行政院國家科學委員會補助專題研究計畫成果報告
期末報告

使用儀器治療對於慢性踝關節不穩定運動員本體感覺的影響

計 畫 類 別 ：個別型計畫
計 畫 編 號 ：NSC 101-2410-H-028-003-
執 行 期 間 ：101 年 08 月 01 日至 102 年 10 月 31 日
執 行 單 位 ：國立臺灣體育運動大學運動健康科學學系

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報 告 附 件 ：出席國際會議研究心得報告及發表論文

處 理 方 式 ：
1.公開資訊：本計畫可公開查詢
2.「本研究」是否已有嚴重損及公共利益之發現：否
3.「本報告」是否建議提供政府單位施政參考：否

中 華 民 國 103 年 01 月 31 日

中 文 摘 要 ： 本體感覺輸入提供中樞神經系統對於身體位置、關節動作方向與速度的訊息。對於骨骼肌肉系統傷害，儀器治療是一個經常被使用的治療方式，在許多文獻中已證實儀器治療可以有效降低發炎反應與減輕疼痛。但是對於使用儀器治療後是否會影響到本體感覺回饋或平衡，目前仍少有相關文獻探討。因此，本研究目的為探討儀器治療使用後是否會改變踝關節的本體感覺與站立平衡。使用的儀器介入包括冷療、經皮神經電刺激(TENS)和超音波，共有 34 位單側慢性踝關節不穩定受試者，在使用儀器治療之前和之後（0 和 30 分鐘），利用 Biodex 等速肌力儀測量踝關節本體感覺，並進行星型平衡測試。使用二因子重複量數變異數分析，以比較使用儀器治療前後的差異和健側患側的差異。結果發現在星型平衡測試中，立即冷療介入後的跨步距離比冷療介入前顯著較小，而立即和 30 分鐘 TENS 介入後的跨步距離比 TENS 介入前顯著較大，立即和 30 分鐘超音波介入後的跨步距離比超音波介入前顯著較大。在踝關節本體感覺測試中，患側的絕對誤差比健側顯著較大。冷療介入後對於站立平衡有負面影響，但 TENS 介入後或超音波介入後對於站立平衡有正面影響。當運動員接受冷療後，若立即回到運動場訓練或比賽，可能會提高受傷的發生率。

中文關鍵詞： 冷療、經皮神經電刺激、超音波

英 文 摘 要 ： Proprioception plays a critical role in injury prevention by affording the correct afferent message. Therapeutic modality is often used for the treatment of disorders in musculoskeletal system. Previous studies indicated that the use of therapeutic modality can effectively decrease pain and inflammation. However, little is known about the influence of therapeutic modality on the proprioception. Therefore, the purpose of this study was to investigate the effect of therapeutic modality on proprioception in subjects with chronic ankle instability. Thirty four subjects were participated in this study. Cryotherapy, transcutaneous electrical nerve stimulation (TENS) and ultrasound were used as modality interventions. Ankle proprioception tests were measured by Biodex isokinetic dynamometer and star excursion balance tests were conducted. Data collection was performed in pre-intervention, immediately and 30-minute after intervention. Two-way

ANOVA with repeated measures were used to compare the differences between pre-intervention and post-intervention, and between affected and unaffected sides. The results showed that immediately after cryotherapy showed a significantly lesser reaching distance than pre-cryotherapy in star excursion balance test. Immediately and 30-minute following TENS program showed a significantly greater reaching distance than pre-TENS in star excursion balance test. Immediately and 30-minute following ultrasound program showed a significantly greater reaching distance than pre-ultrasound in star excursion balance test. Affected side had a significantly greater absolute error than unaffected side in ankle proprioception test. Cryotherapy might have risky effect on dynamic standing balance while TENS or ultrasound program might have positive effect on dynamic standing balance. The risk of injury following a return to sports activity might be enhanced immediately after cryotherapy.

英文關鍵詞： cryotherapy, TENS, ultrasound

Effect of Modality Therapy on Proprioception in the Subjects with Chronic Ankle Instability

Introduction

Proprioception is the body's own sense of position and motion, including body segment static position, displacement, velocity and acceleration (Reiman, 2002). Proprioceptive signals are transformed into electrical impulses represented at conscious (cerebral cortex) and unconscious (cerebellum) levels (Lundy-Eckman, 2007). In conjunction with visual and vestibular inputs, proprioception provides the central nervous system proper somatosensory information and allows people to move their body segments and maintain stability accurately and efficiently. With a well-functioned proprioceptive feedback, a controlled and precise movement can be generated, which is critical in the functional activities of daily living as well as the sports performance (Ogard, 2011).

There are numerous factors affecting proprioception, such as temperature, fatigue, injury, disease, vibration and training (Rosker, 2010). If proprioception is impaired as a consequence of the affecting factors, poor body alignment, false posture or incorrect joint force production may result in injury (Myers, 2008). Deficits in proprioception have been proposed to be associated with the risk of injuries of the otherwise intact joints (de Noronha, 2006). There have been lots of reports in literatures to quantify the proprioception change after ligament injury, such as knee after anterior cruciate ligament injury (Beard 1994; Mir, 2008) and ankle sprain (Garn, 1988). Ankle sprain is a common injury in the lower extremities, especially in basketball (Dick, 2007) and volleyball (Agel, 2007). Chronic ankle instability frequently occurs following suffering acute ankle sprain and it is prone to cause repetitive injury. The victims usually complain the feeling of suddenly giving way at ankle (Anandacoomarasamy, 2005).

Therapeutic modalities have been widely used for the first aid of trauma or the rehabilitation program for the injuries in musculoskeletal system (Prentice, 2009). For the ligament injury at ankle, cryotherapy, transcutaneous electrical nerve stimulation (TENS) and ultrasound therapy have been used to reduce pain and inflammation (Prentice, 2003). However, little is known about how the therapeutic modalities affect the ankle joint proprioception and balance. It is important to understand their impacts on peripheral sensory feedback to ascertain the athletic safety throughout using therapeutic modalities before resuming exercise in sports setting. Therefore, the purpose of this study was to investigate the effect of therapeutic modalities on ankle joint proprioception in

subjects with chronic ankle instability.

Methods

Subjects

Thirty four subjects (24 male subjects and 10 female subjects) with chronic ankle instability participated in this study (age: 21.2±1.9 years; body length: 171.4±8.9 cm; body weight: 66.9±12.9 kg). The subjects had no surgery history in the lower extremities and no other injury except unilateral chronic ankle instability. The inclusive criteria were (1) having at least one ankle sprain leading to swelling, pain and protected weight bearing and/or immobilization of the injured ankle; (2) having episodes of the ankle suddenly giving way and at least two ankle sprains within the past two years; (3) by now recovery from ankle sprain and no pain, swelling, or other inflammation symptom in testing days; (4) going back to regular training in their sport specialty. The excluded criteria were (1) they had a history of lower extremity fractures or any serious neuromusculoskeletal injury that would affect the proprioception or balance tests; or (2) they have any contraindication of the therapeutic modalities used in this study. The subjects consisted of 13 soccer athletes, 5 field and track athletes, 4 Frisbee athletes, 3 basketball athletes, 3 volleyball athletes, 2 baseball athletes, 1 badminton athlete, 1 table tennis athlete, 1 Taekwondo athlete, 1 Judo athlete. There were 18 subjects with right affected side and 16 subjects with left affected side.

Equipments

Biodex isokinetic dynamometer (Biodex Medical System, Inc., Shirley, NY, USA) were used to measure the ankle joint proprioception, active and passive joint reposition sense. Therapeutic modalities used in this study were cold pack, ultrasound (Electro-medical supplies Ltd., Oxfordshire, England) and the TENS modality (SJC Medical, San Gabriel, CA, USA).

Ankle Proprioception Tests

There were two tests in joint position sense in this study: active and passive. In each trial, the foot was passively moved at a velocity of 10 degrees/sec to a target angle (30 degrees of plantar flexion) and the target position were maintained to memorize for 10 seconds. In an active test, the subject actively reproduced the target angle with the best of his/her ability. In a passive test, the lever arm of the dynamometer was automatically moved at the velocity of 10 degrees/sec. The subject had a button in one hand so that he/she could stop the lever arm when he/she feels it to be at the target angle. The subjects had to wear headphones and close their eyes to minimize the sensory

information from hearing and vision. The subject would not get any feedback about the assessment performance.

Star Excursion Balance Test

Tape was placed in diagonal patterns with 45-degree increment. Each subject stood on the center of the grid and was then instructed to reach to the farthest possible point with the distal-most part of the foot on the non-testing lower limb while balancing on the testing lower limb. The testing direction was the anterior, posteromedial and posterolateral directions. Subject should not use the reaching leg to provide any support in the maintenance of the upright posture and move the stance foot from its original position (Reiman, 2009).

Experimental Procedures

There were three therapeutic modalities tested in this study, cryotherapy, TENS and ultrasound. The tests for different modalities were conducted in three different days separated at least 2 days. The testing order of different modalities was random for each subject. All application skills of the modalities were referred to the published guideline (Prentice, 2009; Prentice, 2003).

There were six experimental sessions in each testing day: pre-intervention, immediately post-intervention and 30-minute post-intervention for affected side and unaffected side. The ankle proprioception test and the star excursion test were performed in each experimental session.

In intervention of cryotherapy, cold pack was applied on anterior lateral ankle area. Cold pack was prepared and placed in the refrigerator at least 6 hours. The application time was 20 minutes. A flexible wrap was used to hold the cold pack in place. In intervention of ultrasound, the direct skin application of ultrasound at continuous mode was used. The frequency was set at 1 MHz. The diameter of the transducer was 1 cm to easily fit the irregular area of the ankle. The major treatment area was at anterolateral ankle region. The intensity was set between 1 and 2 W/cm^2, dependent on the feedback of each subject. The treatment duration was 5 minutes. In intervention of TENS, the auto mode of TENS modality was used with the frequencies varied within 5 – 200 Hz. The pulse duration was 200 ms. The treatment duration was 20 minutes. The electrodes were placed on superior and inferior regions of lateral ankle. The intensity was within 1 – 3 mA, dependent on the feedback of each subject. The subject was instructed to have a feeling of electrical stimulating but muscle contraction magnitude as low as possible.

Data Analysis

The outcome parameters were the absolute errors in the active and passive repositioning

sense tests. They were calculated through the computation of the difference between the target angle and the angle chosen by the subject. The reaching distance in star excursion balance test were reported and normalized by the leg length of each subject.

Statistical Analysis

Two-way ANOVA with repeated measure was used to compare the differences between affected side and unaffected side, as well as the differences between pre-intervention, immediately and 30-minute following intervention. The software SPSS V12.0 was used to compute the statistical analysis. The statistical significance of this study was set as $\alpha=0.05$.

Results

Cryotherapy

Star Excursion Balance Test

Reaching distance in star excursion balance test in cryotherapy intervention was shown in Figure 1. Significant difference between different intervention time was found in anterior direction ($p<0.05$) but not in posteromedial and posterolateral directions. Pre-intervention (65.8%) and 30-minute post-intervention (65.5%) showed a significantly greater reaching distance than immediately post-intervention (64.2%). No significant difference was found between affected and unaffected sides. There was no significant interaction.

Ankle Proprioception Test

The absolute errors in ankle proprioception tests were shown in Figure 2. Significant difference between affected and unaffected side was found in active reposition sense test ($p<0.05$). Affected side (4.4 degrees) had a significantly greater absolute error than unaffected side (3.3 degrees). No significant difference between pre-intervention and post-intervention. There was no significant interaction in active reposition sense test.

In passive reposition sense test, there was no significant difference between pre-intervention and post-intervention, as well as between affected and unaffected sides. There was no significant interaction.

TENS

Star Excursion Balance Test

Reaching distance in star excursion balance test in TENS intervention was shown in Figure

3. Significant difference between different intervention time was found in posteromedial and posterolateral directions ($p<0.05$) but not in anterior direction. In posteromedial direction, pre-intervention (105.6%) showed a significantly lesser reaching distance than immediately post-intervention (106.6%) and 30-minute post-intervention (107.8%). In posterolateral direction, pre-intervention (96.1%) showed a significantly lesser reaching distance than immediately post-intervention (98.6%) and 30-minute post-intervention (99.1%). No significant difference was found between affected and unaffected sides. There was no significant interaction.

Ankle Proprioception Test

The absolute errors in ankle proprioception tests were shown in Figure 4. Significant difference between affected and unaffected side was found in passive reposition sense test ($p<0.05$). Affected side (5.2 degrees) had a significantly greater absolute error than unaffected side (3.7 degrees). No significant difference between pre-intervention and post-intervention. There was no significant interaction in passive reposition sense test.

In active reposition sense test, there was no significant difference between pre-intervention and post-intervention, as well as between affected and unaffected sides. There was no significant interaction.

Ultrasound

Star Excursion Balance Test

Reaching distance in star excursion balance test in ultrasound intervention was shown in Figure 5. Significant difference between different intervention time was found in anterior, posteromedial and posterolateral directions ($p<0.05$). In anterior direction, pre-intervention (64.1%) showed a significantly lesser reaching distance than immediately post-intervention (65.4%). In posteromedial direction, pre-intervention (100.8%) showed a significantly lesser reaching distance than immediately post-intervention (103.6%) and 30-minute post-intervention (103.7%). In posterolateral direction, pre-intervention (91.8%) showed a significantly lesser reaching distance than immediately post-intervention (94.7%) and 30-minute post-intervention (95.8%). No significant difference was found between affected and unaffected sides. There was no significant interaction.

Ankle Proprioception Test

The absolute errors in ankle proprioception tests were shown in Figure 6. In active reposition sense test and passive reposition sense test, there was no significant difference between pre-intervention and post-intervention, as well as between affected and unaffected sides. There was

no significant interaction.

Discussion

The effect of modality therapies on proprioception and balance in the subjects with chronic ankle instability has been documented. Cryotherapy is a common treatment in acute injury. The dynamic balance of one-leg standing was affected by cryotherapy. Immediately after cryotherapy showed a lesser reaching distance than pre-cryotherapy in anterior direction of star excursion balance test. The findings suggested that cryotherapy might impair the dynamic standing balance. The risk of injury following a return to sports activity might be enhanced immediately after cryotherapy.

The therapeutic goal of the TENS program would be pain control with the theoretic background of gate control theory. The dynamic balance of one-leg standing was affected by the TENS program. Immediately and 30-minute following the TENS program showed a greater reaching distance than pre-TENS in posteromedial and posterolateral directions of the star excursion balance test. The findings suggested that TENS program might improve the dynamic standing balance possibly due to the continuous transcutaneous nervous stimulation and the corresponding muscle contraction at ankle.

The therapeutic goal of the ultrasound program would be deep thermal effect and the possible facilitation in the healing process of chronic ligament injury. The dynamic balance of one-leg standing was affected by the therapeutic ultrasound program. Immediately and 30-minute following the ultrasound program showed a greater reaching distance than pre-ultrasound in anterior, posteromedial and posterolateral directions of star excursion balance test. The findings suggested that ultrasound program might improve the dynamic standing balance possibly due to the thermal effect at ankle and the enhancement of local circulation.

The affected side showed a greater absolute error than unaffected side in active reposition sense test in the session of cryotherapy intervention. The affected side also showed a greater absolute error than unaffected side in passive reposition sense test in the session of TENS intervention. Previous history of ankle ligament injury or chronic ankle instability might affect the ankle proprioception. It should be aware of the possible impairment of ankle proprioception when performing the high-impact sports in the athletes with chronic ankle instability.

Cryotherapy might have risky effect on dynamic standing balance while the application of TENS and ultrasound might have positive effect on dynamic standing balance. The information

about the effect of modality therapy on proprioception at ankle and standing balance can be offered for athletes, coaches and clinicians to decide the time back to play following using therapeutic modality.

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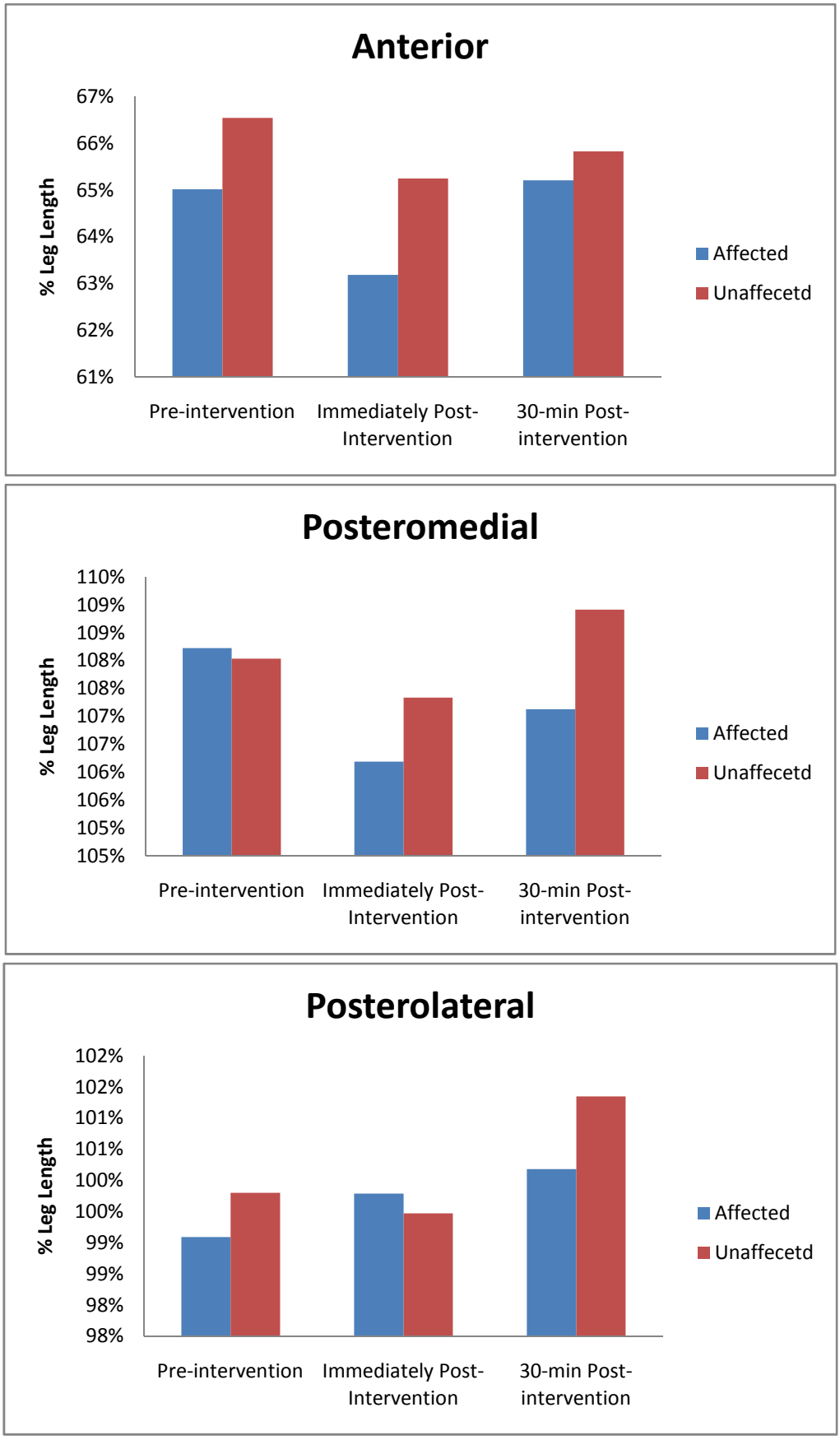


Figure 1: Reaching distances in star excursion balance test in cryotherapy intervention.

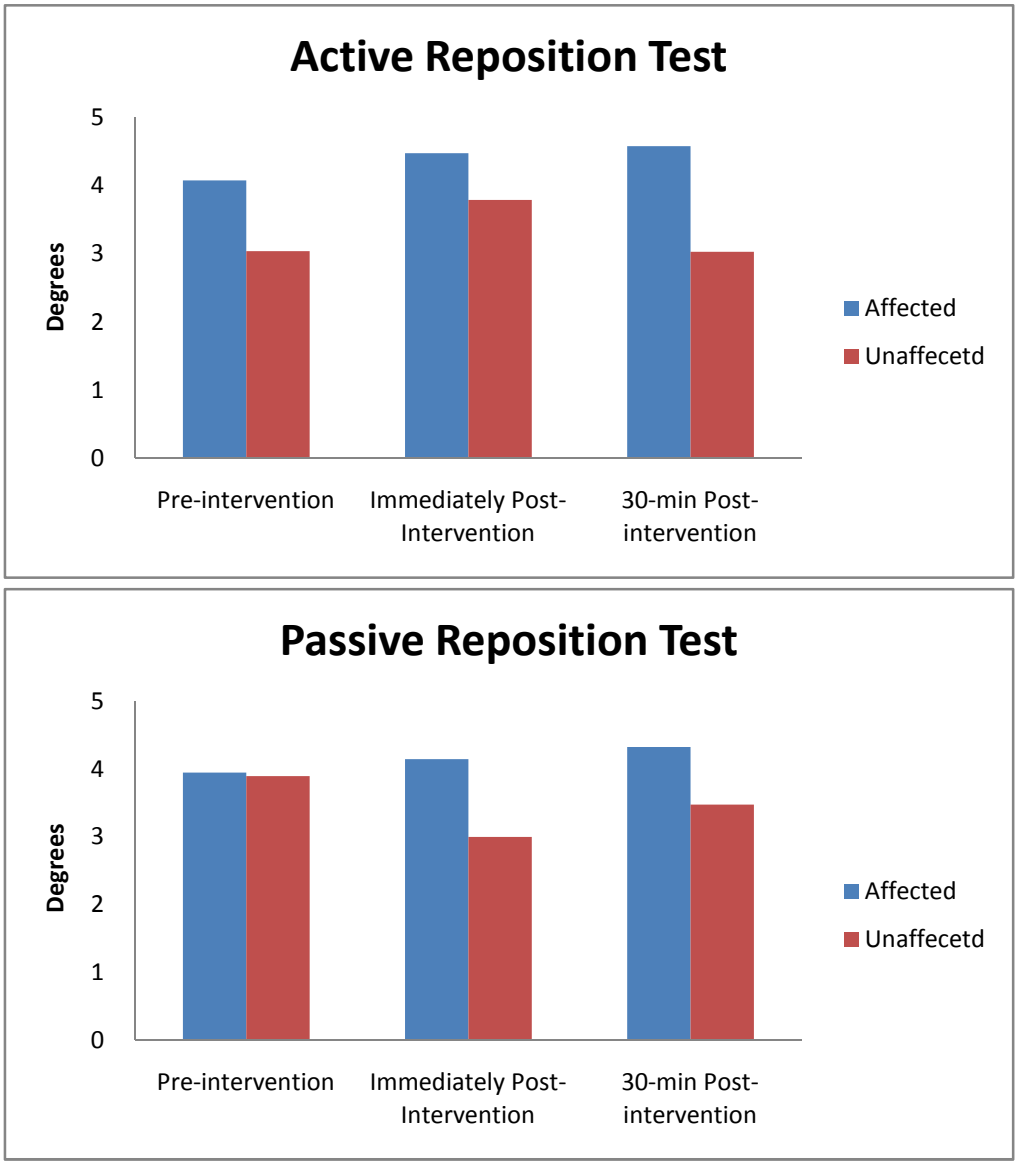


Figure 2: Absolute errors in ankle proprioception test in cryotherapy intervention.

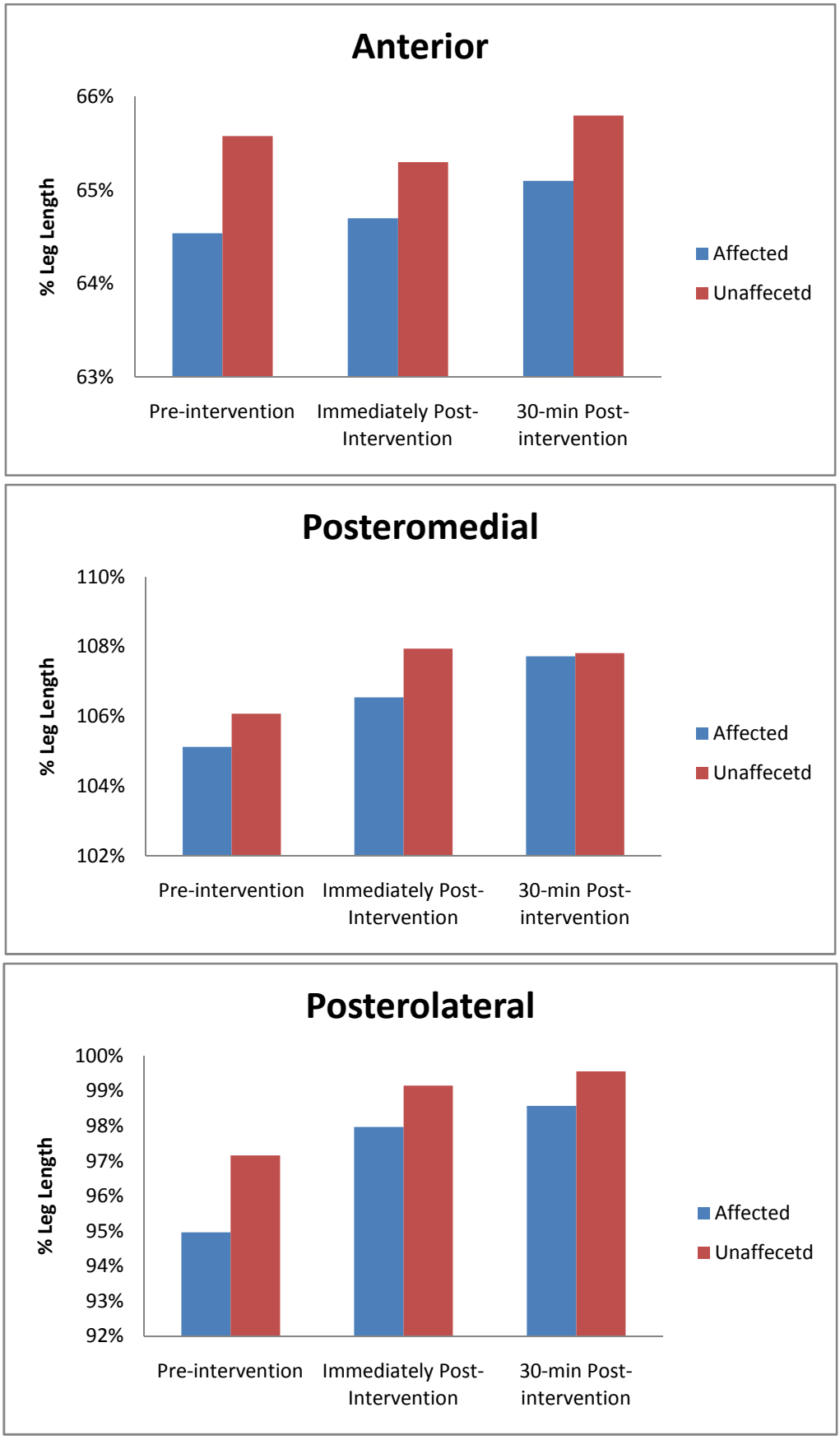


Figure 3: Reaching distances in star excursion balance test in TENS intervention.

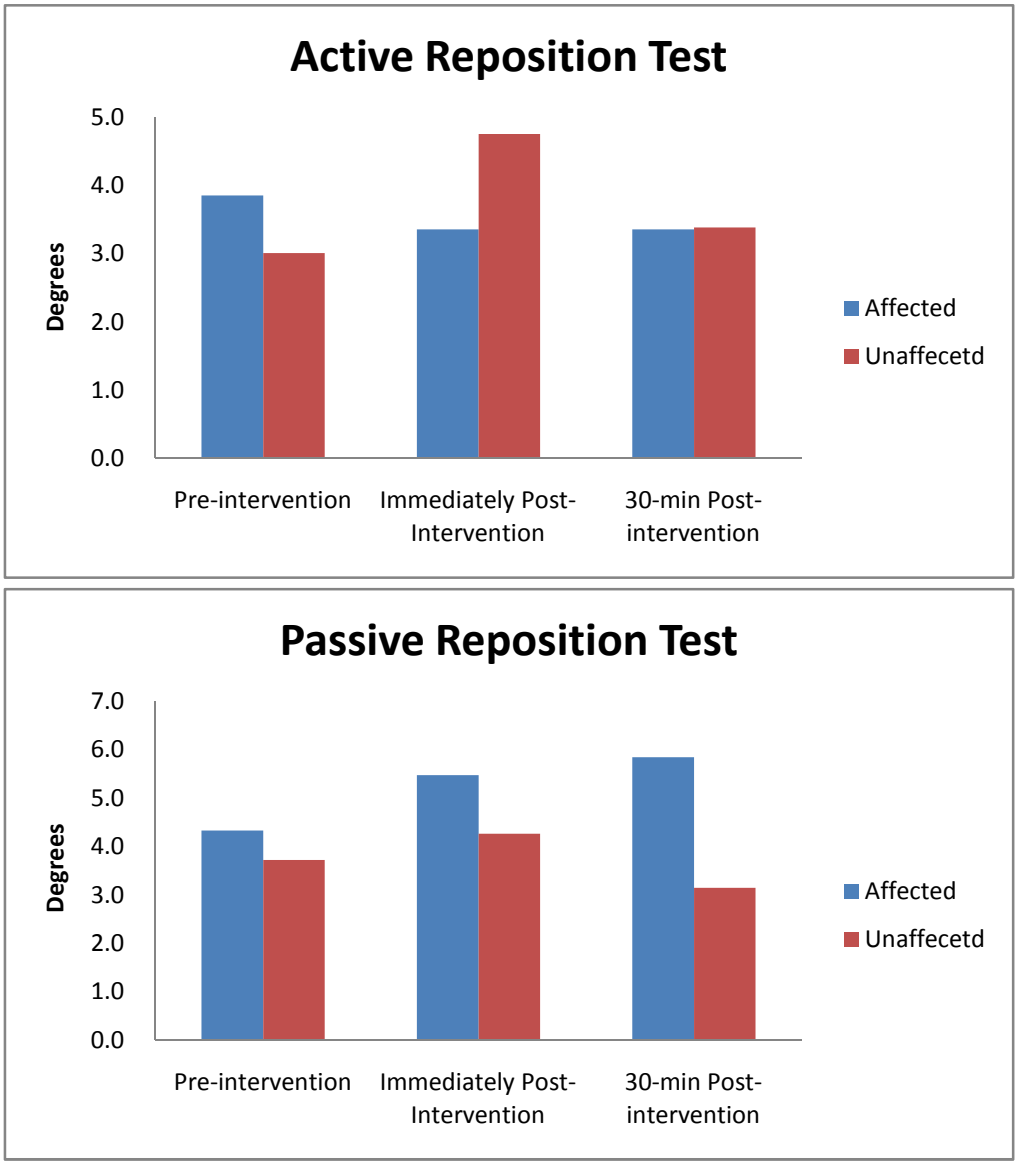


Figure 4: Absolute errors in ankle proprioception test in TENS intervention.

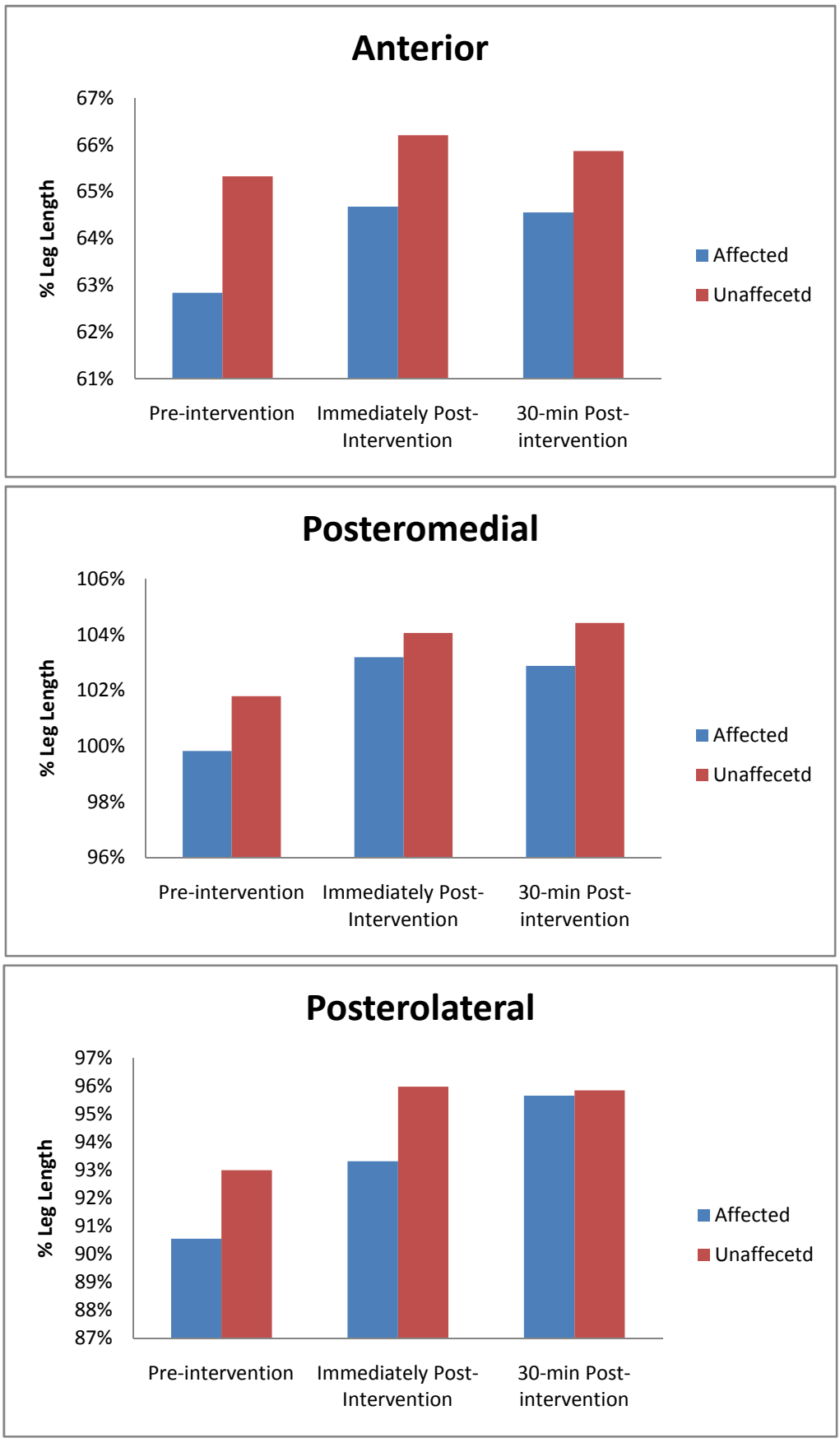


Figure 5: Reaching distances in star excursion balance test in ultrasound intervention.

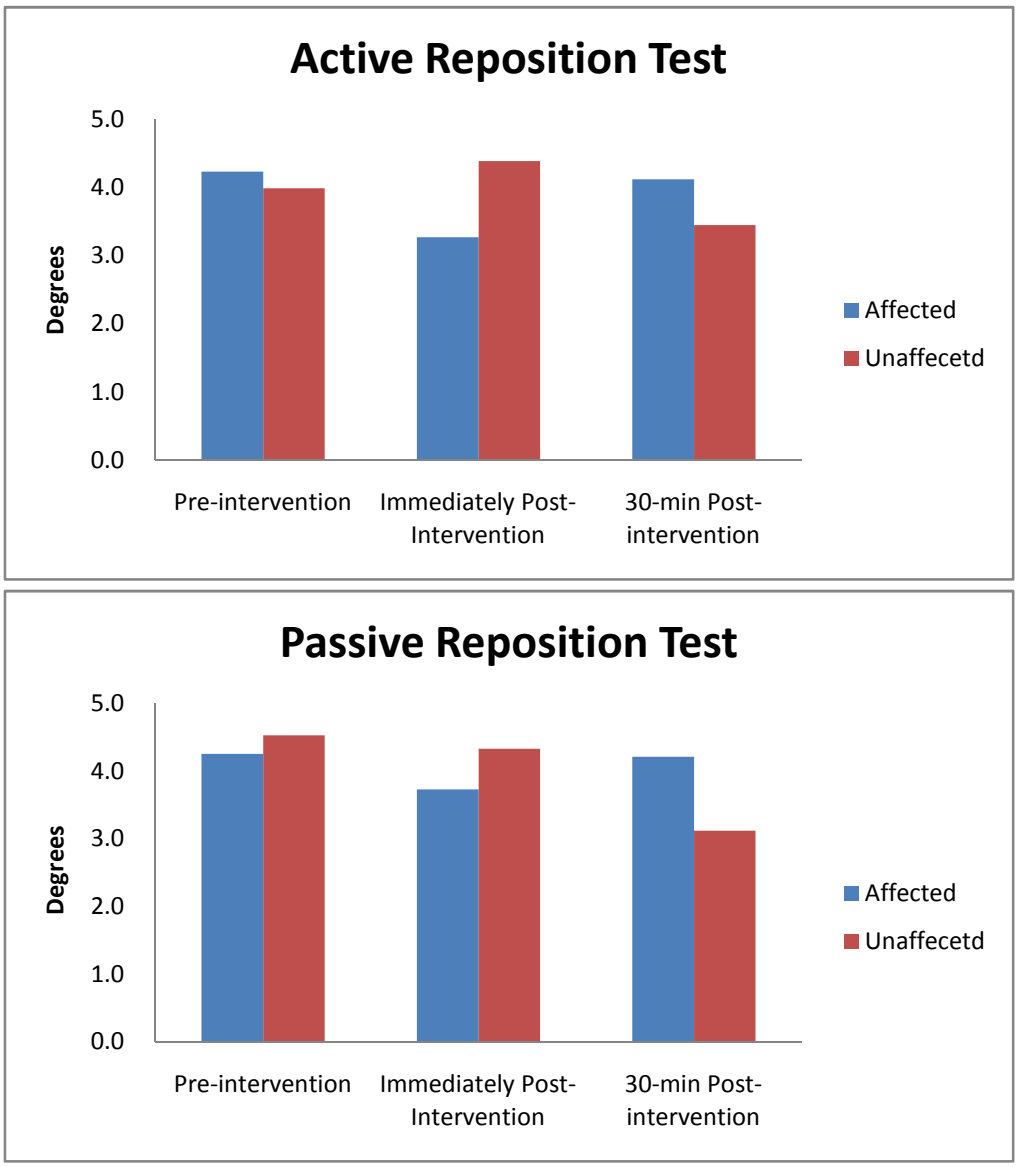


Figure 6: Absolute errors in ankle proprioception test in ultrasound intervention.

附件五

國科會補助專題研究計畫出席國際學術會議心得報告

日期：102 年 7 月 30 日

計畫編號	NSC 101－ 2410 － H －028 －003 －		
計畫名稱	使用儀器治療對於慢性踝關節不穩定運動員本體感覺的影響		
出國人員 姓名	張怡雯	服務機構 及職稱	國立臺灣體育運動大學 運動健康科學學系 副教授
會議時間	2013 年 6 月 22 日至 2013 年 6 月 26 日	會議地點	日本 秋田 Akita, Japan
會議名稱	國際姿勢與步態研究學會年會暨研討會 International Society for Posture & Gait Research		
發表論文 題目	肌內效貼紮對於髕股骨疼痛症候群的肌電訊號活化時間之效益分析 Effect of kinesio taping on EMG onset in patellofemoral pain syndrome		

一、參加會議經過

國際姿勢與步態研究學會 (International Society for Posture & Gait Research, ISPGR) 成立於1969年，是相當具有歷史性的國際性學會，目前包含20多個會員國，每一年的年會暨研討會均由世界各地會員國來主辦，今年的ISPGR研討會和「步態與智能功能學會」(Gait and Mental Function)共同舉辦聯合會議，由日本東北秋田市之秋田大學(Akita University) 舉辦，會議日期為2013年6月22日至6月26日。旅程的開始，首先搭乘高鐵由台中至台北，在松山機場出境後，搭乘國際班機飛抵日本東京羽田機場，再轉搭日本國內線班機到達秋田機場，接著搭乘機場-市區的接駁巴士，約莫50分鐘就抵達秋田車站，最後再背著背包，拉著行李，約步行10分鐘即到達目的地－Akita view hotel，一棟古老典雅的漂亮建築物，這是本次大會的會場，也提供與會學者住宿的地方，相當的便利。

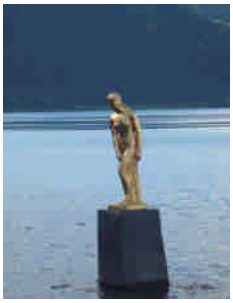
秋田市是一個寧靜純樸的都市，沒有一般大城市的車水馬龍、喧囂繁亂，擁有豐富的文化和歷史，街道非常乾淨，步調中庸沉靜，呈現日本北國風貌的宜人景緻。市區中最著名的景點便是千秋公園，占地非常廣大，有大片的森林與草地，間或點綴著小湖流水，漫步其中，非常清新舒適，其中更有一些著名的歷史遺跡，如：久保田城跡。



圖一：(A) 秋田車站前的市區街道，也是大會會場所在之處
(B) 千秋公園正門處 (C) 公園內的歷史遺跡。

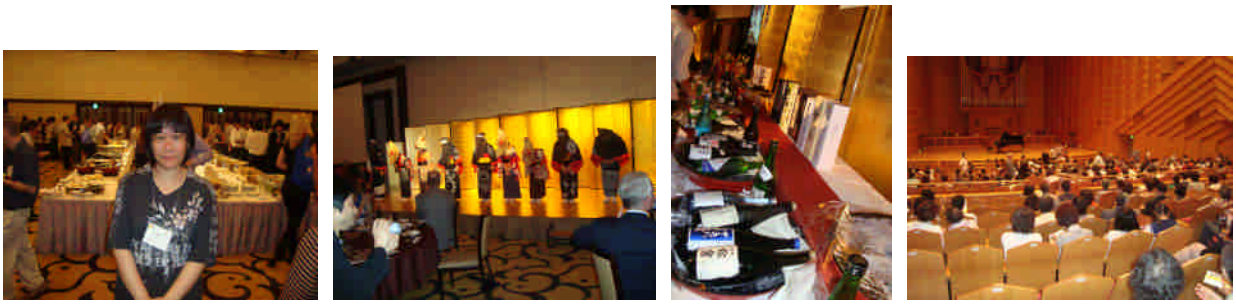
會議議程的安排上，每天早上 8 點半開始，包含專題演講 (Keynote speaking)，皆是世界級的姿勢控制和動作分析大師的演講，相當精彩，並且有口頭發表 (Oral presentation) 與海報發表 (Poster presentation)，參與的學者們都仔細聽講，並有犀利的提問及精闢的回應，令人獲益良多。在聽完早上的報告後，中午大會有提供午餐，皆為日本當地的傳統美食，口味和臺灣食物相近，非常鮮美可口。由於日本的地理位置和臺灣相似，皆處於環太平洋的區域，海鮮漁獲量相當豐富，有相當高比例的海鮮料理，風味相當道地。

在會議第二天的下午為戶外行程 (Social tour)，大會安排了田澤湖(Lake Tazawa)之行，田澤湖為日本最深的內陸淡水湖，深度可達 423.4 公尺，湖邊有一個小金人雕像(Statue of the legendary princess Tatsuko)，能夠祝福人們青春永在，美麗永駐，同時小金人也變成田澤湖的守護女神。除此之外，行程中也安排各國學者到另一著名景點 Kakunodate，這個小城位於秋田市的東邊，又有小京都(little Kyoto)之稱，三面環山，Hinokinai-gawa river 河流貫穿其中，景色相當秀麗，據說春天時河邊的櫻花綻放，日本民眾都會到此賞櫻，並慶祝春天即將到來，落英繽紛，非常漂亮。不過我們來到的時候，已經是日頭炎炎的夏天，只看到了綠意盎然的櫻花樹，只能憑空想像初春時的粉紅櫻花盛開的燦爛美景。同時 Kakunodate 擁有典雅的街道與建築物，古色古香的歷史文物，許多經營好幾甲子的老店，像是製造味噌的或是日本醬油的傳統店，非常有味道。



圖二：(A) 田澤湖 (B) 田澤湖守護女神 (C) 河邊賞櫻步道 (D) Kakunodate 的歷史建築。

大會於晚宴的安排上，也是精心準備，有取之不盡的日本美食，大家都盡情的享用，期間穿插著傳統日本藝術表演，雖然聽不懂日語，但是音樂節奏鏗鏘有力，舞蹈動作優美動人，各國學者還是充分感動於日本的文化藝術之美。另外，大會也提供了無數的日本美酒，也包含了相當有名的大吟釀，大家都舉杯互相致意，更拉近了彼此的距離。在第三天的晚餐後，大會更精心安排了中西合璧的音樂盛會，在秋田市美術館頂樓美麗的音樂廳演奏，有傳統東方的日本古箏表演，以及西方的男高音演唱，是一場相當專業的高級音樂饗宴，博得各國學者和現場觀眾一致的喝采，安可聲不間斷。



圖三：(A) 晚宴的精緻餐點 (B) 日本舞表演 (C) 大會提供的日本美酒
(D) 美輪美奐的音樂廳。

二、與會心得

此次會場位於秋田市中心的 Akita view hotel，裡面有三間大型會議室，可容納數百人，也可讓不同主題的報告同時進行。參與會議的專家學者，來自世界各國，例如：地主國日本、美國、英國、大陸、香港、韓國、愛爾蘭、德國、比利時、法國、紐西蘭、挪威、澳洲等，臺灣也有不少專家學者參加，都有精彩的報告。

圖四：(A) 會場入口處有相當醒目的會議資訊 (B) 此次會議所發表論文海報的合影。

此次會議主題廣泛，舉凡和姿勢控制及步態分析有關的內容，皆是會議中探討的主題，共有約 72 篇的口頭報告，及超過 300 篇以上的海報發表，數量頗為豐富，含括以下各個項目：

- Gait analysis
- Tools and methods
- Neurological diseases
- Cognitive impairments
- Habilitation and rehabilitation
- Fall and fall prevention
- Sensormotor control
- Modeling
- Vestibular functions and disorders
- Psychiatric disorder
- Exercise and physical activity
- Orthopedic disease and injuries
- Aging
- Coordination of gait and posture
- Learning, plasticity and compensation
- Balance support devices
- Attention and emotional influences
- Biomechanics and neuroprothesis
- Development of gait and posture
- Ergonomics

在這些不同的研究領域之中，我最感到有興趣的口頭報告，主題是關於腦震盪(concussion)對於下肢動作影響之研究。由於腦震盪為競技運動中常見的頭部傷害之一，特別是衝撞力量強大的接觸型運動種類，如：橄欖球、足球、手球、美式足球等，由於對大腦產生可能潛在的損傷或漸進式的傷害，預後變化差異很大，有時會造成選手須要暫時休息，或是停止訓練或比賽，甚至有些選手不得不終止其運動生涯，對專業菁英運動員的影響非常大。因此，希望可以利用生物力學的量化分析，探討腦震盪對於下肢關節動作協調性的影響，主要內容如下：

Effect of Concussion on Lower Extremity Inter-joint Coordination during Obstacle Crossing and Dual Task Walking

腦震盪對於跨越障礙物及雙任務步態的下肢關節協調性的影響

過去研究曾指出，創傷性頭部所造成的腦震盪可能會增加跨越障礙物時跌倒的機率，下肢協調性不良也會影響姿勢維持或步態穩定，而行走時伴隨腦部的認知任務，也會增加步態的不穩定。因此，本研究目的為腦震盪對於一般步態、跨越障礙物、及雙重任務步態的影響，包含 23 位健康受試者及 23 位 48 小時內腦震盪的受試者參與測試，利用 10 台高速攝影機及動作分析系統收集資料，測試包括一般平地走路，跨越障礙物，和走路時同步聆聽問題並回答的雙重任務步態分析。結果顯示，在下肢關節協調性的生物力學參數中，腦震盪受試者在跨越障礙物與平地走路之間的差異、及雙重任務步態與平地走路之間的差異，比健康受試者還要大；而在步態的站立期，腦震盪受試者比健康受試者出現顯著較大的膝-踝關節間協調的變異性，在步態的擺動期，腦震盪受試者比健康受試者出現顯著較大的膝-踝關節間和髖-膝關節間協調的變異性。由此可知，腦震盪會改變步態動作的變異性，影響到神經肌肉控制的穩定性，以及選擇適當的下肢協調模式的能力。因此，對於曾經有過腦震盪病史的運動員，

應特別注意下肢各關節間動作的協調性，或加強協調平衡訓練，以避免對於專業競技運動表現造成影響。

由於海報發表的篇數眾多，因此大會商借秋田市美術館寬闊的展場，才有辦法容納 300 多篇的海報發表，在如此多的研究報告中，我最感到有興趣的報告，是關於老人跌倒的議題。由於臺灣的出生率低，相對的老年人口的比例就變高，已達到老人國的標準。老年人的下肢肌力、平衡與協調性均較年輕人不佳，因此容易跌倒，導致身體的骨骼肌肉神經系統的損傷，並可能衍生其他系統的併發症，有時甚至會造成嚴重的後果。因此，如何擁有一個健康快樂的銀髮族生活，老年人跌倒之預防，則是其中一個相當重要的議題，經由生物力學的研究方法，某一些姿勢平衡的參數則能夠用於預測老年人的跌倒可能性，如此則可以更積極的預防跌倒，使得老人不會以臥床或坐輪椅的方式度過老年生活，促使銀髮族可以具有自由活動、參與社區的行動力，擁有豐富美好的生活品質。報告的主要內容如下：

Biomechanical Balance Parameters in Frontal Plane Predict Prospective Falls in Elderly Adults

冠狀面生物力學平衡參數預測老人跌倒

平衡評估用以預測老人跌倒的機率，對於及時的預防性介入是相當重要的，因此，本研究目的為，想要了解步態不平衡的生物力學參數用於預測老年人跌倒的適用性，共有 60 位年齡大於 70 歲的社區老人參與為期一年的實驗，接受 timed up and go 測試的資料收集，使用 logistic regression，檢驗 COM－ankle 角度作為跌倒預測的能力，當這些生物力學參數加入回歸模式中，解釋變異(explained variance)由原本的 25.3%增加到 50.2%，而其敏感性(sensitivity)和特異性(specificity)分別為 66.7%和 88.4%。在由坐到站的測試中，有較小 COM－ankle 活動度的老人，有較低的跌倒機率。另外，當作轉身動作時，有較大的冠狀面 COM－ankle 角度的老人，也有較低的跌倒機率。本研究結果發現，動態的生物力學參數可以用於預測老人未來跌倒的機率，其中最有預測效力的變數為冠狀面的生物力學參數。因此，經由對老年人的生物力學檢測，分析冠狀面特定參數的大小，可以進一步評估老人跌倒的風險，對於高跌倒風險的老人，則可以建議進行預防性的運動訓練計畫，使得肌力增加、平衡穩定，進而全面降低跌倒的機率，也可以相對的減輕醫療負擔。

三、發表論文全文或摘要

Effect of Kinesio Taping on EMG Onset in Patellofemoral Pain Syndrome

BACKGROUNG AND AIM: Patellofemoral pain syndrome is a common sport injury at knee, which is resulting from the abnormal tracking of the patella on the trochlear groove of the femur.

Patellar malalignment occurs when the vastus medialis oblique (VMO) is weaker or has a delayed onset of activation than vastus lateralis (VL). Kinesio taping has been clinically used for correcting the patellar tilt. However, little is known about the effect of the kinesio taping on muscle activation timing in the patellofemoral pain syndrome. Therefore, the purpose of this study was to investigate the effect of kinesio taping on the electromyographic (EMG) characteristics in the subjects with patellofemoral pain syndrome.
METHODS: Fourteen subjects with patellofemoral pain symdrome participated in this study (10 females and 4 males; age: 25.4±6.6 years; length: 162.3±8.7 cm; weight: 61.3±11.2 kg). Stair ascent and descent were performed for each subject. Two taping conditions were used (no tape and kinesio tape around patella). The surface EMG system was used (MA300, Motion Lab Systems Inc., USA) and two surface EMG electrodes were placed on the VMO and VL. The onset time differences between these two muscles were calculated. Positive value denoted an earlier onset of the VMO than the VL. Paired t test was used for comparing the difference between no tape and kinesio tape.
RESULTS: Kinesio tape (1.1±7.4 ms) showed a significantly earlier onset of the VMO than no tape (-5.6±3.5 ms) during stair ascent ($p<0.005$). Kinesio tape (-4.0±6.5 ms) showed a significantly lesser onset time difference than no tape (-8.4±5.2 ms) during stair descent ($p<0.005$).
CONCLUSIONS: Kinesio taping could be used to elicit an early contraction of the VMO for the people with patellofemoral pain syndrome. Kinesio taping might help improve the patellar stability in knee extension during stair ascent and descent.

四、建議

在聆聽了多場的來自世界各地學者所發表的動作分析及姿勢控制的各項報告後，深深覺得獲益匪淺。經由分析各項生物力學的變因，無論是在神經科的復健評估，或是臨床骨科的治療應用上，都有精闢的探討。另一方面，對於如何促進神經肌肉之間的肌群平衡，以及各個肢體關節之間的協調，皆提出不少的動作策略與科技輔具的使用，這些都能夠應用於促進競技運動之表現以及運動傷害的防護。參與大型的國際學術研討會，確實是開拓眼界、增進新知、廣結善緣的不二方法。

五、攜回資料名稱及內容

本次會議帶回的書面資料為「**Program of 2nd Joint World Congress – ISPGR / Gait & Mental Function**」，內容包含會議資訊的介紹、議程、專題演講的內容和主講學者的介紹、和各國學者所發表的論文報告摘要。另外，大會的官方網頁上，也提供了各篇論文的詳細內容，有興趣的人皆可以從網頁上下載，非常的便利。

六、附錄

附錄一：大會議程

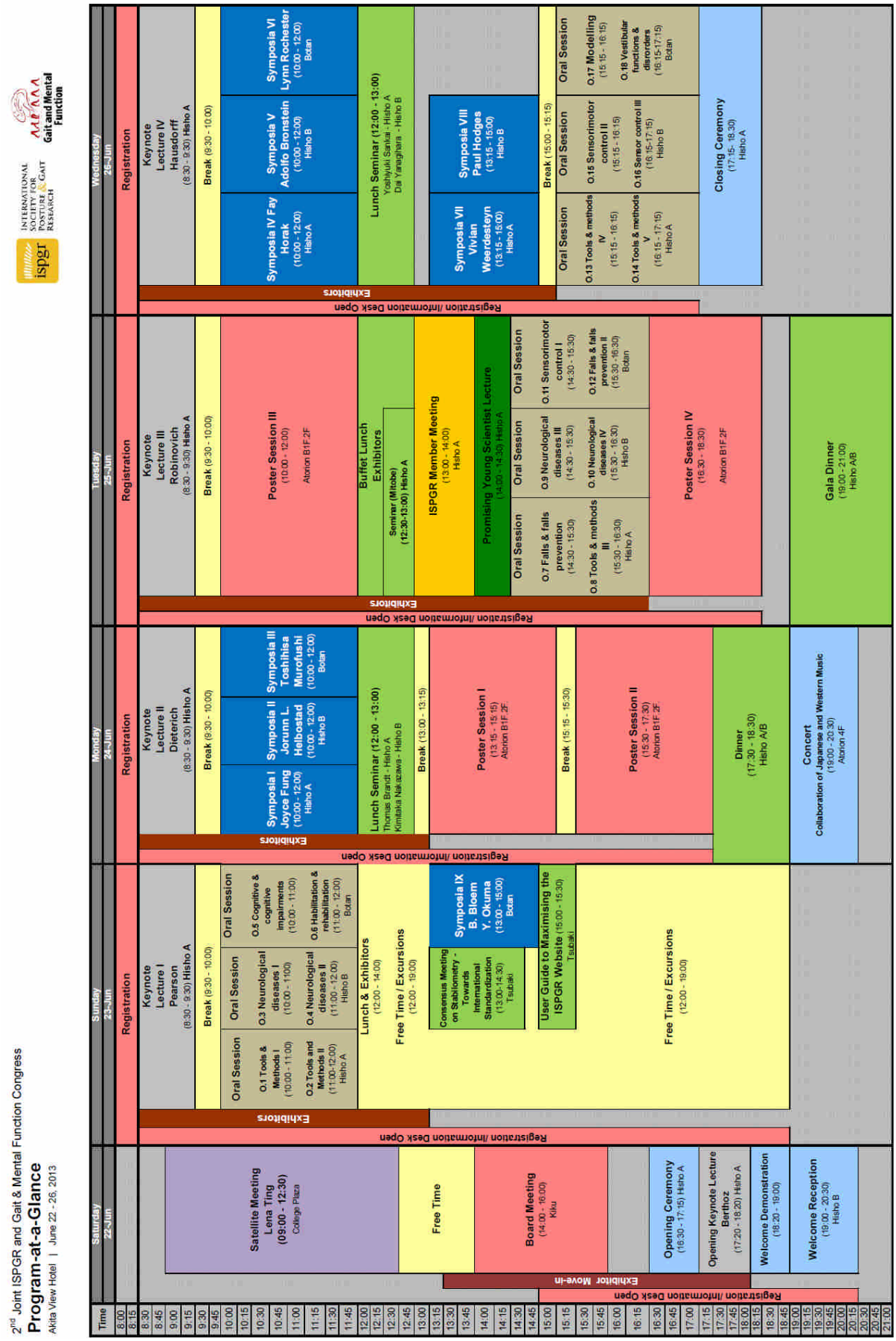
附錄二：參加研討會的名牌

附錄三：研討會論文封面

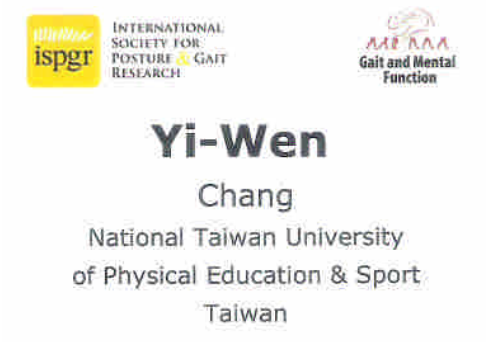
附錄四：發表之論文摘要

附錄五：發表之海報

附錄一：大會議程


2nd Joint ISPGR and Gait & Mental Function Congress
Program-at-a-Glance
Akita View Hotel | June 22 - 26, 2013
ISPGR
INTERNATIONAL SOCIETY FOR POSTURE & GAIT RESEARCH
MF
Gait and Mental Function
Saturday 22-Jun
Sunday 23-Jun
Monday 24-Jun
Tuesday 25-Jun
Wednesday 26-Jun
Time
Satellite Meeting Lena Ting (09:00 - 12:30) College Plaza
Free Time
Board Meeting (14:00 - 16:00) Kiku
Registration
Registration /Information Desk Open
Exhibitors
Exhibitor Move-in
Keynote Lecture I Pearson (8:30 - 9:30) Hisho A
Break (9:30 - 10:00)
Oral Session O.1 Tools & Methods I (10:00 - 11:00) Hisho A
Oral Session O.3 Neurological diseases I (10:00 - 11:00)
Oral Session O.5 Cognitive & cognitive impairments (10:00 - 11:00)
Oral Session O.2 Tools and Methods II (11:00-12:00) Hisho A
Oral Session O.4 Neurological diseases II (11:00 - 12:00) Hisho B
Oral Session O.6 Habilitation & rehabilitation (11:00 - 12:00) Botan
Lunch & Exhibitors (12:00 - 14:00)
Free Time / Excursions (12:00 - 19:00)
Consensus Meeting on Stabilometry - Towards International Standardization (13:00-14:30) Tsubaki
Symposia IX B. Bloem Y. Okuma (13:00 - 15:00) Botan
User Guide to Maximising the ISPGR Website (15:00 - 15:30) Tsubaki
Opening Ceremony (16:30 - 17:15) Hisho A
Opening Keynote Lecture Berthoz (17:20 - 18:20) Hisho A
Welcome Demonstration (18:20 - 19:00)
Welcome Reception (19:00 - 20:30) Hisho B
Keynote Lecture II Dieterich (8:30 - 9:30) Hisho A
Break (9:30 - 10:00)
Symposia I Joyce Fung (10:00 - 12:00) Hisho A
Symposia II Jorum L. Helbostad (10:00 - 12:00) Hisho B
Symposia III Toshihisa Murofushi (10:00 - 12:00) Botan
Lunch Seminar (12:00 - 13:00) Thomas Brandt - Hisho A Kimitaka Nakazawa - Hisho B
Break (13:00 - 13:15)
Poster Session I (13:15 - 15:15) Atorion B1F 2F
Break (15:15 - 15:30)
Poster Session II (15:30 - 17:30) Atorion B1F 2F
Dinner (17:30 - 19:30) Hisho A/B
Concert Collaboration of Japanese and Western Music (19:00 - 20:30) Atorion 4F
Keynote Lecture III Robinovich (8:30 - 9:30) Hisho A
Break (9:30 - 10:00)
Poster Session III (10:00 - 12:00) Atorion B1F 2F
Buffet Lunch Exhibitors
Seminar (Mitobe) (12:30-13:00) Hisho A
ISPGR Member Meeting (13:00 - 14:00) Hisho A
Promising Young Scientist Lecture (14:00 - 14:30) Hisho A
Oral Session O.7 Falls & falls prevention (14:30 - 15:30)
Oral Session O.8 Tools & methods III (15:30 - 16:30) Hisho A
Oral Session O.9 Neurological diseases III (14:30 - 15:30)
Oral Session O.10 Neurological diseases IV (15:30 - 16:30) Hisho B
Oral Session O.11 Sensorimotor control I (14:30 - 15:30)
Oral Session O.12 Falls & falls prevention II (15:30 -16:30) Botan
Poster Session IV (16:30 - 18:30) Atorion B1F 2F
Gala Dinner (19:00 - 21:00) Hisho A/B
Keynote Lecture IV Hausdorff (8:30 - 9:30) Hisho A
Break (9:30 - 10:00)
Symposia IV Fay Horak (10:00 - 12:00) Hisho A
Symposia V Adolfo Bronstein (10:00 - 12:00) Hisho B
Symposia VI Lynn Rochester (10:00 - 12:00) Botan
Lunch Seminar (12:00 - 13:00) Yoshiyuki Sankai - Hisho A Dai Yanagihara - Hisho B
Symposia VII Vivian Weerdesteyn (13:15 - 15:00) Hisho A
Symposia VIII Paul Hodges (13:15 - 15:00) Hisho B
Break (15:00 - 15:15)
Oral Session O.13 Tools & methods IV (15:15 - 16:15)
Oral Session O.14 Tools & methods V (16:15 - 17:15) Hisho A
Oral Session O.15 Sensorimotor control II (15:15 - 16:15)
Oral Session O.16 Sensor control III (16:15-17:15) Hisho B
Oral Session O.17 Modelling (15:15 - 16:15)
Oral Session O.18 Vestibular functions & disrorders (16:15-17:15) Botan
Closing Ceremony (17:15- 18:30) Hisho A

附錄二：參加研討會的名牌



附錄三：研討會論文封面

"Cutting Edge of Posture and Gait Research"

PROGRAM

2nd Joint World Congress

ISPGR / Gait & Mental Function

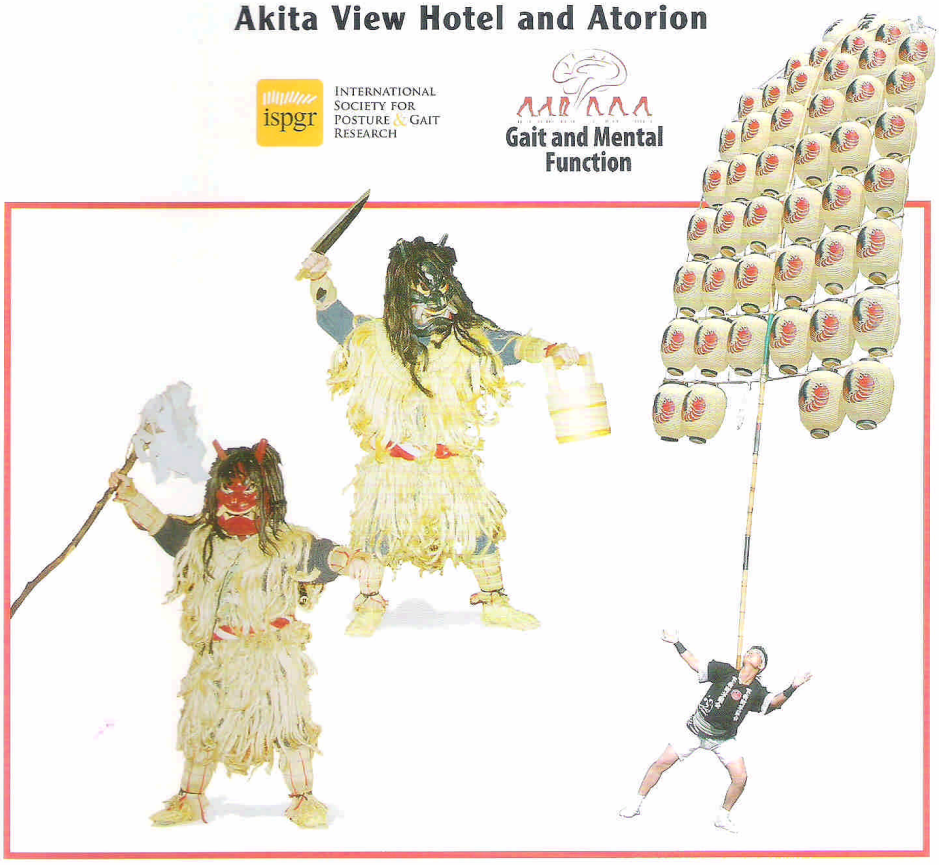
June 22nd-26th, 2013

Akita, Japan

Akita View Hotel and Atorion

ispgr INTERNATIONAL SOCIETY FOR POSTURE & GAIT RESEARCH

Gait and Mental Function



www.ispgr.org

附錄四：發表之摘要

Profound distortions of body image were reported when the GVS lagged the real motion by 90º. Subjects described these sensations as shearing and/or sliding of the top of the body over the bottom with the shear plane somewhere in the mid-lower thoracic region. We conclude that altered vestibular input distorts perceived body image in addition to its orientation in gravity.

E - Orthopedic diseases and injuries

P4-E-110 Effect of Kinesio Taping on EMG Onset in Patellofemoral Pain Syndrome

Yi-Wen Chang[1], **Shr-Ming Li**[1], **Hong-Wen Wu**[1]
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BACKGROUNG AND AIM: Patellofemoral pain syndrome is a common sport injury at knee, which is resulting from the abnormal tracking of the patella on the trochlear groove of the femur. Patellar malalignment occurs when the vastus medialis oblique (VMO) is weaker or has a delayed onset of activation than vastus lateralis (VL). Kinesio taping has been clinically used for correcting the patellar tilt. However, little is known about the effect of the kinesio taping on muscle activation timing in the patellofemoral pain syndrome. Therefore, the purpose of this study was to investigate the effect of kinesio taping on the electromyographic (EMG) characteristics in the subjects with patellofemoral pain syndrome. METHODS: Fourteen subjects with patellofemoral pain symdrome participated in this study (10 females and 4 males; age: 25.4±6.6 years; length: 162.3±8.7 cm; weight: 61.3±11.2 kg). Stair ascent and descent were performed for each subject. Two taping conditions were used (no tape and kinesio tape around patella). The surface EMG system was used (MA300, Motion Lab Systems Inc., USA) and two surface EMG electrodes were placed on the VMO and VL. The onset time differences between these two muscles were calculated. Positive value denoted an earlier onset of the VMO than the VL. Paired t test was used for comparing the difference between no tape and kinesio tape. RESULTS: Kinesio tape (1.1±7.4 ms) showed a significantly earlier onset of the VMO than no tape (-5.6±3.5 ms) during stair ascent ($p<0.005$). Kinesio tape (-4.0±6.5 ms) showed a significantly lesser onset time difference than no tape (-8.4±5.2 ms) during stair descent ($p<0.005$). CONCLUSIONS: Kinesio taping could be used to elicit an early contraction of the VMO for the people with patellofemoral pain syndrome. Kinesio taping might help improve the patellar stability in knee extension during stair ascent and descent.

P4-E-112 The effect of hip chondropathy on single-leg balance performance in adults

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BACKGROUND AND AIM: Impaired balance control has been reported in the elderly with advanced hip osteoarthritis (OA), yet this relationship has not been explored in young adults with hip chondropathy, or early hip joint degeneration. It is also unclear whether limitations in hip joint mobility and hip muscle strength are associated with balance performance in adults with hip chondropathy. This study aimed to determine whether people with hip chondropathy demonstrate impaired balance ability during a dynamic single-leg squat with eyes open (SquatEO) and single-leg standing task with eyes closed (StandEC), relative to controls. A secondary aim was to explore whether hip range of motion (ROM) and muscle strength were correlated to balance measures in the hip chondropathy group. METHODS: 63 adults (36 female, mean [SD] age: 37.6 [11.6] years) with hip chondropathy (diagnosed arthroscopically in the previous 12-24 months using the Outerbridge classification system for chondral damage) and 60 healthy controls (41 female, mean [SD] age: 35.7 [9.7] years) performed two single-leg balance tasks: SquatEO and StandEC while standing on a Nintendo Wii balance board. All tests were performed with the participant barefoot, on the surgical leg of hip

附錄五：發表之海報

Effect of Kinesio Taping on EMG Onset in Patellofemoral Pain Syndrome

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Introduction

- Patellofemoral pain syndrome is a common sport injury at knee, which is resulting from the abnormal tracking of the patella on the trochlear groove of the femur. Patellar malalignment occurs when the vastus medialis oblique (VMO) is weaker than vastus lateralis (VL) or has a delayed onset of activation. There are some biomechanical factors associated with the patellofemoral pain syndrome, such as the pronated foot and hip abductors weakness.
- Kinesio taping is a clinical treatment which has been often used in the management of sport injury, such as the correction of the patellar malalignment. However, there were very little studies addressing the effect of kinesio taping in the patellofemoral pain syndrome. Therefore, the purpose of this study was to investigate the effect of the kinesio taping on the electromyographic (EMG) onset timing in the patellofemoral pain syndrome.

Methods

- Fourteen subjects with patellofemoral pain syndrome participated in this study (10 females and 4 males; age: 25.4±6.6 years; length: 162.3±8.7 cm; weight: 61.3±11.2 kg). The surface EMG system was used (MA300, Motion Lab Systems Inc., USA) and two surface EMG electrodes were placed on the VMO and VL.
- Four kinesio taping conditions were used, including no taping, patellar corrective taping, hip abductor taping and arch supporting taping (kinesio™ tex tape, Fig 1). Five trials in each taping condition during stair ascent and descent were collected for each subject (Fig 2).
- The EMG onset differences between VL and VMO in the stance phase were calculated. Positive value denoted an earlier onset of the VMO than the VL. One-way ANOVA with repeated measures was used for comparing the onset difference among the four taping conditions. Post-hoc analysis (LSD) was used if the within-subject factor was significant. The significant level was set as $\alpha = 0.05$.

(A) (B) (C)

Fig 1: (A) Patellar corrective taping, (B) Hip abductor taping, (C) Arch supporting taping.

Results

- Significant difference in onset difference was found during stairs ascent ($p<0.05$, Table 1). No taping (-5.2 ms) showed significantly lesser onset difference than hip abductor taping (0.3 ms) and patellar corrective taping (2.3 ms). The hip abductor taping and patellar corrective taping could elicit an early onset of the VMO during stairs ascent.
- Significant difference in onset difference was found during stairs descent ($p<0.001$, Table 1). No taping (-8.2 ms) showed significantly lesser onset difference than hip abductor taping (-1.0 ms), patellar corrective taping (-3.3 ms) and arch supporting taping (0.4 ms). The hip abductor taping, patellar corrective taping and arch supportive taping could help decrease the delayed onset of the VMO during stairs descent.

Table 1: EMG onset difference (ms) in four taping conditions.

	No Taping	Hip Abductor Taping	Patellar Corrective Taping	Arch Supporting Taping
Stairs Ascent	-5.2±3.3	0.3±5.5*	2.3±6.3*	-2.0±7.7
Stairs Descent	-8.2±5.4	-1.0±9.4†	-3.3±6.3†	0.4±5.4†

*Significant difference compared to no taping ($p<0.05$).

†Significant difference compared to no taping ($p<0.001$).

Discussion

- Cowan et al. (2002) indicated that the onset difference between the VMO and VL was decreased following McConnell taping due to the modification in patellar alignment, proprioceptive feedback and the pain modulation. The patellar corrective taping used in this study could provide a medial force on patella and stabilize the patella without direct compression on the patella.
- Cichanowski et al. (2007) indicated that hip abductor weakness was found in the affected side in the basketball players with patellofemoral pain syndrome but not in the unaffected side. The hip abductor taping used in this study might facilitate more hip abductor activation to reduce the hip adduction angle, decrease the Q angle, maintain the patellar alignment and decrease the delayed onset of the VMO.
- Cheung et al. (2009) indicated that VMO would have an early onset when the anti-pronated insole was used in running. The arch supportive taping used in this study could limit foot pronation and elicit the early onset of the VMO.

Conclusion

- Kinesio taping might help improve the patellar stability in knee extension and assist in eliciting an early onset of the VMO for the people with patellofemoral pain syndrome during stairs ascent and descent.

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Acknowledgement

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P4-E-110

國科會補助計畫衍生研發成果推廣資料表

日期:2014/01/30

國科會補助計畫	計畫名稱: 使用儀器治療對於慢性踝關節不穩定運動員本體感覺的影響
	計畫主持人: 張怡雯
	計畫編號: 101-2410-H-028-003- 學門領域: 運動生物力學

無研發成果推廣資料

101 年度專題研究計畫研究成果彙整表

計畫主持人：張怡雯	計畫編號：101-2410-H-028-003-
計畫名稱：使用儀器治療對於慢性踝關節不穩定運動員本體感覺的影響	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	3	3	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	1	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	1	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	無

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：□已發表 □未發表之文稿 ■撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：（以 100 字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）

本研究目的為探討儀器治療使用後是否會改變踝關節的本體感覺與動態站立平衡，儀器介入包括冷療、經皮神經電刺激和超音波，在使用儀器治療之前和之後，評估踝關節患側與健側的本體感覺及平衡測試。在踝關節本體感覺測試中，患側的誤差比健側較大，而冷療介入後對於站立平衡有負面影響，但經皮神經電刺激或超音波介入後對於站立平衡有正面影響。當運動員接受冷療後，若立即回到運動場訓練或比賽，可能會提高受傷的發生率。對於曾有過踝扭傷經驗者，也須注意本體感覺回饋能力受到影響。這些資訊將可提供選手、教練和運動傷害防護師作為處理踝扭傷運動員或設計復健計畫時的參考依據。預計將結果撰寫成稿件，投稿於國際或國內期刊發表。