Trial	IAUC value during postprandial		Substrate utilization during exercise			
	Glucose ($mmol \cdot min \cdot L^{-1}$)	Lactate ($mmol \cdot min \cdot L^{-1}$)	CHO OA (g)	CHO OR ($g \cdot min^{-1}$)	Fat OA (g)	Fat OR ($g \cdot min^{-1}$)
LGI	76.0±8.0	43.1±6.8	58.6±3.0	1.13±0.05	23.8±6.5	0.50±0.04
LGIF	126.8±17.7	137.4±11.8*	70.1±4.8*	1.28±0.09	19.1±5.7	0.39±0.04
HGIG	240.0±18.8*#	71.9±15.9#	73.3±4.9*	1.37±0.10*	17.8±4.6*	0.39±0.04*

IAUC: incremental area under the blood response curve; OA: oxidation amount; OR: oxidation rate; LGI: low-GI meal; LGIF: low-GI meal including fructose; HGIG: high-GI meal including glucose;

*: P<0.05, compared with LGI trial; #: P<0.05, compared with LGIF trial;

Conclusions

1. LGI meals consumption will induce more fats oxidation and less CHO oxidation during subsequent 1-hr brisk walking, compared with when HGI meals were consumed.

2. Except for GI, fructose content in meals will also affect the substrate utilization during subsequent brisk walking.

Serve performance in rested and physical exertion conditions in physical education route and sport-specified route tennis players

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Introduction

Several attempts have been made to quantify the effect of fatigue on tennis performance, protocols employed in the previous investigations, however, were not well simulated as a tennis match and the previous research findings are inconsistence.

Purpose

The purpose of this study was to evaluate the effects of rested and physical exertion conditions on velocity and accuracy of the tennis serve. Also it would evaluate whether the effect of physical exertion differ between tertiary level tennis players in Physical Education concentrated and Sport specialized state.

Methods

Six male Physical Education route players (age=21.67±1.366 yr; height=172.5±6.595 cm; weight=63.08±8.003 kg; BMI=21.11±1.246) and two Sport-specified route players (age=21.5±0.707 yr; height=187.5±3.536 cm; weight=79.5±10.607 kg; BMI=22.57±2.165) volunteered to participate in this study. Participants serve balls in both rested and after match like protocol conditions. The ball speeds (mph) were measured by a radar gun (Sports Radar, Tracer Precision Company; U.S.A) and the service accuracy were determined by two observers.

Results

The results showed that Physical Education route's players' ball service velocity and total serve score in physical exertion condition (96.62±21.612 mph; 987.83±230.721) was significantly ($p<.05$) lower than their Sport-specified route's counterparts (114.45±1.202 mph; 1431.05±95.954). However, no significance difference in overall tennis serve performance ($p>.05$) between rested and physical exertion conditions.

Conclusion

The fatigue condition may not affect tennis players' service performance, at least on the male college level players. Sport-specified route tennis players' serve velocity and overall serve score in fatigue condition are much higher than Physical Education route players.

Physiological profiles of elite senior, elite, sub-elite and novice junior Hong Kong windsurfers

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Introduction

There is lack of descriptive data on the physiological profiles of elite senior, elite, sub-elite and novice junior windsurfers in Hong Kong. The aim of this study: (1) determine the difference on anthropometric parameters and physiological parameters in different levels of windsurfers, and establish performance standard for these athletes. This study is novel, as no such data exist on junior windsurfers in the world; (2) examine the relationship between anthropometric and physiological parameters and windsurfing performance in junior windsurfers.

Methods

Study 1 - A total of 82 male windsurfers (Elite Senior (ES), n = 5, Elite Junior (EJ), n = 15, Sub-Elite Junior (SEJ), n = 11 and Novice Junior (NJ), n = 51), underwent measurements of anthropometric parameters (height, body mass, arm span, leg length) and physiological parameters (forearm muscular strength and endurance, low back strength, aerobic capacity, leg power, biceps, triceps, upper back and abdominal muscular endurance, hamstring and low back flexibility) to compare any differences between levels of windsurfers. Study 2 - 23 male junior windsurfers underwent measurements of anthropometric parameters and physiological parameters same as study 1, and correlated with windsurfing racing score in competition.

Results

Study 1 – significant difference ($p<0.05$) were detected among ES, EJ, SEJ and NJ windsurfers for all anthropometric and physiological parameters. Results show that there is a progressive improvement in the physiological capacities of windsurfers as the playing level increases. Study 2 - all of the correlations were moderate (r = 0.43-0.71) between parameters and windsurfing performance. The highest correlation was found in height (r = -0.53) in anthropometric variables, whilst VO_{2max} (r = -0.66) and hanging test (r = -0.60) in physical fitness tests.

Table 1. Anthropometric characteristics of novice, sub-elite, elite junior and elite senior windsurfers.

	NJ	SEJ		EJ		ES	
Age (years)	13.45 ± 0.09	14.00 ± 0.30		15.93 ± 0.38	^#	22.80 ± 2.31	^#*
Training Experience (years)	3.36 ± 0.17	3.38 ± 0.29		5.34 ± 0.38	^#	9.00 ± 0.55	^#*
Height (cm)	165.08 ± 1.02	169.43 ± 1.28		173.83 ± 0.76	^	175.80 ± 1.50	^#
Body Mass (kg)	52.13 ± 1.12	54.69 ± 1.37		61.97 ± 1.41	^	68.60 ± 1.80	^#
Body Mass Index	19.03 ± 0.27	19.03 ± 0.32		20.49 ± 0.37	^	22.20 ± 0.56	^#
Arm Span (cm)	172.21 ± 1.16	178.38 ± 1.20	^	183.01 ± 1.03	^#	184.00 ± 2.66	^
Arm / Height(%)	104.32 ± 0.28	105.32 ± 0.75		105.29 ± 0.55		104.66 ± 1.06	
Leg Length (cm)	81.60 ± 0.60	83.41 ± 1.02		86.03 ± 0.79	^	86.70 ± 3.21	
Leg / Height(%)	49.43 ± 0.16	49.26 ± 0.70		49.49 ± 0.34		49.28 ± 1.45	

^ Significant difference with NJ (novice junior) ($p < 0.05$)
# Significant difference with SEJ (sub-elite junior) ($p < 0.05$)
* Significant difference with EJ (elite junior) ($p < 0.05$)
NJ; Novice Junior (n=51); SEJ; Sub-Elite Junior (n=11); EJ; Elite Junior (n=15); ES; Elite Senior (n=5)
Data are reported as Mean ± SE

Table 2. Physical fitness variables of novice, sub-elite, elite junior and elite senior windsurfers.

	NJ	SEJ		EJ		ES	
Sit & Reach (cm)	28.04 ± 1.05	37.05 ± 1.57	^	36.38 ± 1.16	^	35.76 ± 4.27	
Handgrip Strength (kg)	64.45 ± 1.94	77.23 ± 2.77	^	87.97 ± 2.10	^#	98.60 ± 5.53	^
Vertical Jump(inch)	18.52 ± 0.48	19.00 ± 1.09		21.63 ± 0.73	^	21.90 ± 1.00	
Torso Pull (kg)	94.50 ± 2.96	114.68 ± 4.70	^	128.05 ± 4.28	^	155.10 ± 8.69	^#
Sit up (times/min)	36.71 ± 0.97	44.55 ± 1.50	^	46.60 ± 1.39	^	49.00 ± 1.76	^
Push-ups (times/min)	27.90 ± 1.53	34.45 ± 2.22		50.13 ± 1.59	^#	50.80 ± 1.32	^#
Modified pull-ups (times/min)	33.90 ± 1.62	55.27 ± 1.29	^	52.27 ± 1.92	^		
Hanging (seconds)	84.89 ± 5.00	126.09 ± 11.44	^	130.67 ± 13.03	^	246.80 ± 29.71	^#*
Estimated VO_{2max} (ml/kg/min)	45.30 ± 0.90	47.60 ± 1.29		52.97 ± 0.91	^#	57.15 ± 2.00	^#

Significant difference with SEJ (sub-elite junior) ($p < 0.05$)
* Significant difference with EJ (elite junior) ($p < 0.05$)
NJ; Novice Junior (n=51); SEJ; Sub-Elite Junior (n=11); EJ; Elite Junior (n=15); ES; Elite Senior (n=5)
Data are reported as Mean ± SE
Table 2: Physical fitness variables of novice, sub-elite, elite junior and elite senior windsurfers.

Table 3. Descriptive Statistics and Correlation Coefficient with windsurfing performance on anthropometric characteristics and physical fitness variables.

No of subjects = 23	Mean	±	SD	Correlation Coefficient
Age (year)	13.22	±	0.74	-0.51*
Train (year)	3.52	±	1.04	-0.71*
Height (cm)	163.07	±	9.10	-0.53*
Body Mass (kg)	50.53	±	9.95	-0.29
Body Mass index	18.82	±	2.22	-0.05
Arm Span (cm)	169.68	±	10.44	-0.45*
Arm Length / Height (%)	104.04	±	2.07	0.18
Leg Length (cm)	80.30	±	4.89	-0.43*
Leg Length / Height (%)	49.24	±	0.95	0.10
Sit & Reach (cm)	28.13	±	6.06	-0.19
Handgrip Strength (kg)	60.65	±	16.84	-0.44*
Vertical Jump (inch)	18.70	±	3.30	-0.45*
Torso Pull (kg)	92.78	±	24.56	-0.53*
Sit-Ups (times/min)	36.61	±	6.89	-0.19
Push-Ups (times/min)	24.61	±	9.61	-0.21
Modified Pull-Ups (times/min)	32.09	±	7.79	-0.37
Hanging (sec)	70.48	±	23.94	-0.60*
Estimated VO_{2max} (ml/kg/min)	45.16	±	6.75	-0.66*

Significant correlation ($p < 0.05$) between variables and windsurfing ranking
Table 3: Descriptive Statistics and Correlation Coefficient with windsurfing performance on anthropometric characteristics and physical fitness variables.

Conclusion and discussion

These findings provide normative data and performance standards for elite senior, elite, sub-elite and novice junior windsurfers. Given the improvement in most of the variables of the tests with increase in playing levels, forearm muscular endurance ability and aerobic capacity is the most important parameter in elite senior level. The results give the importance of these qualities to competitive performances, conditioning coaches should train these qualities to improve the windsurfing performance.

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Association between Chinese parents' perceptions of their children's weights and parenting behaviors

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Purpose
To examine Chinese parents' perceptions of their children's weights and the relationship between these perceptions and parenting behaviors.

Methods
There were 2,285 pairs of adolescents and parents recruited from secondary schools in Ganzhou and Shantou in China. The adolescents' actual weights and heights were measured by trained testers. Self-reported parents' weights and heights, parental perception of the adolescents' weights, the adolescents' perception of their own weights, parenting behaviors, and demographic information were collected through the questionnaires distributed to the respondents.

Results
Based on Kappa statistics, results showed that there was only a slight agreement between parental perception of their children's weights and the adolescents' actual weights (Kappa=0.224). The results of logistic regression showed that the parents' gender (OR=0.69, 95% CI: 0.50–0.94), the adolescents' gender (OR=1.88, 95% CI: 1.40–2.52), and the adolescents' perception of their own weights (OR=0.22, 95% CI: 0.16–0.30) were associated with the parents' perception of their children's weights. The results of analysis of covariance (ANCOVA) suggested that, compared with parents who had the incorrect perception of their children's weights, parents who had correct perception of their children's weights got higher scores in the parenting behaviors of "Food and PA monitoring" and "Reinforcement". Nonetheless, parents who had the correct perceptions of their children's weights got lower scores in the implementation of feeding strategies, including "Pressure to eat" and "Restricting access to unhealthy food and sedentary behaviors".

Conclusion
Misconceptions about their children's weights were prevalent among Chinese parents. The accuracy of parental perceptions of their children's weights could be associated with the parents' gender, the adolescents' gender, and the adolescents' perceptions of their own weights. Parental perceptions of their children's weights maybe associated with some parenting behaviors.

Pedometer reactivity and rehearsal in children

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Introduction

An important premise underlying the use of pedometers for both measurement of physical activity (PA) and prompting behavioral change is the concept of 'reactivity'. Reactivity, in the context of PA, refers to a change in behavior due to participant awareness of being measured. It is desirable if behavioural change is a goal and the device is left unsealed in order to provide feedback to the wearer. It is undesirable if the device is sealed and used as a measurement tool for habitual PA.

Investigations into pedometer reactivity have presented mixed results with some finding evidence of reactivity (Southard & Southard, 2006), whilst others finding none (Ozdoba, Corbin, & le Masurier, 2004; Rowe, Mahar, Raedeke, & Lore, 2004; Vincent & Pangrazi, 2002). In view of these inconsistencies, the aim of the current study was to investigate pedometer reactivity in children and ask whether an underlying mechanism that might explain individual differences in reactivity is the predisposition to "rehearse or ruminate on emotionally upsetting events" (Roger, 1997). Rehearsal has been evidenced to be related to physiological responses to stress (Roger & Najarian, 1998), trait anxiety (Roger & Najarian, 1989) and health complaints (Lok & Bishop, 1999). Experimental research has also consistently shown that high rehearsers tend to show greater attention bias towards negative information and affect than low rehearsers when subjected to stressors (e.g., Kuehner, Huffziger, & Liebsch, 2009). We therefore expected that high rehearsers would demonstrate greater reactivity when wearing a pedometer than low rehearsers, as they may initially view the monitoring of their PA to be more emotionally taxing.

Methods

Children were recruited from two local government aided primary schools in Hong Kong(156 students, 80 boys, 76 girls; mean age 10.14 ± .73 years). Informed consent was received from all parents and the methods and procedures utilized were endorsed by the Institutional Ethics Committee for Human Research.

Participants completed the Rehearsal Scale for Children-Chinese (RSC-C), a validated 13-item self-report questionnaire for Chinese children (Ling, Maxwell, Masters & McManus, 2010). They then wore the sealed New Lifestyles NL-800 peizoelectric pedometer on an adjustable nylon belt on the left hip every day for 3-weeks. The pedometer was worn during waking hours except during water sports and bathing for a minimum of 2 days per week. The number of steps taken each day was stored to the device memory and downloaded manually by the researcher every 7 days. A minimum of 2,000 steps/day and a maximum of 30,000 steps/day were necessary for inclusion in the final analyses.

We used one-third cut points to identify participants who scored low and high on the RSC-C. Mean RSC-C score was 21.91 ± 2.46 for low rehearsers (n = 43) and 33.05 ± 2.65 for high rehearsers (n = 56). An independent samples t-test showed that the scores were significantly different ($p < .001$). Differences in number of steps between Week 1 and Week 3 were examined for the low and high rehearsers using a two-way ANOVA with repeated measures on the Week factor. Follow-up analyses were carried out using t-tests where appropriate. A p-value of <0.05 was set a priori for all analyses.

Results

Of the 156 participants, 133 had pedometer data which fit the inclusion criteria. Figure 1 shows the mean number of steps taken by high and low rehearsers in Week 1 and Week 3. A main effect was present for Week ($F(1, 82) = 25.52$, $p < .001$, $\eta 2 = .24$), but not for Rehearsal score ($F(1, 82) = .01$, $p = .916$, $\eta 2 = .001$) . An interaction was evident ($F(1,82) = 4.40$, $p = .039$, $\eta 2 = .052$). High rehearsers showed significantly greater change in mean steps from Week 1 to Week 3 than low rehearsers ($p < .05$); however, mean step count was not significantly different between high rehearsers and low rehearsers in Week 1 or Week 3 (p's > .05).

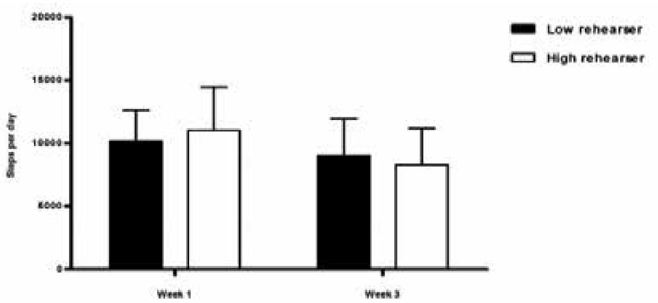

Figure 1. Mean(SD) pedometer steps per week as a function of high and low scores on the RSC-C

Discussion

Our results suggest that reactivity was present, as shown by an elevation in the steps per day in the first week compared to the third week. The difference between the highest and lowest mean daily step is similar to the previous findings for children (Ozdoba, et al., 2004, Vincent & Pangrazi, 2002), falling between 1500 and 2700 steps per day. Importantly, high rehearsers showed significantly greater reactivity as revealed by larger decreases in step count from Week 1 to Week 3 than low rehearsers, suggesting that the tendency to ruminate on emotional events may play a part in reactivity.

To our knowledge, this study is the first to explore the underlying psychological mechanisms behind reactivity. Our results suggest that for high rehearsers, the recurrent reminder that their PA was being monitored, may have motivated them to engage in more than usual PA during the first week of wearing a pedometer. Possibly, high rehearsers found the thought of being monitored to be emotionally upsetting because it raised personal concerns about self-perceived low habitual PA level. The lower number of steps of the high rehearsers at Week 3, though not statistically significant, suggests that they may have lower habitual levels of PA than low rehearsers. This finding lends support to numerous studies that have shown a positive association between PA and psychological health (e.g., Holmes, Eisenmann, Ekkekakis, & Gentile, 2008).

One limitation to the study is that the wear time at the weekends was very low with data attrition of approximately 46% for the entire sample, thus no weekend data was included in the analysis. This limitation highlights the unresolved issue of non-compliance in pedometry studies that is more prominent in children than in adults (Trost, 2001).

Conclusion

This study has shown that reactivity does exist when children use sealed pedometers, and this particularly applies to children with a high propensity to rehearse or ruminate about emotionally upsetting events. Future PA intervention initiatives should take rehearsal tendencies into account.

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The efficacy of the Internet in physical activity promotion for university students

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Background

The university campuses can provide good opportunities to influence the physical activity (PA) habits of young adults (Eva et al., 2001). As most university students have access to the Internet and are familiar to computer & Internet use, using Internet to promote PA in university campus settings is promising but the efficacy is unknown. Therefore, it is worthwhile to investigate the efficacy of Internet-based PA promotion interventions among university students.

Purpose

To examine the efficacy of an Internet-based in relation to a print-based physical activity promotion intervention in university students

Methods

One hundred and eleven Hong Kong university students were randomly assigned to one of the three groups namely, Internet-based intervention group (IG), print-based intervention group (PG), and control group (C). Both IG and PG received the same program materials, that is the 14-week PA behaviour change program entitled "Active Living Every Day (ALED)" (Blair et al., 2001), but through different delivery media. Group C did not receive any intervention program. The PA level was assessed using International Physical Activity Questionnaire (IPAQ) and the stage of exercise change was assessed using the Stage of Exercise Change Questionnaire (SECQ) adapted from Marcus and colleagues (1992). The participants were assessed at baseline, third and sixth month of the intervention.

Results

Increased PA was found in both Internet-based and print-based groups at the third and sixth month assessments. There was no difference in the change of PA between these two intervention groups. Improvement in stage of change was found in the print-based group at the third and sixth month assessments. Improvement in stage of change was found in the Internet-based group at the sixth assessment.

Conclusions

These findings supported the efficacy of using an Internet-delivered program to promote PA for university students.

Acknowledgement

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SYMPOSIUM IV

Evaluation of web-based VS web-based plus email reminder physical activity intervention in Hong Kong Chinese adolescents

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Background

Growing body of research found that Information Communication Technology (ICT) may be an attractive alternative to engage adolescent in physical activity (PA) (Norman et al., 2007; Vandelanotte, Spathonis, Eakin, & Owen, 2007 ; Wantland, Portillo, Haolzemer, & Slaughter, 2004). However, there is lack of empirical evidence regarding the effectiveness of different e-intervention modes on Chinese adolescent's PA behaviour change.

Purpose

To evaluate the efficacy of a web-based vs. web-based plus email reminder physical activity intervention in Hong Kong Chinese adolescents.

Methods

Participants were recruited from 3 secondary schools in Hong Kong. The eligible criteria are: 1) in the pre-contemplation, contemplation and preparation stage, 2) without intellectual and physical disabilities, and 3) accessible to internet at home. Finally, two hundreds and twenty-seven students were included in the study. Participants were divided into 2 groups: The web only group (W) and the website plus email reminder group (WE). Both groups were assigned to access a stage-based website for 8 weeks, but the WE received email reminder 3 times per week in week days. A 4-item stage of change algorithm (Marcus & Forsyth, 2003) was used to measure Stage of motivational Readiness (SMR). Perceived benefits of and barriers to PA was assessed by Exercise Benefits to Barriers Ration Scale Adolescent version (EBBS) (Garcia, Pender, Antonakos, & Ronis, 1998) and Physical Activity Questionnaire for Children (PAQC) (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997) was employed to measure self-reported PA. Measurements were conducted before and after the 8-week intervention.

Results

One hundred sixty-eight out of 227 participants completed the post-test [completion rate=74.0%, mean age= 13.27 (1.17), and 56.5% of them were female]. Wilcoxon Sign Rank test indicated that there was a significant increase in SMR from pre- to post-test in both groups [W: ($p<.0005$); WE ($p=.05$)]. Chi-square test showed no between-group difference in stage movement (χ^2 =2.22; df =2, $p=.33$). Repeated measure ANOVA indicated a significant group x time [F (1,128) = -3.97, $p=.05$] interaction effect in EBBS. The mean EBBS score showed that the pre-post EBBS decreased greater in W. No significant main effect for group and time was found in EBBS. Neither the interaction nor main effect in PA attained significance. Though, self-reported PA increased in both groups.

Conclusion

The present study showed that web-based did not different to website plus email reminder on forward stage progression and improving PA behaviour change in Hong Kong Chinese adolescents who are in the initial stages.

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Effect of a school-based adapted physical activity program for children with physical disability after the 2008 Sichuan earthquake

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Introduction

The Sichuan Earthquake which happened on 12th May, 2008 had left few hundreds of children and adolescents with different physical disability including amputation, fracture and compartment syndrome etc. (Fu et al, 2009; Yi et al, 2008). Due to the lack of proper rehabilitation, the rate of complication was very high and many of the student survivors were physically inactive in their daily lives. The adverse consequence of physical inactivity was increased risk of developing secondary condition such as obesity, coronary heart disease and type 2 diabetes. (Rimmer, 2008)

Objective

The objective of this study was to design and explore the effect of a school-based Adapted Physical Activity (APA) program among students with physical disability to promote a higher level of physical activity.

Design

The current study employed a Quasi-experimental design. The sampling method was by convenient sampling.

Subjects

A total of 77 disabled children were recruited from a local school in Sichuan. The subjects were allocated into either the experimental group or the control group according to their availability. There were 38 students in the experimental group and 39 students in the control group. Among all the subjects, 25 (32.5%) had lower limb amputation, and 52 (67.5%) had fracture or compartment syndrome. There was no statistical difference in demographic data (mean age, height & weight) and physical parameters (2 minutes walk test, timed up & go test & physical activity level) between the groups at baseline.

Intervention

The experimental group received weekly APA program for 12 weeks in the form of group activities which include a variety of therapeutic exercises and games specially designed and modified for amputees and physically disabled students. The exercise program incorporated components of cardiovascular endurance, muscle strength and flexibility training. The APA program was designed and conducted by registered physiotherapists from Hong Kong. On the other hand, the control group did not receive any intervention during the 12-week period.

Outcome measures

The primary outcome measure was physical activity level evaluated by International Physical Activity Questionnaire (IPAQ) (Booth, 2000) and the students were classified into “active” or “inactive” according to current physical activity guideline. (HHS, 2008) The secondary outcome measure was quality of life measured by 36-item Short form health survey (SF-36) (Li et al, 2003).

Results

Both the experimental group and the control group showed significant increase in physical activity level after the 12-week intervention period. However, the magnitude of increase in activity level is significantly higher in the experimental group than the control group. (Figure 1) There was statistically significant increase in the proportion of students being “active” in the experimental group after the APA program whereas no difference was observed in the control group. (Figure 2) The results of SF-36 in our subjects showed significantly lower score than the Chinese population norms in all domains except general health, vitality and mental health. (Figure 3) There was no significant difference in the SF-36 scores between the experimental group and the control group.

Conclusion

The school-based Adapted Physical Activity program is feasible, safe and effective in promoting physical activity among people with physical disability.

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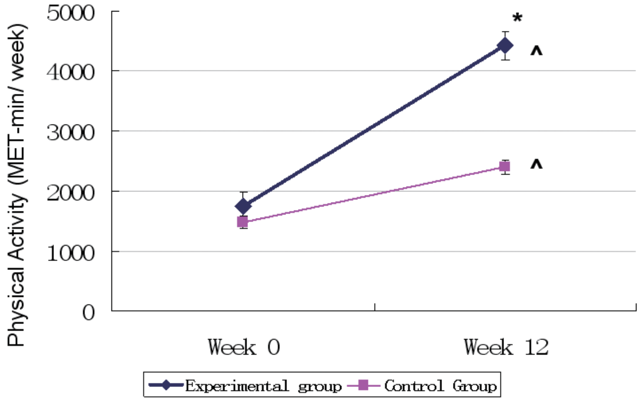

Figure 1. Mean physical activity level at week 0 and week 12. Bars represent +/- 1 standard error of the mean. ^Significantly different from baseline within group, p<0.001; * magnitude of increase significantly higher than the control group at week 12, p<0.001.

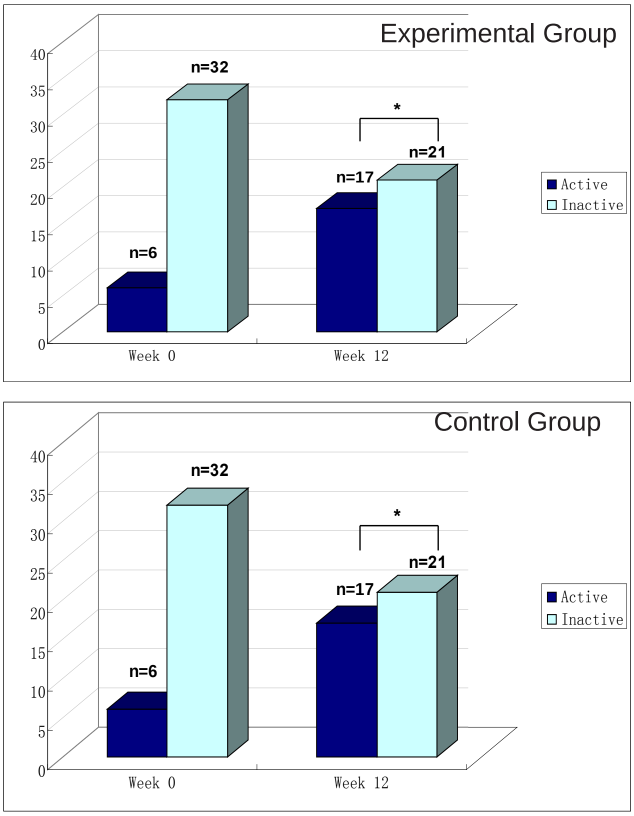

Figure 2. Change in classification of physical activity level at week 0 and week 12.
* Significantly different from baseline in the experimental group, p=0.012.

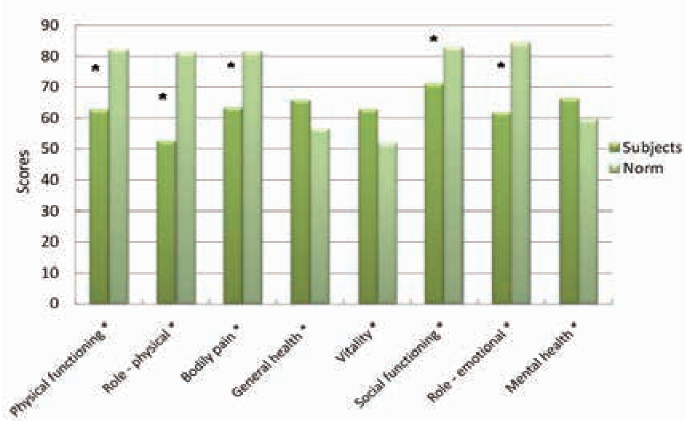

Figure 3. SF-36 scores compared between the subjects and the Chinese population norms.
*Our subjects had significantly lower scores in physical functioning, role limitation due to physical health, bodily pain, social functioning and role limitation due to emotional problems than the norms. (p<0.001)

SYMPOSIUM IV

Association between family characteristics and children's TV viewing

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Introduction

Childhood obesity is in rising trend in both developed and developing countries (WHO, 1997). Similarly, prevalence of childhood obesity in Hong Kong from 2001 to 2006 is double as compared to 1993 (Hong Kong Department of Health, 2005). The problem of childhood obesity is even worse among Hong Kong primary schoolchildren. According to latest statistics, around 20% of primary school children, which means one out of each five school children, were classified as obese (Hong Kong Department of Health, 2008).

Early onset obesity, inducing insulin resistance, hyperlipidemia, promotes metabolic disorders and increases risk of suffering from chronic illnesses in adulthood (Goran et al., 2001; Teixeira, et al, 2001). Therefore, the problem should be addressed as early as possible.

Obesity is resulting from imbalance between energy intake and energy expenditure (Rosenbaum et al., 1997). Over past few decades, introduction of television, videogames and internet have led to increased sedentary behaviours, thus reducing energy expenditure among children (Caroli et al., 2004). American College of Sports Medicine stated that obesity is directly related to numbers of hours spending on TV viewing (Bar-Or et al., 1998). Evidence suggests that family characteristics, which include parental education, family income and family structure etc., are related to children's and adolescents' sedentary behaviour such as TV viewing (Bagley et al., 2006; Hardy et al., 2006 & Hesketh et al., 2006). However, the studies mainly investigated western population. Therefore, the purpose of this study is to explore any associations between different family characteristics (such as socioeconomic status, family structure, family TV viewing behaviour, rules and restrictions on TV viewing and family TV environment) and TV viewing behaviour among Chinese primary schoolchildren in Hong Kong.

Methods

A cross-sectional study design was undertaken in January 2010. Data were collected from children studying Primary 1 to 3 and their parents from a local primary school. Particpating children's height, weight and body fat percentage were collected. Their parents were required to fill in a questionnaire about their family characteristics, child's and their TV viewing behaviour, their attitude and rules towards TV viewing and home TV viewing environment. They required returning the questionnaire one week after they received it.

The questions in parent questionnaire were adopted from the Chinese questionnaire (CLASS-C) modified from the Children's Leisure activities Study Survey (CLASS) (Huang et al., 2009) which is used to assess physical activity patterns. CLASS-C showed acceptable reliability and validity to assess physical activity levels among local schoolchildren (Huang et al, 2009; Huang & Wong, 2007).

Descriptive statistics and frequencies tables were run to characterize the anthropometric data and different family characteristics. Chi-square test was used to compare any differences in family structure and family socioeconomic status between gender, differences in TV viewing behaviour between gender and difference in TV viewin time between weekday and weekend. To explore any association between the effect of family characteristics and child's TV viewing behaviour (≥2hour/ day), cross-tabulations with Chi-square test was used for each family variables for child's TV viewing ≥ 2hour/ day on weekday and weekend separately. Data were analyzed using SPSS 13.0 (SPSS Inc., Chicago, IL, USA). For all statistical analysis, the level of significance was set at 0.05.

Results

Total 287 children enrolled in Primary 1 to 3 in the school were given information of the study and 168 families agreed to participate in the study and the overall response rate was 58.6%. Among 287 famililes, 154 families completed the parent questionnaire. The mean age ± SD of participating children was 8.0 ± 0.8 yrs old. The lowest and highest age of participating children was 6 and 10 respectively. 53.7% of participating children were boys. 66.1% of responding parents was mother in parent questionnaire.

Regarding socioeconomic status, majority of fathers (90.7%) and mothers (93.8%) were from low to medium education background while most of the mothers (73.6%) were from low income group. Most the children were from dual-parent family (89.9%) and had siblings (59.6%). Using Chi-square test, there were no significant differences between boys and girls in family background and structure.

Only 18.4% of children watched TV ≥ 2h/day in weekday while 43.6% of them watched TV ≥ 2h/day in weekend. There was significant difference in children watching TV ≥2h/day between weekday and weekend ($p < 0.001$). There was no significant difference in TV viewing times between boys and girls in weekday and weekend.

Regarding parent TV viewing, most of their parents (72.8%) watched TV ≥ 2h/day in weekend. More than half (55.2%) of parents reported they watched TV < 2h/day in weekday. 44% of parents stated that they watched TV frequently with their children. Above half of the parents (56.8%) did not allow their children watching TV during meals. In general, parents tended to control and supervise TV viewing among their children. Nearly all of families (98.7%) reported having TV set at home. Majority of families (64.2%) have electronic games (i.e. Playstation, Nintendo, etc.) at home.

At weekend, no TV viewing during meals ($p = 0.015$) and presence of electronic games at home ($p < 0.001$) were significantly associated with child's TV viewing ≥ 2h/ day. On weekdays, parent watching TV ≥ 2h/ day on weekday ($p = 0.045$) and no TV viewing at mealtimes ($p = 0.022$) were significantly associated with TV viewing ≥2hours/ day (Table1).

Discussion and conclusion

The main findings of the study were (1) having electronic games at home and allowing TV viewing at meals were significantly associated with child watching TV ≥2h/day at weekend; (2) allowing TV viewing at meals and parent (either mother or father) watching TV ≥2h/day on weekday were significantly associated with child watching TV ≥2h/ day on weekday.

Since children have more time for leisure activities at weekend, they probably use TV to play videogames, thus increasing the time spending on TV viewing and making this factor associated with increased child's TV viewing. Other significnat factors, like allowing TV viewing at meals and parent (either mother or father) watching TV ≥ 2h/day, were consistent with other studies done in western populations.

There were several limitations in the study. Firstly, all participants were recruited from the same school and the sample size was small so that the results may not be generalisable to entire population. Secondly, proxy report was used to measure children's TV viewing time, which may cause inaccuracy in measuring child's actual TV viewing time among children because parents may not be fully aware of the exact time their child spending on TV viewing. Finally, it is a cross-sectional study which cannot examine the effect of age on children's TV viewing behaviour and the causal relationship between family characteristics and child TV viewing behaviour.

Our findings showed that family TV environment (i.e. presence of electronic games), parental TV viewing behaviour and rules and restrictions on TV viewing are associated with children TV viewing habit. However, it is recommended further study should include other screen-based behaviours like playing electronic games and computer together with TV viewing for investigation because the pattern of sedentary behaviour among children and adults was gradually changed due to advancement of information technology.

Table 1. Association between family characteristics and child TV viewing ≥ 2h/ day

Family characteristics (frequency)	Children's TV viewing <2h/day	≥ 2h/ day	p value	n
At weekend				
No TV at meals	50	25	0.015**	136
TV at meals	28	33		
Have electronic games	39	49	<0.001**	137
No electronic games	37	12		
On weekdays				
Parent watching TV ≥ 2h/day at weekday	46	16	0.045**	135
Parent watching TV < 2h/day at weekday	64	9		
No TV at meals	66	9	0.022**	137
TV at meals	45	17		

The difference of physical ability between youth soccer player and professional soccer player: a training implication

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Introduction

Soccer is a fitness demanding sport. To prepare youth soccer player to be professional players in the future, soccer-specific fitness training is necessary besides soccer skill training. Agility, speed, and lower limb muscle power relative to body weight are the crucial physical abilities for soccer players to compete in the game. Specific training that improving agility, speed, and muscle power is beneficial to them. However, some fitness elements would be in the higher priority for the youth. The purpose of this study is to suggest suitable fitness training to youth players according to the difference of the physical abilities of youth soccer players and professional soccer players.

Methods

81 soccer players were recruited from 2 soccer club in Hong Kong. 19 of them (Mean age = 24.05, SD = 2.59) competed in professional league in Hong Kong. They trained 6 times a week. 62 of them (Mean age = 15.06, SD = 2.5) were youth players, trained in the soccer club. They trained 2 times a week. Both groups performed countermovement jump (CMJ) on a jump mat to test the lower limb explosive strength, 20m sprint and arrowhead agility test timed by infra-red timing gate to test the straight sprinting speed and the agility. Height, weight, and the body mass index (BMI) were also recorded. Independent t-tests were used to compare the difference between youth and professional players. A significant level of $p<0.05$ was used.

Results

Test results are provided in Table 1. Significant differences were found in all tests except countermovement jump test ($p<0.05$). Youth soccer players have a better performance than professional soccer players in the 20m sprint test. Professional soccer players performed better in the arrowhead agility test than youth soccer players

Table 1. The mean (SD) of the fitness tests

	Youth	Professional
Height	165.3cm (14.0)	*179.6cm (7.7)
Weight	55.4kg (13.6)	*76.0kg (9.8)
BMI	20.0 (3.7)	*23.2 (1.6)
CMJ	44.7cm (7.9)	46.5cm (4.8
20m Sprint	2.99 seconds (0.38)	3.17seconds (0.10)
Arrowhead agility		
- Left	8.73 seconds (0.64)	*8.25 seconds (0.27)
- Right	8.46 seconds (0.56)	*8.16 seconds (0.20)

*Significant different between youth and professional soccer players ($p<0.05$)

Discussion

Poor performance compared to youth players in 20m sprint for professional soccer players was unexpected. It is possibly that speed is not the most important abilities in the game or the players have already developed their speed when they are youth.

Professional group had higher BMI indicating that their musculature was more developed.

However, similar CMJ performance of two groups meant that the lower limb power relative to body weight is similar for both groups. It indicated that the leg muscle qualities are similar for both group. Better performance was found in agility test for the professional. As the longest distance in arrowhead test is only 10m. The ability of straight line sprinting is not critical to have good performance in arrowhead test.

Conclusion

Overall, the test results implied that professional players can accelerate and decelerate better than the youth players. This difference involves the abilities of proprioception, balance, muscle coordination and technique of agility. Static balance exercise, dynamic balance exercise, and plyometric exercise with multi-direction movement are suggested to improve agility. Exercises, such as eye close single leg balance on ground or foam, zig zag single leg hop with balance when landing, lateral single leg plyometric jump, bounding, running and cutting, are the examples.

Acknowledgement

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A comparison of static and dynamic balance between elderly dancers and non–dancers

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Introduction

Balance is an integration of muscle strength and sensory functions. Yet, these functions deteriorate slowly with advancing age; risk of falling is higher in elderly population. Social dance is a fun physical activity that long term health benefits can be gained by elderly. However, its effects to body balance within elderly population have not been systematically assessed yet. A comparison of static and dynamic balance between social dancers and non – social dancers was done to determine the difference, which may result in a positive effect of training that is beneficial to implement a falls prevention program for elderly.

Methods

A retrospective study. Dependent variables included leg balance (dominant and non-dominant), standard deviation of center of pressure (medial – lateral and anterior – posterior during eyes opened and closed conditions). Thirty - eight volunteers (21 social dancers, 17 nonsocial dancers) were recruited from the ballroom dancing council and elderly centre in Hong Kong. Positions of center of pressure were collected on the force plate and standard deviation of center of pressure in medial – lateral and anterior - posterior directions were calculated to assess static balance. Normalized leg reached distance from the Star Excursion Balance test was used to assess dynamic balance. Multivariate analysis was chosen to analyze six dependent variables and the demographic information between two groups were compared with an independent T –test.

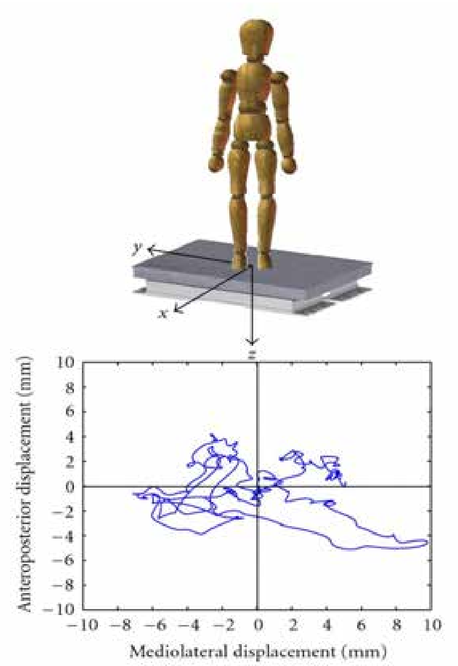

Figure 1. A center of pressure displacement (COP_{ML}, COP_{AP}) of one representative sample in the double-leg Static Balance test.

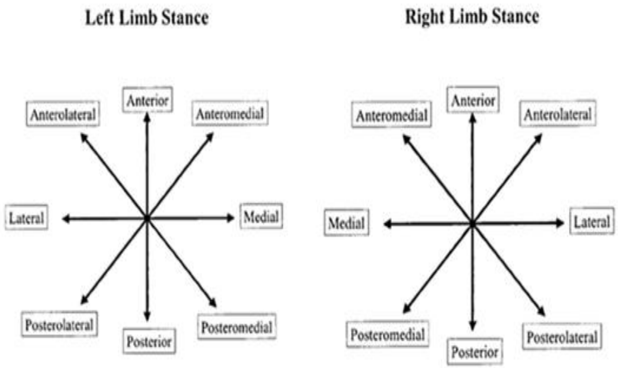

Figure 2. Multi-directional maximal single-leg reaches of the Star Excursion Balance Test

Results

Social dancers had better dynamic balance than nonsocial dancers on their non-dominant legs with p = 0.037. There was no significant difference found with the static balance tests in both eyes opened and closed conditions.

Table 1. Results from Independent T –test of background physical characteristics comparison between social dancers and non social dancers. Results are presented in mean ± SD.

	Dancers (n = 21)	Non-Dancers (n +17)	P value at 0.05 (T - test)
Age (years)	59 ± 7	57 ± 6	0.475
Height (cm)	159 ± 8	156 ± 11	42
Weight (kg)	57 ± 9	57 ± 7	0.758

Table 2. Results from Multivariate Analysis test of comparison between social dancers and nonsocial dancers.

Dependent Variables	Measurements	F	P value at 0.05
Eyes Opened	SD_{ML}	0.835	0.367
	SD_{AP}	0.238	0.629
Eyes Closed	SD_{ML}	1.174	0.286
	SD_{AP}	1.132	0.295
Domin Leg Balance	Summed Normalized Leg Length	1.962	0.17
Non - Domin Leg Balance	Summed Normalized Leg Length	4.68	*0.037

Discussion

The relative causes of social dancers to have better dynamic balances were probably due to their unique training in Transfer of Weight, greater fitness in muscle strength, flexibility and proprioception.

Conclusion

Social dancers and nonsocial dancers differ only in their non-dominant leg balance at the dynamic balance test. Having elderly participate in regular social dance and fitness program will help establish health benefits as well as help plan future dance related fitness interventions to prevent adverse outcomes such as falls.

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Clinical and biomechanical outcome following surgery for Achilles tendon rupture: comparison of minimally invasive repair with open repair

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Objectives

Despite minimally invasive surgical (MIS) repair with Achillon applicator has been introduced, there is lack of literature to investigate the clinical merits of Achillon method over open surgery. This study aims to investigate the correlation between clinical outcome, gait analysis and biomechanical properties comparing both surgical methods.

Study Design

A single centre retrospective review on all the consecutive operated patients between January 2004 and December 2008 was performed. Twenty-two patients (15 male and 7 female; mean age 40.8 years) were identified. 6 MIS patients versus 9 Open group patients underwent clinical assessment using Holz's scale and biomechanical evaluation at a mean of 29.9 months after operation. Cybex II isokinetic dynamometer was utilized to assess the isokinetic peak force of plantar-flexion and dorsiflexion of both ankles. Gait analysis was conducted in our laboratory with eight-infrared camera motion capture system (VICON, UK).

Results

The mean operative time and length of hospital stay were shorter in the MIS group: 53 minutes versus 68.80 minutes of the MIS group and Open group respectively (p= 0.012); 3.43 days versus 6.40 days respectively (p=0.084). There is statistically significant decrease (p<0.001) in incision length, 3.53cm versus 9.64cm respectively. Holz's scores were similar, 11.83 versus 12.0 respectively (p=0.813). Mean follow-up duration was 3.43 months versus 6.40 months (p=0.084); physiotherapy duration of 3.50 months versus 4.56 months (p= 0.198). The mean percentage stance time of the injured leg was 58.27% and 56.57% respectively. The loss of peak torque and total work done of the injured side were similar between the MIS and open group. T-test showed no significance differences.

Conclusion

MIS can achieve smaller incisions, shorter operative time and hospital stay. There is no statistical significance difference in clinical outcome, the stance time to strike time ratio and biomechanical properties on the leg receiving Achilles tendon repair using MIS method and open surgery.

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A prophylactic device for preventing sport-related knee ligamentous sprain injury

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Introduction

Knee sprain is a common sport injury which causes ligmentous injury. It occurs in certain sports that involve rapid stopping, cutting motion. These sports included basketball, handball and soccer. For example, an ACL injury is often caused by an awkward stop and anticipation of lateral movements, which exceed the position of no return (Ireland 1999). In one of the videotape analysis on ACL injury case, the victim was in relatively upright position with less flexion of hip and knee, and relatively straight back, momentum forward, and then excessive valgus at the knee. The ACL tears occurred at 70 milliseconds (Yasuda et al. 1992).

An ACL deficient knee has a high loading during the initial phase of the gait cycle (Schipplein and Andriacchi 1991), therefore causing possible cartilage breakdown after ACL injury (Andriacchi et al. 2004). ACL deficient patients always suffer from knee rotational instability. Players suffer from knee ligament injury always have to stop their sports training and competition, which cause high expenses on medical and also economical loss for professionals players. Therefore, protection of athletics from knee ligament injury causes by knee sprain is an important task in clinical biomechanics research.

Methods

In order to prevent the knee ligament injury from knee sprain, we need to investigate on the injury mechanism first. Previous studies show that the joint position affects how the muscles can prevent injury. When the knee is in a flexed position, the hamstrings can prevent the anterior tibial translation more effectively. Therefore, a more flexed hip, knee and normal lumbar lordosis is considered as a safer landing position (Ireland 2002).

After the aetiology mechanism is investigated, a review of existing knee protective device and injury prevention exercise will be evaluated. This allows better understanding on current device and room of improvement to be made. A prophylactic device will be developed for preventing sport-related ligament injury. The work will start from improving current protective device to see if pure mechanical protection is enough for knee ligament injury or not. Further development of an intelligent knee prophylactic device will also be investigated. The intelligent knee prophylactic device will adopt the three steps mechanism of the vehicle air bag system: 1) Sensing, 2) identification and 3) correction.

The sensing part can be done by motion sensors with accelerometers, gyrometers and magnetic sensors (O'Donovan et al. 2007). These motion sensors have to be firmly fixed on the thigh and shank segment of the leg. Other measurement devices such as pressure sensors and goniometer may also be used in the sensing system. The developed sensing system will then be validated in sawbones and cadaveric limbs with navigation system (Colombet et al. 2007) or bone pin motion analysis system which is the current golden standard in motion analysis. The identification system will then be built by summarizing previous research outcome knee ligament injury mechanism. When the knee exceeds the risk threshold in the injury mechanism, it will be identified as undesired motion which will then send a signal to activate the protective mechanism.

The protective mechanism will be developed in the correction part. As it is suspected that excessive valgus motion of knee is a risk factor of ACL injury, the protective mechanism can be developed to prevent the excessive valgus motion to happen. This can be done by braces which restrict the range of motion of knee, or by stimulating muscles to return the knee to the "safe" range of motion. In order to investigate the possibility of applying myoelectric muscle stimulation in protecting knee ligament injury, a study on voluntary muscle control of valgus motion of knee during jumping and landing is needed. This can be done by biomechanics test using electromyography to evaluate the reaction time and strength of the muscle contraction. After the development of the whole intelligent prophylactic device, it will then be evaluate on either patients with ACL deficient knee or using finite element model if human subjects are not available.

Conclusion

The intelligent knee prophylactic device aims to protect athletics from sports related knee ligament injury caused by knee sprain.

Acknowledgement

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POSTER PRESENTATION

Static and dynamic postural control in professional dancers

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Introduction

Postural control is the combination of sensory and motor processes involved in the maintenance of standing balance and it is well-known to result from the integration of visual, somatosensory and vestibular information [1].
Professional dancers demonstrate high levels of spatial skills as illustrated by their ability to orient and position themselves accurately in space [3,4]. It may be properly related to and resulted from their specific training.

Since the dancers usually practice in front of a mirror and use visual landmarks, it suggests that they rely preferentially on visual inputs and it may therefore postulated that dancers and the general population might impact differently on postural balance control [4,5,6]. For example, Hugel et al. (1999) and Perrin et al. (2002) both found better balance performance by dancers in eyes open conditions.

The aim of the present study was to compare both static and dynamic postural control in professional dancers and in a control group of age- and gender-matched healthy individuals.

Participants and methods

Participants

Ten female professional dancers (mean age = 24.7 ± 2.5 years; mean body weight = 48.1 ± 3.6 kg; mean body height = 162.0 ± 3.5 cm) from local training schools and 10 female healthy individuals (mean age = 24.5 ± 1.3 years; mean body weight = 50.0 ± 4.4 kg; mean body height = 158.4 ± 4.7 cm) from the Physiotherapy Department, Prince of Wales Hospital, Hong Kong, were enrolled. The dancers' experience ranged from 8 to 23 years and the healthy individuals served as a control group. There was no significant difference either in age, weight and height between the two groups. The included participants had been screened not to have factors affecting their balance control. Written informed consents were obtained from all of the participants prior to the study.

Experimental set-up

Variations in availability of vision (eyes open vs. eyes closed) and rigidity of support surface (rigid surface of the force platform vs. 12cm thick foam block) were factorially combined, yielding four experimental test conditions (eyes open/rigid; eyes open/foam; eyes closed/rigid; eyes closed/foam) in both static and dynamic postural tests respectively.

(1) Static Postural Control
In both rigid and foam conditions, participants with barefoot stood upright and with the dominant leg centered with respect to the force platform. The other leg was lifted. Participants were asked to stand immobile as much as possible for 30 seconds for each trial.

Postural stability data was obtained by using a Switzerland Kistler 9281 force platform with data sampling at 1000Hz. Customised Matlab program calculated the centre of mass (COP) from the force and moment signals measured by the force platform.

Two COP dependent variables were used: the mean path length of COP displacement indicating the total sum of the deviation of the COP in all directions and the average speed of COP displacement which is the sum of the displacement scalars divided by the sampling time. If a participant failed to complete the tests due to falls, TTF (the time they stood on the surfaces before falling) was also recorded for analysis.

For each of these COP summary variables, higher values indicate decreased postural control while lower values indicate increased postural control and vice versa for TTF variables.

(2) Dynamic Postural Control
Participants stood with the dominant leg on a wooden box (20cm x 40cm x 51cm) which was in front of the platform, outstretched their arms and put the opposite leg posteriorly, simulating a landing posture in dancing. They then jumped down from the box, onto rigid or foam surfaces, landed on the dominant leg and kept the landing posture until stability retained (see Figures 4 and 5). Dependent variable used was SL which was the time the participants required to return to a stable postural state. Data collection was terminated at 15 seconds after landing to make sure the participants had retained stability. If a participant failed to complete the tests due to falls, TTF (the time they stood on the surfaces before falling) was also recorded for analysis.

For SL variables, higher values indicate decreased postural control while lower values indicate increased postural control and vice versa for TTF variables.
Three consecutive trials were conducted in each condition and a mean score of the three trials was calculated for each test.

Statistical Analysis

Two-tailed independent samples t test was used to examine differences in the dependent variables between the professional dancers and the controls. Repeated measures analysis of variance (ANOVA) was also used to test the effect and interaction of group and/or vision and/or surface on the dependent variables. (β=0.05)

Results

Static Postural Control

Despite the results showed that the postural sways of the professional dancers were lesser than the controls during the 30 second quiet stance in all eyes open/rigid (dancers:

mean=2903.3±372.1mm, speed=96.8±12.4mm/s; controls: mean=3163.1±411.2mm, speed=105.4±13.7mm/s; p>0.05), eyes open/foam (dancers: mean = 2917.5 ±342.0mm, speed=97.3±11.4mm/s; controls: mean=3006.7±495.2mm, speed=101.9±16.0mm/s; p>0.05) and eyes closed/rigid (dancers: mean=2905.0±350.9mm, speed=96.8±11.7mm/s; controls: mean=2993.4±458.4mm, speed=99.9±15.3mm/s; p>0.05) conditions (see Figure 1), the t test showed no significant difference in either mean path length or average speed of COP displacement between the two groups and it was not analysed in eyes closed/foam condition since all participants in both groups fell and therefore were not able to complete the tests.

In eyes closed/foam condition, the most challenging condition in static balance tests, mean TTF (static) was then used to detect the differences between the two groups. However, there is no significant difference in TTF (static) (dancers= 13.6±6.5s; controls= 8.9±6.6s; p>0.05) detected although the professional dancers could stand longer periods of time than the controls before falling (see Figure 2).

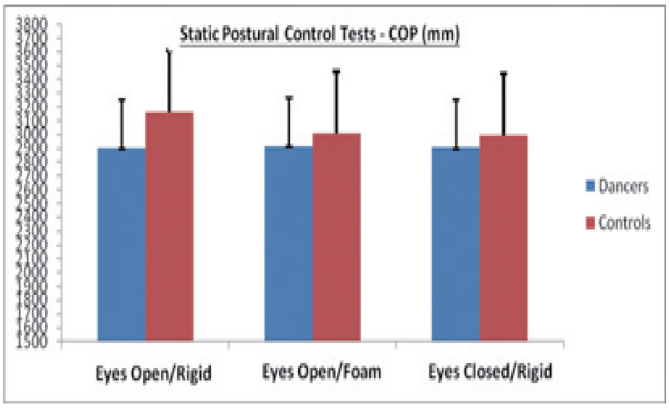

Figure 1. COP of both groups in static balance control tests.

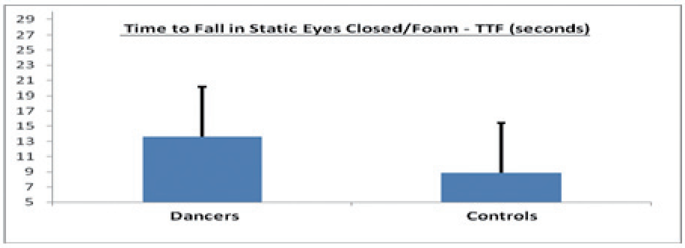

Figure 2. TTF in the most challenging static conditions – Eyes Closed/Foam.

Dynamic Postural Control

Regardless of the professional dancers required shorter periods of time to return to a stable postural state than the controls during the 15 second stance after single leg jumping from a wooden box in all eyes open/rigid (dancers: mean=2.9±1.8s; controls: mean=2.2±1.6s; p>0.05), eyes open/foam (dancers: mean=3.4±1.4s; controls: mean=1.4±0.7s; p>0.05) and eyes closed/rigid (dancers: mean=2.8±1.3s; controls: mean=2.6±1.2s; p>0.05) conditions (see Figure 3), the t test showed no significant difference in sway latencies between the two groups and it was not analysed in eyes closed/foam condition since all participants in both groups failed to complete the tests due to falls.

Since there were six controls and five dancers failed in eyes closed/rigid condition and all controls and dancers fell in eyes closed/foam condition, mean TTF (dynamic) was then used to detect the differences between the two groups. The results also demonstrated no significant difference in TTF (dynamic) in both conditions (eyes closed/rigid: dancers=4.4±2.0s, controls=3.6±1.9s, p>0.05; eyes closed/foam: dancers=4.9±3.9s, controls=2.2±1.2s, p>0.05) even though the dancers could bear slightly longer e than the controls before falling as observed from their performance (see Figure 4).

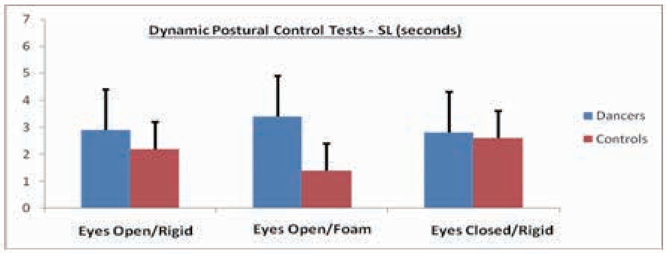

Figure 3. SL of both groups in dynamic balance tests.

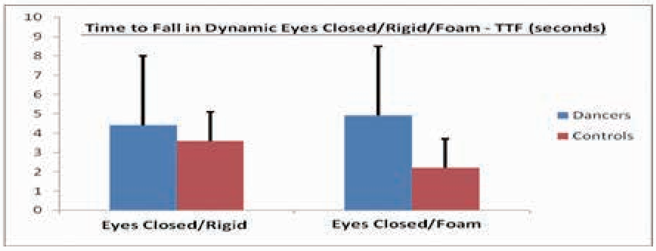

Figure 4. TTF in challenging dynamic conditions – Eyes Closed/Rigid and Eyes Closed/Foam

Influence and interaction of group, vision and surface

For all of the dependent variables, there was no main effect of group, vision and surface (p>0.05) and no interaction group x vision, group x surface and surface x vision (p>0.05) observed, such that in general no factor help minimizing postural sway.

Discussion

Based on the displacements of the COP in static balance tests, the results showed that, postural sways of the dancers were lesser than the controls in all conditions, except in eyes closed/foam condition. However, the differences between the two groups were not significant (p>0.05). When both groups were further challenged in eyes closed/foam condition, all of them fell. In which, the dancers could stand slightly longer periods of time than the controls before falling although these differences were not significant (p>0.05).

In dynamic postural control tests, the results showed that the time the dancers required to return to a stable postural state in all conditions after jumping, except in eyes closed/foam condition, was shorter than the controls. However, the differences between the two groups were not significant (p>0.05). Also, when they were in eyes closed/foam condition, all of them fell. In which the dancers could bear slightly non-significantly longer periods of time than the controls before falling (p>0.05).

To summarize, in different combinations of visual and support surface conditions, professional dancers generally performed better than the healthy control participants, non significant though. This indicates that dancers cannot always fully compensate for the lack of vision, but their capability to use the remaining sensory modalities in unstable postures is improved with respect to non-dancers.

Conclusions and future studies

This study generally supports other authors' observation that professional dancers have better balance abilities in both static and dynamic balance postures than healthy age-matched individuals [1-6], but the results were not significant, which may be possibly because: (1) the tests were not challenging enough to differentiate the postural control abilities of both groups; (2) transfer of motor skills is truly not an automatic phenomenon and the ability to maintain balance might depend on the task and (3) sample size was small and thus the results were not generalized.

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Accelerometer-determined physical activity level of primary school children in Hong Kong: a pilot study

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Introduction

Childhood obesity has grown dramatically in Hong Kong in recent years. Longitudinal studies have demonstrated that reduced spontaneous physical activity (PA) is one of the risk factors for obesity (Ravussin and Gautier 2002). Data show that Hong Kong youth may be one of the most inactive populations in the world (Adab and Macfarlane 1998; Hui 2001; Lee and Tsang 2004). However, PA level in these studies were mainly assessed by subjective methods. Research examining PA level by objective measures remains limited in Hong Kong, especially in young children, among whom subjective questionnaire is not appropriate. Therefore, the purpose of this study is to examine the PA level of the primary school children by accelerometer.

Methods

Participants

40 Chinese children (22 boys and 18 girls) aged between 6 and 9 years from a primary school in Tai Po, Hong Kong, volunteered to participate in this study. All the participants have no known medical illness and are not taking medications known to affect body weight and PA. An informed consent form was obtained from the children and their parents or guardians.

Anthropometric Assessment

Body weight and height were measured to calculate body mass index (the weight in kilograms divided by the square of the height in meters). Body fat percentage was measured by TANITA Body Fat Monitor.

Assessment of PA

PA was assessed by the ActiGraph GT1M accelerometer, which is the most widely used accelerometer in pediatric research (Trost et al. 1998; Trost et al. 2005) and has been shown to be a valid and reliable tool for quantifying PA in children and adolescents (Puyau et al. 2002).

In this study the epoch period was set to 60 seconds. Each participant wore the accelerometer for seven consecutive days in free-living conditions. Children were instructed to fit the accelerometer at the waist and to remove the accelerometer only when bathing, swimming and sleeping. To ensure that the participants wore the accelerometer for seven consecutive days, only those children who wore the accelerometer more than 10 hours per day (Macfarlane et al. 2006) for a minimum of four days, which consisted of at least three weekdays and one weekend, were included in the final analyses (Telford 2004).

Activity counts were summed for the entire waking period on each day. Overall activity, weekday activity and weekend activity were computed as the individual's total daily counts averaged over all seven days, five weekdays or two weekends. The ActiGraph data was also expressed as time (minutes) spent on moderate to vigorous intensity of physical activity (MVPA) on weekdays and weekends respectively, based on the age-specific cut-off counts: METs = 2.757 + (0.0015*counts.min-1) – (0.08957*age) – (0.000038* counts.min-1*age). The cut-off MET values for moderate and vigorous intensity are 3 and 6 respectively (Trost et al. 2002).

Statistical Analysis

Statistical analyses were performed using SPSS for Windows version 12.0. Descriptive statistics (mean ± SD) were calculated for all variables. Difference of the variables between genders was assessed by Independent-Samples T Test. The average time that children spent on MVPA between weekdays and weekends was assessed by Paired-Samples T Test. The level of significance was set at $p< 0.05$.

Results

Table 1 summarizes the descriptive data for the participants. There is no gender difference in age and anthropometric variables.

Table 1. Characteristics of the participants (mean±SD)

Variables	All (n=40)	Boys (n=22)	Girls (n=18)	P value
Age (years)	7.5±1.0	7.6±0.9	7.28±1.1	0.311
Height (cm)	125.5±7.9	126.0±7.0	125.0±9.0	0.707
Weight (kg)	27.7±7.7	27.0±6.5	28.6±9.1	0.532
BMI (kg/m^2)	17.3±2.9	16.8±2.5	17.9±3.3	0.144
Body fat %	18.7±6.1	17.4±5.1	20.3±7.1	0.250

P value: between boys and girls

Only twenty-three children completed eligible accelerometer data collection. Table 2 shows the PA level of eligible participants. MVPA of the 23 children is 155.5±39.4mins/day. According to the recommended PA guidelines (Pate et al. 1995), All the children are physically active. Boys tend to have more MVPA than girls (168.0±37.3mins/day vs. 139.2±37.7mins/day, P=0.082). But there is no difference between PA level on weekdays and weekends.

Table 2. PA level of the participants (mean±SD)

Variables	All (n=23)	Boys (n=13)	Girls (n=10)	P value
Overall activity (counts/day)	376846±78325	404442±76936	340971±67630	0.052
Weekday activity (counts/day)	370644±77028	397589±75984	335615±66284	0.053
Weekend activity (counts/day)	389821±131873	421860±141146	348171±111965	0.190
Overall MVPA (mins/day)	155.5±39.4	168.0±37.3	139.2±37.7	0.082
Weekday MVPA (mins/day)	152.3±38.7	163.9±37.8	137.2±36.1	0.101
Weekend MVPA (mins/day)	162.4±62.5	178.0±65.4	142.2±55.1	0.178

MVPA: moderate to vigorous intensity physical activity.
P value: between boys and girls.

Discussion

PA level of primary school children

Overall activity counts attained by this study are higher than children aged 9.1±0.9 years in previous study in Hong Kong (376846±78325counts/day vs. 299348±140427 counts/day) (Rowlands et al. 2002). And daily MVPA (155.5±39.4mins/day) derived from the activity counts also shows pretty high level. Study in Australia also found that daily MVPA of young children (7.1±0.9 years) was around 200 minutes per day, and a significant inverse relationship with grade level, especially between grades 1–3 (7.1±0.9 years) and 4–6 (10.1±0.9 years) (Trost et al. 2002). This may support the findings of this study.

PA level between boys and girls

Boys tend to be more active than girls. But the difference is lack of statistical significance which could be due to low statistical power. The lack of difference between activity level of boys and girls was supported by previous study which assessed PA level of 8-11-year old Hong Kong children via CSA uniaxial accelerometer (Rowlands et al. 2002) and an earlier study assessing PA level of 6-8-year old Hong Kong children by observation (Johns and Ha 1999). Recent research in UK (Al-Nakeeb et al. 2007) also showed that there is no significant gender differences in primary school children. However, the relatively small sample size and the non-randomized sampling method may make the comparison limited.

PA level between weekdays and weekends

Some studies have found that children are more active on weekdays than weekends (Al-Nakeeb et al. 2007; Nyberg et al. 2009). But there are also studies reported no difference in PA level between weekdays and weekends (Cardon and De Bourdeaudhuij 2008) or reverse result (Metcalf et al. 2002). In this study, we found that there is no difference between PA level on weekdays and weekends.

Conclusion

The children in this pilot study may have pretty high level of daily PA and boys tend to be more physically active than girls. Further investigation with a larger sample size is needed.

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Association between physical activity knowledge, physical activity behavior and age in Hong Kong Chinese adults with type 2 diabetes

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Introduction

Exercise has been a mainstay of the treatment regimen for diabetes mellitus [1-5]. There have, however, been few attempts to study how much of the information on exercise is known in patients with diabetes and their physical activity habit in Hong Kong (HK) Chinese adults.

Objective

The purpose of this study was to assess the knowledge of exercise and physical activity habit, and to assess their correlates in HK Chinese adults with type 2 diabetes.

Patient and methods

Two hundred and eleven patients were recruited for survey in the diabetes out-patient clinic of a local regional hospital. The survey consisted of three main parts: 1) participant's knowledge about physical activity; 2) physical activity behavior using International Physical Activity Questionnaire; and 3) sociodemographic and health status characteristics.

Results

The subjects' characteristics were as follows: age 53.5 ± 10.1 years, 60.2% male, mean length of diagnosis 10.7 ± 7.2 years. More than 70% has BMI over 23 kg/m2, among them 19.9 % of the sample were overweight and another 54.9% were obese (Figure 1). Physical activity knowledge varied by education level and physical activity level. One third of them (29.9%) reported low level of physical activity. Younger patients were associated with physical inactivity.

Conclusion

The majority of individuals with type 2 diabetes were overweight or obese, one-third of them did not engage in recommended levels of physical activity. In order to obtain the beneficial effects of physical activity, more attention should be paid to sedentary individuals, especially at a younger age, and the positive effects of physical activity on diabetic management should be the key message.

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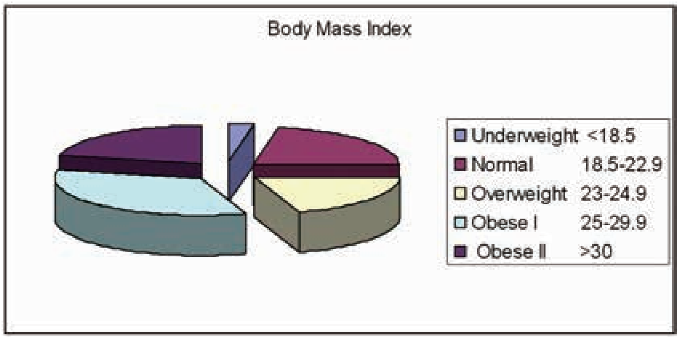

Figure 1

POSTER PRESENTATION

How the walkability of a neighbourhood affects the pattern of physical activity

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Introduction

The current literature has shown that physical activity can be influenced by environmental factors (1). These factors include the accessibility of commercial destinations (2), aesthetics, proximity of recreational facilities (3,4) and the walkability of the neighbourhood (5). Although the walkability of a neighbourhood is known to be an important determinant of physical activity undertaken by its residents, most of these studies have been undertaken in relatively low-density Western cities, with little data available from high-density Asian cities. Furthermore, it is unknown how the walkabiity index may influence the pattern in which people accumulate physical activity; for example, it was hypothesized that residents in high walkable neighborhoods would accumulate more activity time from very short duration trips when compared to residents of low walkable neighborhoods. As current international activity guidelines recommend that more than ten minutes of continuous physical activity is required to attain health benefits (6), it is also important to extend our knowledge to examine if the neighbourhood environment affects the duration of physical activities typically undertake by its residents.

Methods

Two hundred Hong Kong residents aged 18 - 65 years were selected in the study. They were recruited from at least eight blocks within four different neighbourhoods representative of high and low socio-economic status (SES) and high and low "walkability". The four neighbourhoods represent: high walkability and high SES; high walkability and low SES; low walkability and high SES; low walkability and low SES; hence a total of thirty-two tertiary planning units (TPU) were selected (eight blocks each in the four different neighbourhoods). Walkability indices are measured based on two components: street connectivity and household density. Street connectivity data was obtained from the density of true intersections by Geographical Information System (GIS) databases available in Hong Kong, whilst neighbourhood SES was determined via the Hong Kong Census statistics of median household income. To provide a wide range of diversity, the 32 TPU's were selected from the extremes of SES and walkability indices.

Physical activity was objectively measured by accelerometry (Actigraph Actitrainer). Participants were asked to wear the accelerometers on their right hip in the mid-axillary line for seven consecutive days, except for the time when they are sleeping, bathing and swimming. Time spent in light, moderate, and vigorous physical activity was recorded, then the data was further processed and analyzed through an Excel Macro program, in which the bouts of activities of different durations and intensities were classified. The duration of continuous 1-4, 5-9,10-14,15-19,20-24 and 25->30 minutes of physical activity were used, while the intensity of physical activity was segregated using Metzger's standard cut-points (7) to distinguish physical activity into low, moderate and high intensity thresholds.

The means of time accumulated across the three intensities of physical activity were compared between people living in high and low walkable environment and statistically analyzed using independent t-tests.

Results

Variables	High Walkability (n = 120)	Low Walkability (n = 80)	t	p
Different duration and its corresponding intensity of physical activity	Mean (minutes/day)	Mean (minutes/day)		
1-4min >LT	**51.4**	**61.0**	**-2.43**	**0.02**
5-9min >LT	29.3	31.0	-0.63	0.53
10-14min >LT	15.0	12.6	1.65	0.10
15-19min >LT	7.1	5.6	1.79	0.08
20-24min >LT	3.6	3.6	0.09	0.93
25->30min >LT	6.1	6.9	-0.45	0.65
1-4min >MT	20.8	21.2	-0.21	0.83
5-9min >MT	12.5	10.1	1.90	0.06
10-14min >MT	**4.4**	**3.2**	**2.08**	**0.04**
15-19min >MT	1.9	1.9	-0.06	0.95
20-24min >MT	0.8	1.2	-0.95	0.34
25->30min >MT	1.6	2.3	-0.80	0.42
1-4min >HT	0.5	0.3	1.08	0.28
5-9min >HT	0.2	0.1	1.12	0.27
10-14min >HT	0.1	0.1	-0.51	0.61
15-19min >HT	0.0	0.0	-1.00	0.32
20-24min >HT	0.0	0.0	-	-
25->30min >HT	0.0	0.1	-1.42	0.16
1-4min in LT	**30.7**	**39.9**	**-2.61**	**0.01**
5-9min in LT	16.9	20.9	-1.66	0.10
10-14min in LT	10.6	9.4	0.88	0.38
15-19min in LT	**5.2**	**3.7**	**2.06**	**0.04**
20-24min in LT	2.8	2.3	0.75	0.46
25->30min in LT	4.5	4.6	-0.06	0.95
1-4min in MT	20.2	20.8	-0.32	0.75
5-9min in MT	12.3	10.0	1.84	0.07
10-14min in MT	**4.4**	**3.1**	**2.11**	**0.04**
15-19min in MT	1.9	1.9	0.00	1.00
20-24min in MT	0.8	1.2	-0.95	0.34
25->30min in MT	1.6	2.2	-0.70	0.49

LT= lower threshold; MT= moderate threshold; HT= high threshold; Data shown for bout durations lasting 1-4, 5-9, 10-14,15-19, 20-24,25 to >30 minutes and intensity greater (>) and within (in) each different threshold. Rows in bold indicates a significant difference exists between the high and low walkable neighbourhoods.

The t-tests showed several significant differences in the patterns of physical activity between residents living in high and low walkable neighbourhoods. Residents living in low walkable neighbourhoods accumulated significantly more time from very short duration bouts (1-4 minutes) both in and above the low threshold of physical activity, while those living in high walkable neighbourhoods tended

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to engage more in longer duration bouts (10-14 and 15-19 minutes), in the low-to-moderate thresholds of physical activity.

Discussion

It is of note that several Western studies have shown evidence for a quasi-linear relationship between physical activity and neighbourhood walkability. In contrast, a previous smaller (unpublished) study carried out in Hong Kong has shown that the total amount of physical activity (particularly in moderate-to-vigorous physical activity) may not conform to this linear relationship with the walkability index, as no significant difference in the total accumulated amount of physical activity was seen between residents living in high and low walkable neighbourhoods. However, in this current larger study, the pattern in which Hong Kong residents accumulated physical activity was somewhat different, and in the opposite direction to that hypothesized. This preliminary finding indicates that residents living in a high walkable Hong Kong neighbourhood (high street connectivity and household density) accumulated less time in very short bouts of activity (1-4 minutes), but accumulated slightly more time in activity bouts of the minimum duration (>10 minutes) recommended to attain health benefits.

A cluster effect is acknowledged to exist due to the data collection format and forms part of the limitations of this current analysis, as well as the fact that participants may accrue significant parts of their daily activity outside their residential neighbourhood (eg. at their work location).

Conclusion

People living in low walkable neighbourhoods accumulated more time in short duration activities (1-4 minutes) in or above the low threshold, while those in high walkable neighbourhoods accumulated more time in longer duration (10-14 and 15-19 minutes), low-to-moderate bouts of physical activity. Further studies need to differentiate the pattern of activities undertaken inside and outside the residential neighborhood.

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Is there any difference in core endurance in elite jumping athletes with and without patellar tendinopathy?

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Introduction

Patellar tendinopathy (PT) is a major problem in many jumping athletes with high incidence of up to 32%-45% (Lian et al, 2005). Deficit in core muscles, including trunk and hip muscles strength were found in athletes with lower extremity injuries (Leetun et al, 2004). However, subjects were not in the elite level. This cross-sectional study examined the trunk and hip muscles endurance of elite jumping athlete and determined the differences in athletes with and without PT.

Methods

Trunk and hip muscles endurance were measured in 21 volleyball and basketball players (9 volleyball & 12 basketball) from Guangdong province elite athletes training bases (9 male & 12 female; age 16.5±2.7; height 187.6±9.4 cm ; weight75.6±10.8 kg; number of years in professional training: 4.2±2.2 years). Trunk muscles endurances were examined in 4 different positions as previously described (McGill et al, 1999) to challenge the flexors, extensors and side-flexors. Hip abductors endurance was examined by asking the subject to keep the leg in inner range of hip abduction in side-lying position. Maximum holding time was recorded. Subject with PT (n=6) was identified with clinical examination including active complain of pain at proximal patellar tendon during training, pain on palpation at proximal patellar tendon, but absence of other knee disorders such as patello-femoral joint pain. All parameters were compared with same activity level healthy athletes (n=15) without any back or lower limb disorders. Parametric t-tests were used to test for differences if data are in normal distributions; otherwise non-parametric Mann-Whitney U tests were used. Paired t-tests were used to examine the dominant and non-dominant side of the same subject if the data are in normal distributions; otherwise non-parametric Wilcoxon signed-rank tests were used.

Results

Results show that elite athletes with PT are relatively older (PT:19.2±1.7 vs Healthy:15.4±2.2, p=0.002), although the number of years in professional training were comparable. There is a trend of decreased endurance in the hip abductors at the non-dominant side (PT: 62.5±28.9 vs Healthy: 83.8±21.1 seconds, p=0.07). The ratios and differences of hip abductors endurance on dominant and non-dominant side in athletes with PT were significantly different to those in healthy group (Table 1). Moreover, there is a significant two sides difference in hip abductors endurance in athletes with PT (p=0.006). However, no such difference found in the healthy group (Table 2).

Discussion

Previous studies shown hip abductors strength significantly weaker in subjects with anterior knee pain (Boling et al, 2009; Souza et al, 2009). Interestingly, this study demonstrated that imbalance and reduced endurance of hip abductors might contribute to the development of PT. When these stabilizing muscles getting fatigue with prolonged high demanding jumping activities, stress & strain cannot be evenly distributed on both legs. This might cause extra loading on the patellar tendon, thus inducing higher chance of overuse pathology. From this point of view, injury prevention program should not only focus on the conditioning of the knee, but also on the core muscles like hip abductors.

Conclusion

This study suggested that imbalance or reduced core muscles endurance may contribute to the development of PT in elite jumping athletes. It would be worthy for clinician to assess the hip abductors endurance balance in their pre-season screening.

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Table 1. Comparative analysis of variables for healthy athletes with PT

Variables		Healthy athletes (n=15) Mean	Healthy athletes (n=15) SD	Athletes with PT (n=6) Mean	Athletes with PT (n=6) SD	P value
Anthropometry						
Height (cm)		186.8	9.6	190.0	9.2	0.54[a]
Weight (kg)		76.7	11.7	72.8	8.2	0.47[a]
BMI (kg/m^2)		21.9	2.3	20.3	2.0	0.14[a]
Muscle endurance (sec) / ratio (%)						
Trunk muscles holding test	Flexor	195.3	54.6	159.5	30.1	0.15[a]
	Extensor	132.6	46.6	131.1	41.3	0.85[b]
	Side-bridge (D)	70.7	31.5	58.5	13.3	0.38[a]
	Side-bridge (ND)	63.8	20.9	75.3	39.3	0.39[a]
Hip abductors holding test	D	79.6	26.0	81.0	29.5	0.91[a]
	ND	83.8	21.1	62.5	28.9	0.07[a]
	D / ND ratio	0.97	0.31	1.35	0.26	0.02*[a]
	D-ND Difference	-4.2	24.62	18.48	9.72	0.04*[a]

*p<0.05
a=Mann-Whitney U test
b=Independent t-test
D=Dominant side
ND=Non-dominant side

Table 2. Within subject comparison between dominent and non-dominent side

Variables	Dominant side Mean	Dominant side SD	Non dominant side Mean	Non dominant side SD	P value
Hip abductors holding test					
PT + (n=6)	81.0	29.5	62.5	28.9	0.006*[a]
Healthy (n=15)	79.6	26.0	83.8	21.1	0.52[a]

*p<0.05
a=Paired t-test

Poor hamstring to quadriceps ratio in Hong Kong professional soccer players: implication for injury prevention and strength training

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Introduction

Soccer is the most popular sport with around 200 million players registered according to the Federation of International Football Associations (FIFA). It is evident that lower extremities injuries are the majority time off injuries in soccer players. On average, every elite male soccer player sustains one performance-limiting injury each year (Junge & Dvorak, 2004). Absences of competition and training from injuries would be a significant financial loss to their clubs. Injury prevention is important to minimize incidence and severity of lower extremity injuries. Researchers developed a theoretical framework for the sports injury prevention study (van Mechelen, Hlobil, & Kemper, 1992). Establishing the injury risk factor is an important step to develop ultimate injury prevention measures. Studies agreed that quadriceps and hamstring strength ratio is a risk factor for non contact ACL injuries in sports and also agreed that hamstring to quadriceps isokinetic strength ratio is a modifiable risk factor for hamstring strain in soccer (Croisier, Forthomme, Namurois, Vanderthommen, & Crielaard, 2002). This study aimed to evaluate the knee joint flexor and extensor strength of Hong Kong professional soccer players for subsequent risk factor analysis and injury prevention research. A preseason screening of isokinetic knee muscle strength is important to identify players with high risk of getting ACL injuries. Team strength and conditioning coach could tailor-made strength training plan based on the profile.

Methods

Twenty male players with right dominant leg (mean age = 22.6, S.D = 3.9 years), from a Hong Kong professional soccer team were invited to take part in an isokinetic knee muscle strength test. Biodex dynamometer was used to test the peak torque during flexion and extension. Both legs were tested five times at three speeds (60, 180, 240 degree/sec). Verbal encouragement was given during the test to ensure maximum effort. The H/Q ratio was calculated by dividing the maximal knee flexor torque by the maximal knee extensor torque measured at identical angular velocity.

Results and discussion

The mean H/Q ratio of dominant and non dominant leg were ranged from 50.7-65.0 and 47.3-59.0 respectively when being evaluated at the three selected speeds (Table 1). The H/Q ratio in Hong Kong professional soccer players was found to be less than at least 15% - 20% and it was above the H/Q ratio cutoffs of 45%, which was suggested by Croisier and his colleagues. (Croisier, et al., 2002) Hong Kong soccer players were in an increased risk to hamstring strain and other lower extremities injuries.

Table 1. The mean (SD) H/Q ratio of left and right leg at three speed, 60, 180, and 240 deg/s respectively (%), N=20

	At 60 Deg/sec	At 180 Deg/sec	At 240 Deg/sec
Non-dominant leg	47.3(9.7)	57.2(10.8)	59.0(12.0)
Dominate leg	50.7(11.3)	63.3(14.9)	65.0(19.6)

Conclusion

The H/Q ratio in Hong Kong professional soccer players was found to be much lower than players in Europe and it was just within the H/Q ratio cutoffs suggested by researcher. We concluded that Hong Kong soccer players were in increased risk to hamstring strain and other lower extremities injuries. A structured training of eccentric knee flexors is crucial for the players. Nordic hamstring suggested by FIFA is a good example. A preseason screening of isokinetic knee muscle strength is important to identify players with high risk of getting Hamstring and ACL injuries. Team fitness coach should include strength training plan based on the profile.

Acknowledgement

This research project was made possible by equipments and resources donated by The Hong Kong Jockey Club Charities Trust.

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Effects of 60 minutes of soccer-specific training on hydration status, core temperature and soccer skill performance in adults when ingesting either water or carbohydrate drink

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Introduction

There is limited information on the effects of certain physiological variables on soccer skill performance. Recently, ingestible temperature sensors have been shown to be a valid and reliable method of quantifying core temperature (Tc) during soccer-specific activity which has extended the possibilities of research within the area of soccer in a natural outdoor field setting (Gant, Atkinson & Williams, 2006). Monitoring hydration status of soccer players is of interest and value to help prevent impaired physical performance. Dehydration has been highlighted to impair ability following a soccer-specific exercise protocol (McGregor, Nicholas, Lakomy & Williams, 1999). Research has highlighted that replacing fluid loss with a 6% CHO-electrolyte solution improves intermittent, high-intensity athletic performance in various sports compared with rehydrating with water (Guerra, Chaves, Barros & Tirapegui, 2004). Therefore this study aimed to examine the effects of 60 minutes of soccer-specific training on hydration status, core temperature and soccer skill performance in adults when ingesting either water or carbohydrate drink.

Methods

Seven healthy male university soccer players (mean ± SD: age 23 ± 2.9 years, height 1.7 ± 0.04 m, BM 62.7 kg ± 6.7) took part in two main trials, a water trial (PLA) and a carbohydrate trial (CHO), each separated by at least 7 days. Each participant was individually assessed to establish both their pre-training hydration status and their fluid consumption during the training session. Participants performed the skill tests (Loughborough Soccer Passing Test) before and after 60 min of soccer-specific training Core temperature, blood lactate and blood glucose were monitored before, every 15 m during and after exercise. Participants were prescribed either water (PLA) or a 6.6% CHO-electrolyte drink (CHO) and consumed 2ml/Kg BM every 15 minutes during the training session

Results

There were no differences in Tc values between trials at any of the measurement stages during and after the training session (See fig. 1). Blood glucose levels were significantly increased in CHO (5.14 ± 2.57 mmol/L) following the completion of soccer-specific training, when compared to PLA (4.51 ± 0.78 mmol/L) (See fig. 2). Blood lactate levels were increased from resting levels at all measurement points in both trials. Percentage dehydration and change in BM loss were greater in the CHO trial ($p<0.05$) (BM loss. PLA: 0.47 ± 0.17 kg, CHO 0.69 ± 0.20 kg. % Dehydration: PLA: 0.75 ± 0.26%, CHO: 1.10 ± 0.30). There was no difference between soccer skill scores in PLA and CHO.

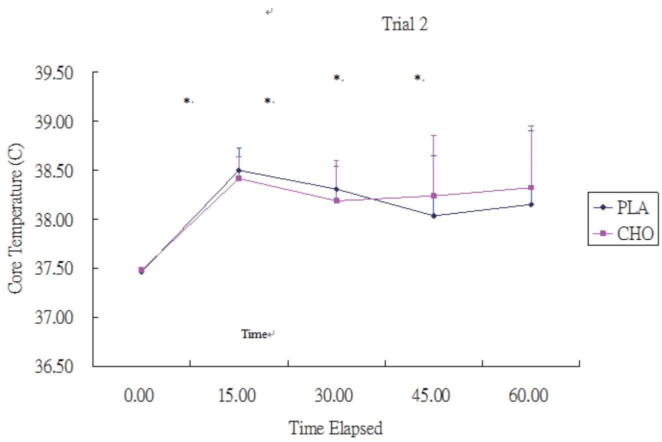

Figure 1. Mean Tc values for all values recorded at specific time points before, during and after exercise
* Significantly increased values from resting value in both PLA & CHO ($p<0.05$).

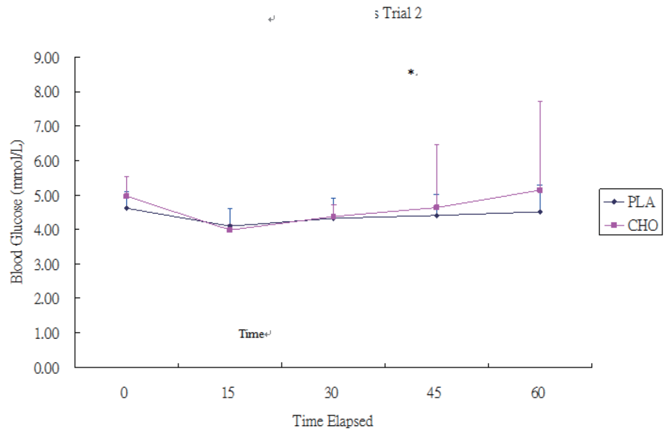

Figure 2 Mean blood glucose values at specific time points before, during and after exercise.
* Significantly increased value in CHO when compared with PLA ($p<0.05$).

Discussion

There was no reduction in soccer passing performance in either the CHO or the PLA trial. This is due to 1)BM loss and percentage dehydration were kept within normal ranges and 2) 60 m of intermittent soccer-specific exercise with and without the ball lead to a maintenance of subsequent soccer skill performance. It was observed that the mean Tc became increased after 15 m and remained high for the duration of the exercise, which is in agreement with a previous study examining soccer match play (Edwards & Clark, 2006). Blood lactate concentrations were significantly higher than resting values in both trials at each time point during exercise which is consistent with previous tests involving measurements relating to soccer skill performance (Ali & Williams, 2009). Post-exercise plasma glucose levels in the CHO trial were significantly higher than resting values, and were also sig-

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nificantly higher than the PLA trial at the 60 m time point, which is in agreement with previous findings examining the LSPT (*Ali et al*., 2009).

Conclusions

60 m of soccer-specific exercise in the heat does not impact core temperature responses to a level where subsequent soccer skill performance is adversely affected and can maintain or slightly increase soccer skill performance when hydration levels are kept <~2% BM loss.

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Reduction of cytosolic caspase-12 proteolytic activity during compression-induced muscle damage

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Introduction

Pressure ulcer (PU), also known as bedsore or decubitus ulcer, is a local defect or excavation of tissue produced by programmed cell death that commonly occurs during disabled patients' rehabilitation processes causing their considerable sufferings and medical expenses[1]. Theoretically, PU may affect any parts of human body as long as those areas have undertaken sufficient prolonged pressure. Indeed, a variety of external conditions including shearing forces, excessive moisture content as well as infections may also contribute to the incidence of PU[2]; but the most common etiological factor of PU is a prolonged pressure exceeding arteriolar filling pressure (32 mm Hg) which may cause partial or total capillary collapse then ischemia leading to the damage of cellular structure and subsequently destruction of all muscular, subcutaneous dermis and epidermis tissues[3].

Responding to cellular damage initiated by ischemia, apoptosis is triggered to destroy and clear away the injured cells avoiding further exacerbation of damage[4]. Unlike necrosis which is regarded as a passive cell destruction process, apoptosis refers to a well developed, operated and monitored cell terminating process[5]. Generally, apoptosis relies on the activities of a 14-member family of cysteine endopeptidases: Caspases, which play as coordinators and executers to catalyze or breaking down a range of cellular substrates through specific proteolytic reactions[6].

At subcellular level, endoplasmic reticulum (ER) stress is induced by a rapid accumulation of unfolded proteins inside endoplasmic reticulum due to certain pathological extracellular conditions like ischemia. These unfolded proteins will form aggregates through hydrophobic interaction resulting in obstruction of ER tube and interruption of normal ER functions[7]. In case ER stress exceeds the threshold level of the cell could tolerate and manage, it will activate the "ER stress mediated Caspase-12 apoptosis (ERS-C12 apoptosis)" by cleavage of cytosolic pro-Caspase-12 to trigger all down-stream apoptotic events such as Caspase-3 activation inside cytoplasma[8].

Research Rationale

It has been demonstrated that prolonged mechanical compression may cause ischemia that can induce programmed cell death to damage muscular tissues during PU development [9,10]. However, whether ERS-C12 apoptosis participates in the muscle destruction process responding to prolonged mechanical compression in PU remains largely unknown. Therefore, the purpose of the present study was to investigate whether the proteolytic activity of cytoplasmic Caspase-12- would increase to initiate apoptosis during the development of PU lesion to destroy muscular tissues.

Materials and methods

Twenty four 6-month-old adult Sprague-Dawley rats were divided into 3 groups based on different experiment intervention settings: 1d3h group (3 hours continuous mechanical compression in one day), 1d6h group (6 hours continuous mechanical compression in one day) and 2d6h group (6 hours continuous mechanical compression per day for two consecutive days). Animals were killed after treatment by overdose narcotics and muscular tissues were collected from legs of each animal.

To bring on compression-induced muscle damage, a mechanical indentor was utilized to deliver a pressure of 13.3 kPa (100 mm Hg) to an area of 1.5 cm2 region over the rat's tibialis region (Fig.1 a & 1 b). Intra-animal control method was applied for all animals: the right tibialis was treated as intervention site for compression induction; while the left tibialis was regarded as control site without any compression for each rat.

To determine the change of myocyte cytoplasmic Caspase-12 proteolytic activity during mechanical compression-induced muscle damage progress, tissue morphological examination and fluorometric Caspase activity assay were performed. For statistical analysis, 3 x 2 factorial ANOVA test and one-way ANOVA test were conducted by SPSS 16.0 software.

Fig.1 a) Compression inducing indentor *b) Mechanical indentor control system*

Results

Tissue histological damages including increasing numerous nuclei and muscle fibers with round contours were observed in the intervention sites of animals in 2d6h group. There was no observable difference in tissue morphology between the intervention sites and corresponding intra-animal control sites tibialis muscle tissues from animals in 1d3h and 1d6h groups (data not shown).

Proteolytic activity of cytoplasmic Caspase-12 in mechanical compression treated myocytes were significantly lower than that in corresponding intra-animal control myocytes in all experimental groups' animals ($p<0.05$).

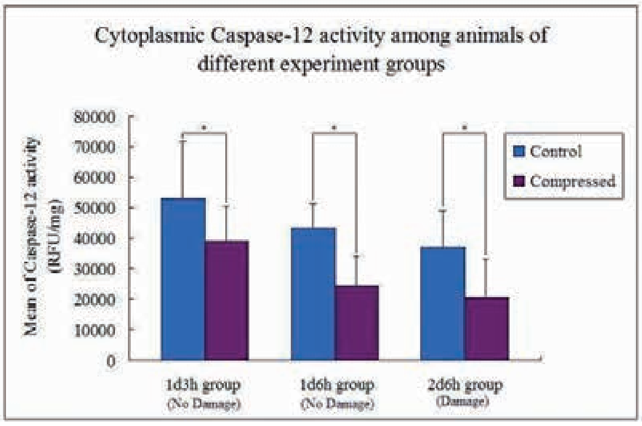

Figure.2 Tibialis myocyte cytoplasmic Caspase-12 proteolytic activity of experimental animals

All data were presented as means ± S.D. of Caspase-12 proteolytic activity in the unit of RFU (Relative Fluorescence Unit) / mg. Caspase-12 proteolytic activity in mechanical compression treated myocytes were equal to 73.6%, 56.5% and 55.5% of that in corresponding intra-animal control myocytes for 1d3h, 1d6h and 2d6h group animals, respectively. "*": statistically significant difference.

Discussion and conclusion

Surprisingly, cytosolic Caspase-12 proteolytic activity varying situations observed in the experiment in rat tibialis myocytes were totally opposite to our expected results based on initial research hypothesis, which was that myocyte cytoplasmic Caspase-12 proteolytic activity would increase to initiate apoptosis during mechanical compression treatment to damage muscle. However, our tissue morphological examination results indeed confirmed that apoptotic programmed cell death was initiated after prolonged mechanical compression treatment. Thus our unexpected finding might suggest a new processing pathway for ERS-C12 apoptosis under prolonged compression treatment condition, which was similar to the one discovered in rat hepatocyte by Dr. K.Haidara (2008)[11]. This novel ERS-C12 apoptosis pathway was described as "Caspase-12 – Caspase-9 nucleus activation cascade" in his work: "Implication of Caspases and subcellular compartments in tert-butylhydroperoxide induced apoptosis" (Fig.3[11]). Initially, pro-Caspase-12 locating on the outer membrane of ER is transformed into its functional category responding to excessive ER stress but its enzymatic activity is still retained by specific cytosolic inhibitor; Afterwards, activated Caspase-12 is translocated into cell nucleus where it exerts its apoptotic function, instead of being released into cytoplasm as expected previously[8]. At last, activated Caspase-12 will recruit pro-Caspase-9 into nucleus where pro-Caspase-9 will be catalyzed into its functional form for subsequent apoptotic events processing. This "Caspase-12 – Caspase-9 nucleus activation cascade" perfectly illustrates our myocyte cytoplasmic Caspase-12 proteolytic activity varying situations observed in the experiment: due to translocation of activated Caspase-12 from its original position in cytosol into nucleus with the aim of executing apoptotic function to induce muscle damage, cytoplasmic Caspase-12 proteolytic activity significantly decreased rather than increase responding to prolonged mechanical compression treatment induced ER stress.

In conclusion, we proved in part that prolonged mechanical compression would motivate pro-Caspase-12 protein to initiate "Caspase-12 – Caspase-9 nucleus activation cascade" to process ERS-C12 apoptosis in PU lesion leading to muscle damage. Moreover, we successfully verified that such a Caspase-12 motivation for apoptosis initiation was prior to muscular tissue histological damages occurrence in PU. Because of the limitations of time and resources, we did not conduct fluorometric Caspase activity assay towards mechanical compression treated rat tibialis myocytes nuclear compartment to verify the existence of significant increment of Caspase-12 proteolytic activity compared to that in untreated control myocytes nuclei. In the future, we will look for more evidences in order to explicitly interpret the intrinsic mechanisms of prolonged mechanical compression induced ERS-C12 apoptosis through PU muscle damage progress, which may closely relate to "Caspase-12 – Caspase-9 nucleus activation cascade".

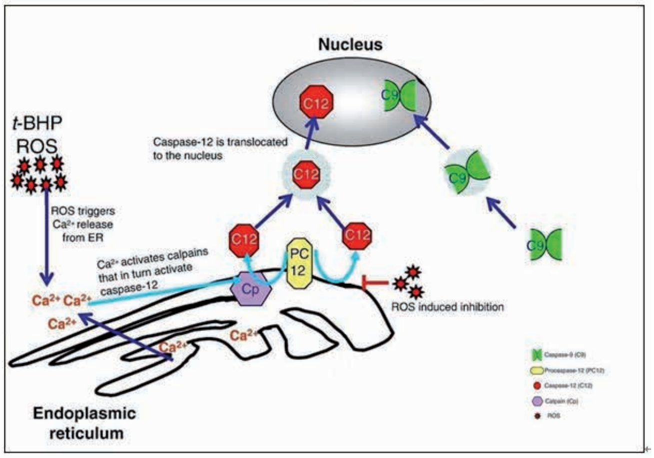

Figure.3 Caspase-12 – Caspase-9 nucleus activation cascade processing pathway[11]

Pro-Caspase 12 in cytosol is activated then translocated into nucleus to initiate apoptosis instead of being released into cytoplasm for direct pro-Caspase-9 motivation.

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Inhibition of apoptosis alleviates muscle damage induced by prolonged compression

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Introduction

Deep pressure ulcer, or deep tissue injury, are common and serious complications of ulcerated tissue breakdown that develops in individuals with diminished pain sensation and/or mobility. It is accepted that muscle tissue is an important site for the initiation of deep pressure ulcer. Prolonged and unrelieved pressure loading is generally regarded as the primary mechanical cause for the breakdown of the underlying muscle tissue. Recently, it has been reported that muscle apoptosis or programmed cell death is activated in pressure-induced tissue injury in vivo. Currently, there are no therapies that have proven effective in alleviating the muscle damage induced by sustained, unrelieved compression. Hence, this study investigated the beneficial effect of pharmacological inhibition of caspase, an essential effector of apoptosis, on muscle breakdown following sustained moderate compression.

Methods

Compression procedure

Adult Sprague-Dawley male rats aged ~2.5 months (bodyweight 260-280g; n=16) were subjected to an in vivo moderate prolonged compression protocol, as previously described (1). By using a mechanical indentor, static pressure of 100 mmHg loading was applied to an area of 1.5 cm2 in the tibialis region of the right limb of the rats for six hours each day for two consecutive days. The loading force was applied by using a controlled, motorized mechanical indentor in which the compression force was continuously monitored by a 3-axial force transducer in the load indentor. A laser Doppler flowmetry with a contact probe was used to monitor the blood flow of the loading site as previously described (Figure 1) (2). The left unloaded limb served as intra-animal control.

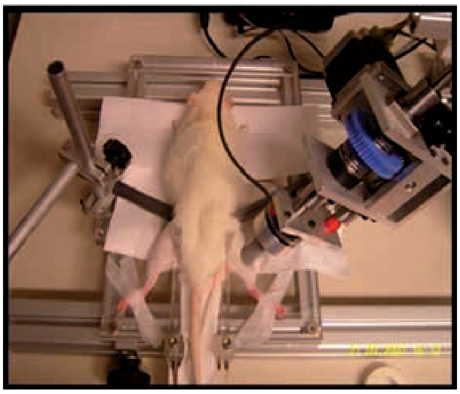

Figure 1. Load indentor for pressure ulcer induction on the right limb of rat

In vivo treatment

Treatments were administered intravenously, via the tail vein, after anesthesia and prior to every compression session. All 16 rats were randomized to receive either vehicle control (DMSO) or caspase inhibitor z-VAD-fmk (Z-Val-Ala-Asp(OMe)-fluoromethylketone) that was dissolved in dimethyl sulfoxide (DMSO) (cumulative dose of 6 mg/kg).

Rats from each of the experimental groups were sacrificed 24 hours after the last session of compression. Tissues underneath the compressed region were harvested for histological analysis, terminal deoxynucleotidyl transferase-mediated dUTP nick-end labelling (TUNEL), cell death and caspase-3 enzymatic activity.

One Way ANOVA with Tukey post hoc test was used to examine the differences between all groups. Statistical significance was accepted at $P<0.05$.

Results and discussion

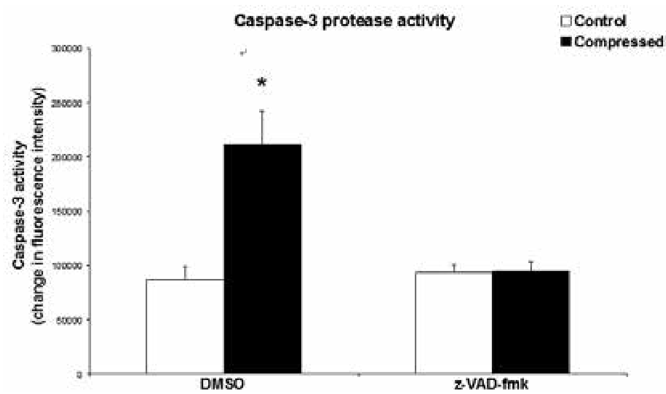

Figure 2. Caspase-3 protease activity was presented as the change in fluorescence intensity normalized to the total protein (mg) after two hours.
*Caspase-3 activity was found to be elevated by ~1.5-fold in the compressed muscle in DMSO group compared to the control (*P<0.05). However, the enzymatic activities of caspase-3 was not found to be different in compressed muscle relative to the control in z-VAD-fmk treatment group (P>0.05).*

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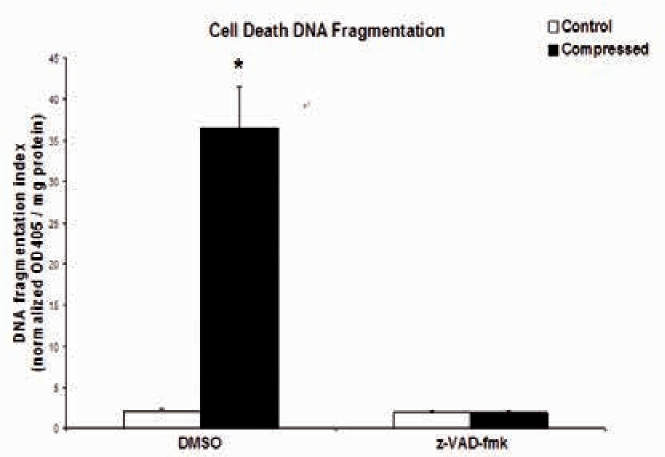

Figure 3. The extent of apoptotic DNA fragmentation investigated using a cell death ELISA was estimated by measuring the cytosolic mono- and oligonucleosomes.

There was a ~16.5-fold increase in the extent of apoptotic DNA fragmentation in the compressed muscle relative to the control uncompressed muscle in DMSO group (*P<0.05), whereas no significant difference was found in either the control or compressed muscle in the treatment (z-VAD-fmk) group (P>0.05). This implies that apoptotic cell death was successfully prevented in treated animals.

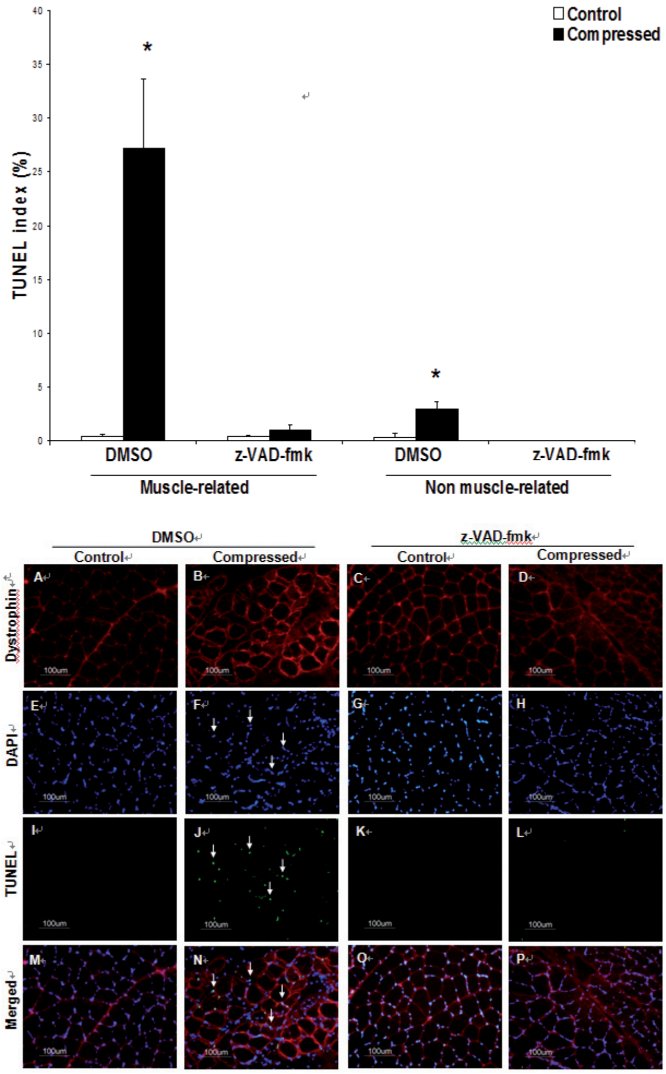

Figure 4. Apoptotic nuclear DNA breaks in muscle tissue were measured using TUNEL staining (A-P) (indicated by arrows) and were expressed as TUNEL index (Q).

Immunofluorescence labeling of dystrophin (A-D) was performed to identify the localization of the TUNEL-positive nuclei (I-L) with regard to the muscle sarcolemmal membrane. Total nuclei were labelled by 4',6-diamidino-2-phenylindole (DAPI) staining (E-H). The number of TUNEL-positive nuclei relative to the total number of nuclei was quantified as TUNEL index (Q). TUNEL/dystrophin staining analysis indicated that there was ~59-fold increase of TUNEL-positive apoptotic muscle-related nuclei (i.e. under or on dystrophin staining) in compressed muscle tissue relative to the control in DMSO group (*P<0.05). We also found ~6.8-fold increase of TUNEL-positive apoptotic non muscle-related nuclei (i.e. lie outside of dystrophin) in compressed muscle in DMSO group (*P<0.05). However, the muscle- and non muscle-related TUNEL indices were not found to be significantly different in z-VAD-fmk group (P>0.05).

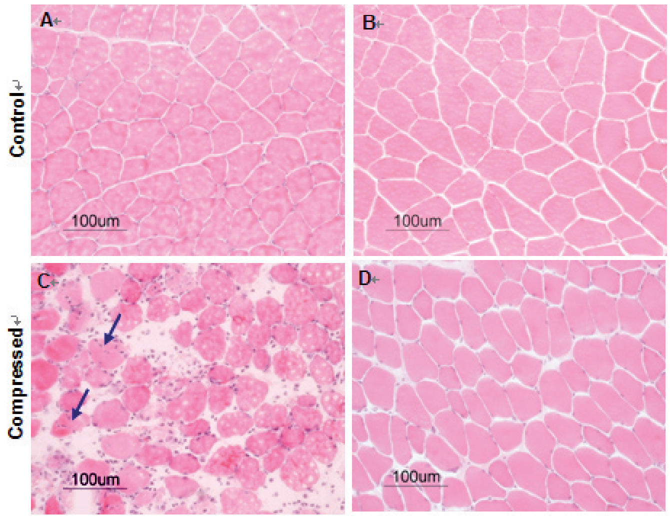

Figure 5. Morphology of muscle cells by hematoxylin and eosin staining.

Compressed muscle tissue of DMSO group (C) demonstrated the morphological characteristics of degeneration including rounded myofibers, accumulated number of nuclei in the interstitial space and presence of infiltrated myonuclei (indicated by arrows). On the other hand, the degenerative characteristics were alleviated in treated compressed muscle (D). Control tissue is shown on the upper panels (A and B).

Conclusion

Our results provide evidence that caspase inhibition attenuates the compression-induced muscle apoptosis. This finding supports the idea that pharmacological caspase inhibition may be beneficial in alleviating muscle damage as induced by prolonged compression by modulating the corresponding apoptotic signaling. Also, our study can facilitate future research into drug or intervention development targeting apoptosis in compression induced muscle disorders.

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Adaptations of circulatory antioxidant defense system from prolonged voluntary exercise training

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Introduction

The health benefits of regular physical activity have been well-documented. It has been postulated that the oxidative stress induced by exercise stimulates the adaptation of antioxidant system and this in turn helps prevent against age-related diseases including cardiovascular diseases, Alzheimer's disease and certain cancers (2). However, the exact antioxidant defense response to exercise-induced oxidative stress or DNA damage has remained unclear. The present investigation, therefore, aimed to characterize the response of plasma antioxidant ascorbic acid in rats in relation to other antioxidant biomarkers and DNA repairing enzymes in skeletal and heart muscles, red blood cells or lymphocytes following 8 and 20-week of voluntary exercise training.

Methods

Forty ad libitum fed 2-month old Sprague Dawley rats were randomly assigned to two groups: physically active (EX) or sedentary control (CON). The physically active (EX) rats were individually housed in their cage where a running wheel with magnetic digital counter was used to record their daily running distance. The sedentary control (CON) rats were housed in their own cages without running wheel. After 8 weeks or 20 weeks of experimental period, the rats were sacrificed 24 hours after the last session of exercise. Their left ventricle, soleus and plantaris muscle, and blood were collected for antioxidant enzyme activity assay. Total RNA was extracted from lymphocytes and was resverse-transcribed to cDNA for real-time PCR to assess the gene expression of antioxidant (AOX) enzymes and DNA repairing enzymes. The level of DNA damage following the exposure to hydrogen peroxide in lymphocytes was detected by comet assay. The total antioxidant capacity and plasma ascorbic acid were measured using Ferric Reducing Antioxidant Power (FRAP) and Ferric Reducing Ascorbic Acid Concentration (FRASC).

Results

Gene Expression of AOX enzymes and DNA repairing enzyme in lymphocytes

The mRNA expression of antioxidant enzyme SOD2, catalase (Figure 1A and B) and certain DNA repairing enzymes APEX, Prkdc, Mgmt (Figure 2A, B, C) in the 20-week EX rats was significantly upregulated. Other antioxidant enzymes SOD1, SOD3 and GPx as well as DNA repairing enzymes PCNA, PARP1, Ogg1, Mutyh, Rad23A, Slk, Brca2, Mre11A, Xrcc4 were not found to be significantly different. 8-week EX rats did not have any significant change in antioxidant enzymes gene expression, except for a 9-fold increase in SOD2 compared to the CON rats (Figure 1A). None of the DNA repairing enzymes mRNA expression was found to be significantly different between 8-week CON and EX rat.

DNA Damage in lymphocytes

Figure 3A and B shows a significant reduction of DNA % in comet tail (-21%, -45%) respectively in the 8-week and 20-week EX rats compared to their corresponding CON rats.

Antioxidant Enzyme Activities, Plasma Total Antioxidant Capacity and Ascorbic Acid

8-week EX rats were found to have 39% higher activity of red blood cell SOD (Figure 4A). 20-week EX rats was found to have 5-fold and 3-fold increased GPx activity of ventricle and plantaris respectively (Figure 4B, C). Although there was no significant increase in total antioxidant capacity between the EX rats and the CON rats, 8-week EX rats were found to have a significant increase (+46%) of plasma ascorbic acid (Figure 5). Similarly, 20-week EX rats were found to have a significant increase (+34%) of plasma ascorbic acid (Figure 5).

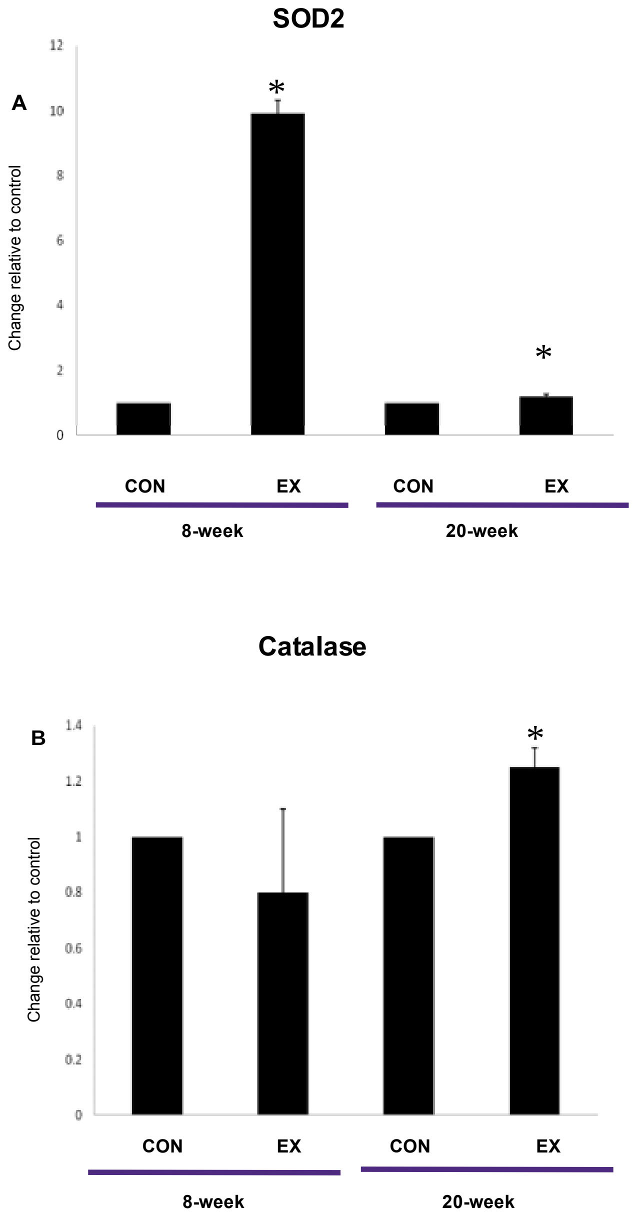

*Figure 1. Effect of exercise training on SOD2 and catalase mRNA expression. Value represents means ± SE. *P<0.05 vs. corresponding control.*

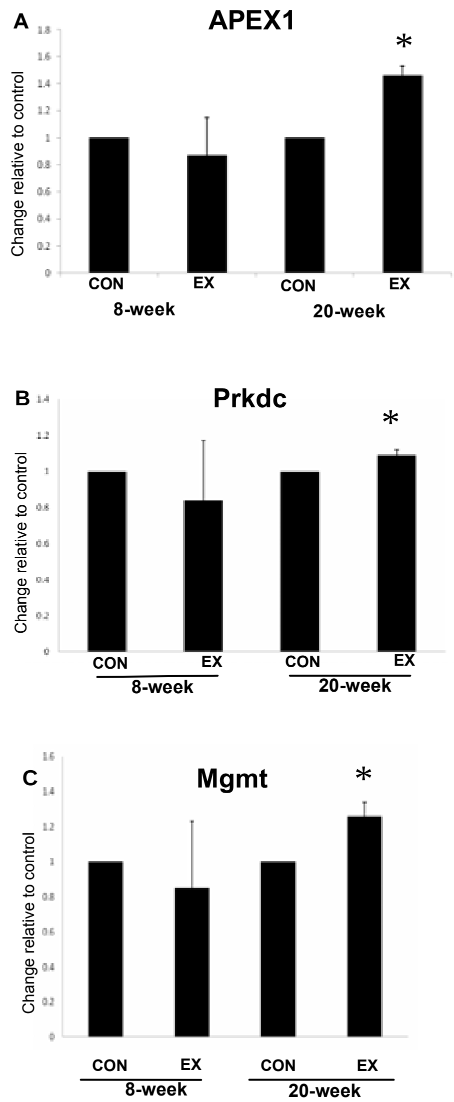

*Figure 2. Effect of exercise training on APEX, Prkdc and Mgmt mRNA expression. Value represents means ± SE. *P<0.05 vs. corresponding control.*

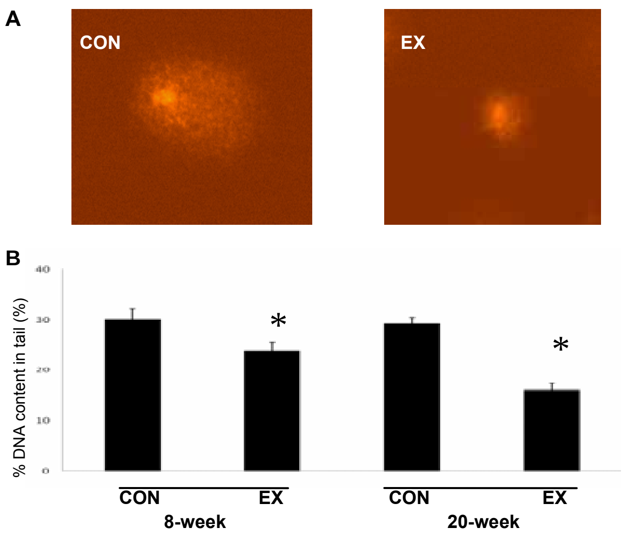

*Figure 3. Effect of exercise training on DNA damage. Value represents means ± SE. *P<0.05 vs. corresponding control.*

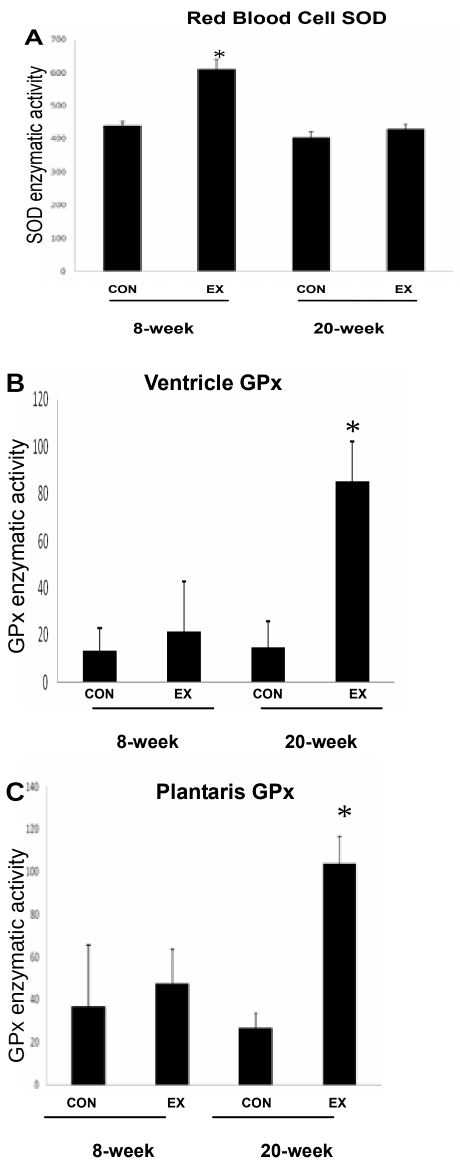

*Figure 4. Effect of exercise training on SOD and Gpx activities. Value represents means ± SE. *P<0.05 vs. corresponding control*

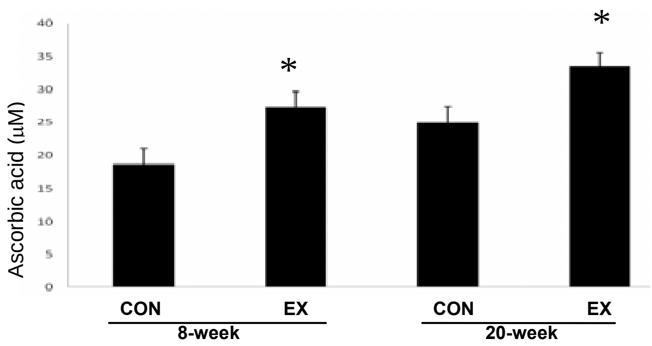

*Figure 5. Effect of exercise training on plasma ascorbic acid. Value represents means ± SE. *P<0.05 vs. corresponding control.*

Discussion and conclusion

In line with the hormesis theory in biology and medicine, our data indicate that the endogenous repair and antioxidant system in 20-week EX rats responded defensively to DNA damage or perhaps oxidative stress by inducing the mRNA expression of antioxidant enzyme SOD2, catalase and DNA repair enzymes (APEX, Prkdc, Mgmt) in lymphocytes. As shown by our comet assay result in 20-week EX rats, the DNA damage in lymphocytes was attenuated by 45% relative to the CON rats. It is possible that neutrophils were activated in response to exercise and generated a favourable level of oxidants that in turn induces beneficial adaptation (1,2). The exercised-induced oxidative stress in mitochondria may also partly account for the increased enzyme activity of GPx in ventricle and plantaris muscle in 20-week EX rats (1). However, our data indicates no induction of DNA repair system, but a 9-fold increase in the lymphocytic SOD2 mRNA expression of 8-week EX rats, suggesting a different, and perhaps weaker defense mechanism (-21%) against DNA damage compared to 20-week EX rats. In fact, the 8-week EX rats were found to have 39% more SOD activity in their red blood cells compared to CON rats. Hence, it is reasonable to believe that a longer duration of physical activity (20 weeks vs. 8 weeks) will not lead to additional oxidative damage in young individual and is likely to be more beneficial due to its ability to further induce the adaptation of DNA repair enzyme system (2). Although there was no significant difference between the total antioxidant capacity in 20-week EX rats and CON rats, it is possible that 20-week EX rats synthesized more plasma ascorbic acid to counteract DNA damage or oxidative stress. This increase in plasma ascorbic acid was consistent with our observation in EX rats after 8 weeks of voluntary exercise training, suggesting that an exogenous source of ascorbic acid may be essential to alleviate the DNA damage or oxidative stress in physically active individual. However, further investigation should also address the relationship between plasma ascorbic acid and oxidative markers before drawing any conclusion on its potential physiological benefits.

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A study on muscle fatigue in patients after ACL reconstruction more than 1 year in involved leg and non-involved leg

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Introduction

People who are suffered from Anterior Curciate Ligament (ACL) injury may need to undergo ACL reconstruction followed by a period of post-operative rehabilitation of around 6 months before they could return to sports activities[1]. However, some studies showed a significant deficit in quadriceps muscle strength 6 months after surgery. Muscle activities and muscle fatigue of quadriceps and hamstring were investigated by the surface EMG in several studies [2-4]. However, these studies only include subject after ACL reconstruction from 3 weeks to 6 months. The long term effect of muscle fatigue was not been investigated. The aim of this study is to compare the muscle activities and muscle fatigue on the involved leg and non-involved leg of subjects after ACL reconstruction more than 1 year by the method of surface Electromyogram (EMG).

Methods

20 subjects were recruited from the ACL reconstruction patient list in Prince of Wales Hospital. The inclusion criteria are male subject, age under 40 year-old, post ACL reconstruction for more than 1 year, and has already return to sports activities. The exclusion criteria included bilateral ACL reconstruction, subject using bone-patellar- tendon bone method in ACL reconstruction, patients with recent knee injury in past 3 months, subject with history of surgery or traumatic injury to the contralateral knee, revision of ACL reconstruction, osteoarthritis knee, and subjects with limited range of motion. The age, height, weight and BMI (body mass index) information are shown in Table 1. One week before testing, all subjects were received a telephone invitation, each subject participated in one testing session. Subjects were instructed to refrain from any strenuous exercise 2 days before the testing day. A warm up exercise of 10 minutes treadmill walking will be performed to avoid muscle cramping during the test.

Table 1. Characteristics of the subjects.

(n=20)	Min	Max	Mean	SD
Age	20.00	39.00	28.55	5.35
weight (kg)	55.00	95.00	71.68	10.01
height (cm)	165.00	184.00	173.15	5.47
BMI[a]	19.90	31.70	23.85	2.86
Length of Operation (year)	1.00	3.00	1.35	0.59

[a]BMI body mass index

Peak Torque Capturing

Cybex HUMAC NORM Testing and Rehabilitation System, was used to provide a consistent measurement of peak torque and work for knee extension. The speeds of the movement test was set at 180 deg/sec,[5] subjects are required to repetitively generate a maximum force in knee extension and flexion in full range of motion for 50 times on each of their legs. Subjects were seated on the chair of Cybex HUMAC NORM system and were secured with straps over the chest, thigh and leg. For each joint movement, the same investigator would make all adjustment over the alignment of testing limb on the system. Subjects were instructed and encouraged to perform maximal effort on both knee extension and flexion throughout the full range of motion. An instant feedback was displayed on the computer screen. After assessing one limb, a 5 minutes rest was given before assessing another limb.

EMG Capturing

Three pairs of self-adhesive surface EMG electrodes (Noraxon Dual #272, US) were attached on each subject's thigh, including vastus medialis, vastus lateralis and rectus femoris. The electrodes were fixed longitudinally over the selected muscle belly. The largest area of muscle belly was identified using an isometric manual muscle resistance test; ground electrode was positioned on the medial plateau of tibia. To reduce skin impedance, the skin was rubbed with alcohol prep pad and hair on skin was shaved before the electrodes were attached. A flexible 2D goniometer was positioned over the knee joint to monitor the knee joint angle. All EMG signals generated from the muscle and knee angle signal generated from the goniometer were recorded simultaneously from a EMG unit (Noraxon, Telemyo 2400T G2, US) with sampling frequency of 1000Hz to an online notebook equipped with MyoResearch XP Master Edition software during the test. All data were collected for future analysis by using self-compiled programs written in MATLAB (The Mathworks, Inc, Natick, MA).

Data Analysis

Statistical analysis was performed using Statistical Package for Social Science (SPSS 16.0 Inc., Chicago, IL). Two-way ANOVA and Turkey post hoc tests was used to evaluate the differences between the peak torque in involved and non-involved leg in different point of repetition and also to evaluate the differences between the percentage change of normalized MPF in involved and non-involved leg in different point of repetition. All statistical tests were performed at the 5% significance level ($p<0.05$, two tailed). We choose 6 points orderly within the 50 repetitions for analysis; they are the 1st, 11th, 21st, 31st, 41st and 50th repetition, because we tend to investigate the trend of the data.

Peak Torque

Peak torque was obtained for every ten contraction and all the data were collected in the Cybex HUMAC NORM system. To compare data across groups, peak torque of selected period were exported for statistical analysis.

Mean Power Frequency

All EMG raw data will be processed firstly by rectification followed by a band pass filter with frequency of 20 to 500 Hz. Fast Fourier Transformation was used to calculate the mean power frequency (MPF) of the EMG power spectrum by using the formula as below.

$$\sum(f \cdot p)/\sum p$$

f: frequency of EMG spectrum
p: magnitude of EMG spectrum

Results

Extension peak torque of Cybex test

The mean peak torque of quadriceps in the involved leg and non-involved leg was shown in Fig.2; there was an increase in both involved leg and non involved leg in the first ten repetitions, after reaching the maximum, both curves fall gradually. The percentage change in peak torque in involved leg and non- involved leg were 54.22% and 45.53% respectively. However, there is no significant difference detected between the peak torque in involved leg and non-involved leg (p=0.513) (Table 2).

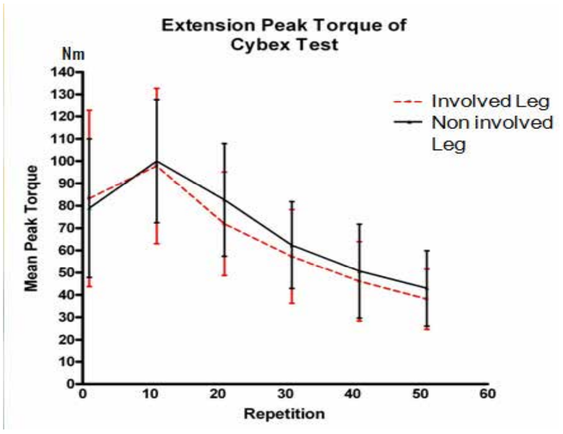

Figure 2. The Mean Extension Peak Torque in both involved and non-involved leg at different point of repetition in Cybex test

Normalized Mean Power Frequency

All three groups of muscle showed a decrease in percentage of normalized mean power frequency. Generally, the normalized MPF of non-involved leg were lower than that of involved leg. However, the normalized MPF is significantly lower in the involved leg of the Rectus Femoris (p = 0.005) only. No significant differences were detected in Vastus Medialis (p= 0.363) and Vastus Lateralis (p=0.628).

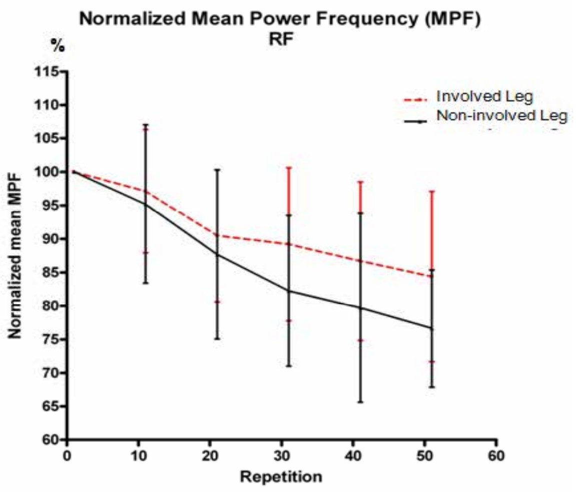

Figure 3. The normalized mean power frequency of Rectus Femoris at different point of repetition.

Discussion

The peak torque in involved leg is lower than non-involved leg, but without statistical significant difference (p=0.268). It indicates that the quadriceps strength in involved leg and non-involved leg are nearly identical one year after ACL reconstruction. It is different from other studies investigated patients who are 6 months after reconstruction, they showed a quadriceps strength deficit in their patients and they considered that it was due to general muscle disuse4. However, the failure to detect difference in this study may due to better trained quadriceps 1 year post operation, or may be related to the small sample.

As a shift of mean power frequency from higher frequency to lower frequency indicates muscle fatigue and we found that the normalized mean power frequency of the non-involved leg is lower than that of that of involved leg within Rectus Femoris, Vastus Medialis and Vastus Lateralias. However, only Rectus Femoris showed a significant difference (p=0.005) in normalized MPF between involved leg and non-involved leg.

Table 2. Two-way ANOVA analysis of Cyber test and normalized MPF of RF, VM and VL

	Cybex		MPF_RF		MPF_VM		MPF_VL	
	F	Sig	F	Sig	F	Sig	F	Sig
Time	20.621	0.000++	15.836	0.000++	6.525	0.000++	14.869	0.000++
Leg	0.430	0.513	7.940	0.005+	0.830	0.363	0.236	0.628
Time*Leg	0.502	0.774	0.717	0.611	0.297	0.914	0.256	0.936

TABLE 2 Two-way ANOVA analysis of Cybex test and noemalized MPF of RF, VM and VL

++ p<0.001

The percentage decrease in normalized MPF in involved leg (15.63%) is less than that of non-involved leg (23.36%). This indicated that the involved leg is more fatigue resistance than non-involved leg6. This result is consistent to a study showing the fatigability of human quadriceps four week after ACL reconstruction, they found that the involved leg were more fatigue resistance than the non-involved leg, however, it is not an EMG study.

POSTER PRESENTATION

Surprisingly, the normalized MPF in involved leg in this study is higher than that of the non-involved leg, which is a different finding from other EMG studies on shift in muscle power spectrum on involved and non-involved leg after ACL reconstruction. In 2006, Bryant et al 4 conducted a study on 13 subjects who underwent ACL reconstruction for 6-9 months, the muscle strength and quadriceps activities were investigated. The result showed that the median frequency of EMG signals in the involved leg was significantly lower than the non-involved leg.

As there are no difference between normalized MPF in VM and VL, and only higher normalized MPF in RF of involved leg was found; this showed that there is no difference in muscle fatigue in VM and VL. The RF in involved leg is more fatigue resistance than that of non-involved leg.

Conclusion

From this study, it showed that RF in involved leg is more fatigue resistance than non-involved leg, however, no difference were found in peak torque and muscle fatigue of VM and VL in both leg. This indicates that the subject with ACL reconstruction are fully recovered and maintained 1 year after ACL reconstruction. This may attribute to the success of ACL surgery and the follow-up rehabilitation program.

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Investigating the use of analogy in speech motor learning

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Introduction

Human speech relies on motor control of mouth and tongue movements to regulate speech production (e.g., Kent, 2000). Speech therapists apply explicit principles of motor learning and control to the treatment of speech disorders (e.g., Steinhauer & Grayhack, 2000). Recent advances in motor learning suggest that changes in motor control are more effective if the client is unaware of the learning or relearning process (see implicit motor learning - Masters, 1992; Masters & Maxwell, 2004). The approach has not been tested in speech production. The purpose of this study was to test an implicit motor learning paradigm, analogy learning, that has potential use in clinical speech therapy settings. Analogy learning uses simple heuristics or metaphors, familiar to the (re)learner, to present information implicitly (unconscious) rather than explicitly (conscious). The (re)learner typically is able to approximate the correct motor control parameters but has minimal access to explicit verbal information or rules about the movement (see Liao & Masters, 2001; Masters, 2000; Poolton, Masters, & Maxwell, 2007).

Using focus group methodology (Kreuger & Casey, 2000), we asked professional speech therapists to identify analogies that best described minimal pitch variation (monotone) and moderate pitch variation in speech. The focus groups established that an appropriate pitch variation metaphor may be related to imagery of 'waves at sea', with minimal pitch variation represented by a flat calm sea and moderate pitch variation represented by a mild sea. To ascertain the potential efficacy of the analogy instructions for speech rehabilitation, we examined acoustic correlates of intonation or pitch variation by calculating standard deviation of fundamental frequency (SDF_0) during speech in participants who received the analogy instructions or matched explicit instructions.

Methods

Thirty-eight participants (mean age 20.38, SD 1.92; 18 males, 20 females) with no known speech impairments were asked to read aloud a standard Cantonese paragraph using their normal (everyday) pitch variation (control condition). They were then allocated randomly to an analogy or an explicit instruction group and were asked to read aloud different paragraphs (presentation of minimal pitch variation and moderate pitch variation instructions was counterbalanced).

Results

Mean SDF_0 in the analogy and explicit conditions for control, minimal and moderate pitch variation are presented in Figure 1. Group x Block (2 x 3) analysis of variance with repeated measures revealed a Block effect ($F(2, 72) = 34.27$, $p = 0.001$, $\eta^2 = 0.49$) but no Group effect ($F(1, 36) = 1.95$, $p = 0.17$, $\eta^2 = 0.51$). However, a significant interaction ($F(2, 72) = 3.21$, $p < 0.05$, $\eta^2 = 0.82$) was present. Further analysis showed that mean SDF_0 in the minimal pitch variation condition was lower than in the control and moderate pitch variation conditions ($p < 0.05$), which were not different ($p > 0.05$). In the minimal pitch variation condition, the analogy instruction was more effective than the explicit instruction condition ($p < 0.05$).

Further analysis of participants in each group who showed excessive pitch variation (> 0.5 SD above the mean SDF_0) revealed that the analogy instruction was 26.34% more effective than the explicit instruction ($p < 0.05$).

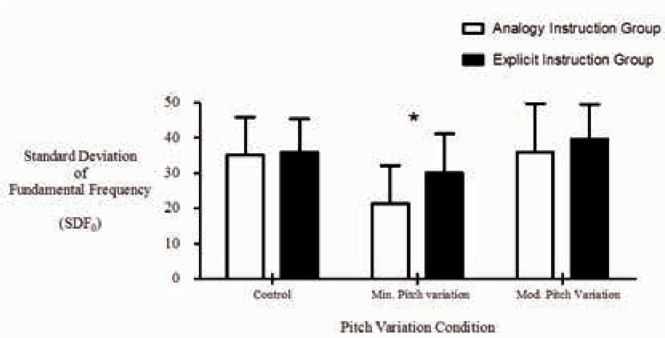

Figure1. SDF_0 for the Analogy Instruction group and the Explicit Instruction Group during control, minimal pitch variation and moderate pitch variation conditions.

Conclusion

Analogy instructions may be a useful tool in speech rehabilitation, especially in clinical populations that exhibit excessive pitch variation, such as some individuals with cerebral palsy.

Acknowledgement

The research was supported by the Sciences of Learning Strategic Research Theme of the University of Hong Kong.

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Reliability of PD pedometer in measuring walking and jogging movements in six different body sites

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Introduction

Pedometers have been widely used as a convenient and inexpensive tool for objective physical activity assessment. Perception Digital (PD) pedometer is a new motion sensor which can measure and distinguish walking and jogging movement using accelerometry technology. One characteristic of PD pedometers is walking and jogging movement can be measured at any sites of the body that at and above the waist level, however, reliability of the PD pedometers has not been established. Therefore, the purpose of this study was to determine the inter-device reliability among PD pedometers of the same model that were worn at different positions on the body during walking and jogging exercises.

Methods

A total of 30 male participants aged 19 to 35 years volunteered to participant in this study. All participants were screened with the physical activity readiness questionnaire (PAR-Q) and signed informed consent forms.

The pedometers of the same model were worn at six different locations of the body. Four pedometers were placed on the hip, including anterior mid-line of the right thigh (AR) and posterior mid-line of the right thigh (PR), anterior mid-line of the left thigh (AL) and posterior mid-line of the left thigh (PL). In additional to the four waist-mounted sites, a pedometer was worn at right mid-arm (anterior biceps) by a belt (RA) and another pedometer was hanging inferior the chin near sternum head by a short string round the participant's neck (AN). The participants then took part in a 1600m walking and a 1600m jogging around a 400-m outdoor track, respectively. Total steps and distance during walking and jogging were recorded.

Reliability (Cronbach's α) coefficient was used to assess the inter-device reliability among pedometers of the same model that were worn at different locations of the body.

Repeated-measures analysis of variance (RM-ANOVA) was performed to compare mean differences in steps and distances of the six pedometers. Statistical significance was set at $p < 0.05$. Bonferroni procedure was followed when significant RM-ANOVA was found.

Results

Table 1 illustrated that the mean walking and jogging steps and distances were almost identical with each other, except trivial difference was found for RA (-0.9%-1% for walking and -3%-4.7% for jogging) when compared with the mean of other sites. No significant difference was found in all variables among the six pedometers. Table 2 shows the inter-device reliability was exceptionally high, with the step measures all higher than r=.99, and distance measures higher than r=.95.

Table 1. Mean, SD and RM-ANOVA Tests of the Walking and Jogging Steps and Distances of the Six PD Pedometers.

	AR	PR	AL	PL	RA	AN	p
Walking steps (steps)	2006±144	2006±146	2006±144	2007±14	1988±160	2006±144	.12
Jogging steps (steps)	1575±214	1574±207	1584±204	1557±214	1530±206	1600±195	.41
Walking distance (km)	1649±55	1649±52	1648±54	1649±53	1631±82	1644±61	.68
Jogging distance (km)	1728±290	1743±271	1757±276	1736±276	1659±205	1728±299	.57

Table 2. Inter-device Reliability Among the Six PD Pedometers

	Walking steps	Jogging steps	Walking distance	Jogging distance
Cronbach's α	0.99	0.99	0.95	0.98

Discussion and Conclusion

The PD pedometer demonstrated excellent inter-device reliability at various mounting positions during walking and jogging conditions which is comparable to several other major pedometers, including Omron, Kenz Liferecorder, New lifestyle and Yamax (all r higher than .99), and better than other models such as the Freestyle, Oregon Scientific, Sportline, Walk4Life, and Yamasa Skeletone pedometers (Schneider, Crouter, Lukajic, & Bassett, 2003). In order to obtain reliable measurements of walking and jogging steps and distances, for research and exercise promotion, PD Pedometer can be one of the best choices.

Acknowledgement

This study was supported by Perception Digital Ltd, HK.

Reference

Schneider, P. L., Crouter, S. E., Lukajic, O., & Bassett, D. R., Jr. (2003). Accuracy and reliability of 10 pedometers for measuring steps over a 400-m walk. Medicine and Science in Sports and Exer

Using Kinesio Tape® to control pain during functional movement in elite soccer with medial collateral ligament injury

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Study design
Cross-over study

Objectives
To determine the short-term functional efficacy of Kinesio Tape when applied to soccer players with medial collateral ligament injury, as compared to a rigid tape application.

Background
Tape and bandaging are commonly used as an adjunct for treatment and prevention of musculoskeletal injuries. So far most of the literature was focused on rigid tape applications. Despite the Kinesio taping method has gained significant popularity in recent years, there is a lack of evidence on its use and performance.

Methods and measures
Six subjects clinically diagnosed with grade I or II MCL injury were treated by Kinesio Tape and Rigid Tape respectively in two visits. Subjects wore the tape and performed a series of functional tasks. Self-reported pain and Confidence level and Functional Level (Functional Scoring of Test for injured Athlete's Knee) were measured to assess for differences between groups.

Results
Both the Kinesio Tape group and the Rigid Tape group showed immediate improvement in pain control when performing running and hopping. However, the result with confidence level and functional score are not statically significant and consistent.

Conclusion
Kinesio Taping may be able to contribute to clinicians in controlling pain movement immediately after tape application for patients with mild to moderate Medial Collateral Ligament injury in some of the running and jumping activities. Kinesio Tape may also achieve similar outcome as Rigid Tape for the condition. However, it is only supported by an observable trend.

Time	Program
0815-0845	**REGISTRATION**
	Symposium 1: Sports medicine Moderator: Prof. Stanley HUI / Dr. Gary MAK
0845-0900	**Excessive tibial rotation is restored after anatomical double bundle anteror cruciate ligament reconstruction** Mak-Ham LAM (O&T, CUHK)
0900-0915	**The use of NSAID is associated with self-reported running performance in recreational marathon runners** Xiao-Meng PEI (HTI, PolyU)
0915-0930	**The clinical and functional outcome of combined anterior cruciate ligament and posterior cruciate ligament reconstruction** Elaine King-Sean LIU (SMHS, CUHK)
0930-0945	**Three-year prospective injury surveillance study of Hong Kong elite able-bodied and disabled foil fencers** Wai-Man CHUNG (RS, PolyU)
0945-1000	**The difference in radiological lower limb alignment between ACL-intact and ACL-deficiency knees in the Chinese population** Stephen Chor-Yat CHUNG (SMHS, CUHK)
1000-1030	**OPENING CEREMONY**
1030-1100	**Keynote lecture 1: New directions in sports nutrition** Speaker: Prof. Ron MAUGHAN (Loughborough University) Moderator: Prof. Stephen H. WONG
1100-1130	**TEA BREAK & POSTER PRESENTATION 1**
	Symposium 2: Biomechanics Moderator: Dr. Daniel FONG / Mr. Mak-Ham LAM
1130-1145	**The biomechanics of Jun Fan Jeet Kune Do-the straight lead** Ching-Po FONG (SMHS, CUHK)
1145-1200	**The relationship between Taekwondo training duration and lower limb muscle strength in adolescents** Yuk-Kwan CHENG (RS, PolyU)
1200-1215	**Functional ability between different categories of wheel chair fencer** Ying-Ki FUNG (O&T, CUHK)
1215-1230	**The effect of Taekwondo training on lower limb muscle strength, joint sense and balance in adolescents** Shirley Siu-Ming FONG (RS, PolyU)
1230-1245	**A model-based image-matching motion analysis technique for measuring ankle kinematics from video sequences of sports events** Aaron See-Long HUNG (BME, CUHK)
1245-1300	**Biomechanical analysis of ankle supination sprain injury in sports** Kam-Ming MOK (O&T, CUHK)
1300-1400	**Lunch symposium:Tips for PhD students and post-docs aiming for a successful academic career** Speaker: Prof. Stephen H. WONG / Dr. Parco M. SIU

Time	Program
1400-1430	**Keynote lecture 2: Helping the players: assessing sweat losses in football** Speaker: Dr. Susan SHERIFF (Loughborough University) Moderator: Prof. Stephen H. WONG
	Symposium 3: Exercise science Moderator: Dr. Peggy CHEUNG / Ms. Karly CHAN
1430-1445	**Factors influencing pre-service teachers' perception of teaching games for understanding: a constructivist perspective** Carrie Li-Juan WANG (SPE, CUHK)
1445-1500	**Process-oriented evaluation of fundamental movement skills in children with cerebral palsy** Catherine M. CAPIO (IHP, HKU)
1500-1515	**Effect of glycemic index and fructose content in breakfasts on substrate utilization during subsequent brisk walking** Feng-Hua SUN (SPE, CUHK)
1515-1530	**Serve performance in rested and physical exertion conditions in physical education route and sport-specified route tennis players** Sam Ka-Lam SAM (HPE, HKIEd)
1530-1545	**Physiological profiles of elite senior, elite, sub-elite and novice junior Hong Kong windsurfers** Cynthia Ka-Kay LO (SPE, CUHK)
1545-1615	**TEA BREAK & POSTER PRESENTATION 2**
	Symposium 4: Physical activity and health Moderator: Dr. Cindy SIT / Dr. Jonathan WAI
1615-1630	**Association between Chinese parents' perceptions of their children's weights and parenting behaviors** Xu WEN (SPE, CUHK)
1630-1645	**Pedometer reactivity and rehearsal in children** Fiona CM LING (IHP, HKU)
1645-1700	**The efficacy of the internet in physical activity promotion for university students** Elean Fung-Lin LEUNG (SPE, CUHK)
1700-1715	**Evaluation of web-based VS web-based plus email reminder physical activity intervention in Hong Kong Chinese adolescents** Erica Yuen-Yan LAU (PE, HKBU)
1715-1730	**Effect of a school-based adapted physical activity program for children with physical disability after the 2008 Sichuan earthquake** Pui-Man PAK (SMHS, CUHK)
1730-1745	**Association between family characteristics and children's TV viewing** Amy Chi-Ming KWONG (SPE, CUHK)
1745-1800	**CLOSING**

CUHK: O&T, Orthopaedics and Traumatology; SMHS, Sports Medicine and Health Science; SPE, Sports Science and Physical Education; BME, Biomedical Engineering
HKU: IHP, Institute of Human Performance
PolyU: RS, Rehabilitation Sciences; HTI, Health Technology and Informatics
HKBU: PE, Physical Education
HKIEd: HPE, Health and Physical Education

No.	Poster Presentation
1	**The difference of physical ability between youth soccer player and professional soccer player: a training implication** Hardaway Chun-Kwan CHAN (SMHS, CUHK)
2	**A comparison of static and dynamic balance between elderly dancers and non-dancers** Katie Ka-Po CHAN (SMHS, CUHK)
3	**Clinical and biomechanical outcome following surgery for Achilles tendon rupture: comparison of minimally invasive repair with open repair** Alexander Pak-Hin CHAN (SMHS, CUHK)
4	**A prophylactic device for preventing sport-related knee ligamentous sprain injury** Yue-Yan CHAN (O&T, CUHK)
5	**Static and dynamic postural control in professional dancers** Tiffany Ching-Man CHOI (SMHS, CUHK)
6	**Accelerometer-determined physical activity level of primary school children in Hong Kong: a pilot study** Gang HE (SPE, CUHK)
7	**Association between physical activity knowledge, physical activity behavior and age in Hong Kong Chinese adults with type 2 diabetes** Grace Pui-Sze HUI (SMHS, CUHK)
8	**How the walkability of a neighbourhood affects the pattern of physical activity** Ka-Yiu LEE (IHP, HKU)
9	**Is there any difference in core endurance in elite jumping athletes with and without patellar tendinopathy?** Wai-Chun LEE (RS, PolyU)
10	**Poor hamstring to quadriceps ratio in Hong Kong professional soccer players: implication for injury prevention and strength training** Justin Wai-Yuk LEE (O&T, CUHK)
11	**Effects of 60 minutes of soccer-specific training on hydration status, core temperature and skill performance in adults when ingesting either water or carbohydrate drink** John O'REILLY (SPE, CUHK)
12	**Reduction of cytosolic caspase-12 proteolytic activity during compression-induced muscle damage** Zao QU (HTI, PolyU)
13	**Inhibition of apoptosis alleviates muscle damage induced by prolonged compression** Bee-Tian TENG (HTI, PolyU)
14	**Adaptation of circulatory antioxidant defense system from prolonged voluntary exercise training** Henry Hon-Fung CHUANG (HTI, PolyU)

15	**A study on muscle fatigue in patients after ACL reconstruction more than 1 year in involved leg and non-involved leg** Suet-Wai TSANG (SMHS, CUHK)
16	**Investigating the use of analogy in speech motor learning** Andy Choi-Yeung TSE (IHP, HKU)
17	**Reliability of pedometer during walking and jogging: do wearing positions affect?** Lin WANG (SPE, CUHK)
18	**Using Kinesio Tape® to control pain during functional movement in elite soccer with medial collateral ligament injury** Quentin Kai-Ching YAU (SMHS, CUHK)

CUHK: O&T, Orthopaedics and Traumatology; SMHS, Sports Medicine and Health Science; SPE, Sports Science and Physical Education; BME, Biomedical Engineering
HKU: IHP, Institute of Human Performance
PolyU: RS, Rehabilitation Sciences; HTI, Health Technology and Informatics
HKBU: PE, Physical Education
HKIEd: HPE, Health and Physical Education

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