

The Effects of Leg Spiral Kinesiology Tape Technique on
Postural Sway in Clients with Multiple Sclerosis: A
Quantitative Preliminary Study

Lead author:

Heather Dowell

York College, UK

Co-author & corresponding author:

Steven Ross

Award Leader for Foundation Degree Sports Therapy

York College, UK

Sim Balk Lane, York, YO23 2BB

sross@yorkcollege.ac.uk (email address publishable)

07951 557 053

01904 770 360

Abstract

Title: The Effects of Leg Spiral Kinesiology Tape Technique on Postural Sway in Clients with Multiple Sclerosis: A Quantitative preliminary Study

Objectives: To understand the effectiveness of leg spiral kinesiology tape technique as a rehabilitation strategy for the treatment of postural sway and balance in patients with Multiple Sclerosis.

Study Design: Experimental cross-over design was used to conduct the study with laboratory based data collection technique.

Method/Protocol: A random sample of 6 participants with Multiple Sclerosis was assessed. Participants postural sway measurements were assessed twice using Wii Balance Board analysis without leg spiral kinesiology tape application and again twice with leg spiral kinesiology tape application.

Key Results: A mean difference in Centre of Pressure (CoP) during quiet stance without spiral kinesiology tape application ($29.2\text{cm} \pm 13.07$) and with application of spiral kinesiology tape ($21.08\text{cm} \pm 8.67$) was calculated at -8.12cm ($\pm 11.71\text{cm}$; 90% CI $-18\text{cm} - 1.5\text{cm}$). The application of kinesiology tape led to a likely small beneficial effect.

Conclusion: It was concluded that the use of spiral kinesiology tape application can lead to a likely small improvement in postural sway in the acute instance.

Key words: Balance; Gait; Stability; Quiet Stance

Running Title: Effects of k-tape on postural sway.

Introduction

Multiple sclerosis (MS) affects mostly young and middle aged adults between the ages of twenty and forty years¹. Some of the main characteristics of MS include fatigue, pain, spasticity and balance and gait problems². This in turn can disrupt occupation, social function and activities of daily living. Within the last two decades it has been suggested³ that mean survival time of patients with MS has increased from an estimated fourteen years to around forty years from diagnosis. It has been noted that possible symptomatic therapy and rehabilitation may have been responsible for this improvement in life expectancy.

Although, force platforms appear to be the most suitable clinical method for assessing small changes in postural sway, many force platforms used in laboratories are expensive and require appropriate software, yet there are cheaper methods of using force plate analysis, such as the Nintendo Wii Balance Board. The Wii fit Balance Board by Nintendo has been used throughout many research studies which have assessed their usage, validity and reliability of assessing standing balance^{4,5}. These studies concluded that the Wii balance board fits the criteria as a valid, reliable and inexpensive tool of assessing centre of pressure measurements when compared to a 'gold standard' laboratory testing force platform. Research has also supported the use of Wii Balance Board on disabled clients who whom balance is impaired⁶ therefore the current research looks to add to previous literature and use this inexpensive, valid and reliable tool for assessing postural sway in persons with MS.

A major and vastly growing rehabilitation intervention for muscular skeletal issues is the use of kinesiology tape. Research relating to the use of kinesiology tape suggests an ability to decrease disability and pain⁷ improve limb control and function⁸ and assist joint range of motion⁹. Studies by^{10,11,12} found kinesiology taping to have little or no effect on proprioception and balance at the ankle. Conversely, one study¹³ concluded that kinesiology tape can benefit mechanical correction techniques and help with muscular performance. The above studies however have addressed the effects of kinesiology tape on healthy subjects and not those with balance impairing illnesses. Nevertheless, further research^{14,15} looked into kinesiology tape effectiveness on balance within stroke patients and patients with spinal cord injury, the studies found kinesiology taping to have significant improvements to asymmetric gait and walking speeds. These studies combined show considerable positivity in the use of kinesiology tape on sway and balance in the less able client group and fire the potential for findings to be applied to those with clients with MS. Some studies have presented research within the MS population, in a study¹⁶ into the effects of kinesiology taping on standing

Kinesiology tape for postural sway in MS

balance in persons with MS; general positive effects were seen in subjects showing decreased sway levels at variable input, however, a similar study found kinesiology taping to have no effect on sway and standing balance in subjects with MS¹⁷. With these opposing views and findings, it opens the question of which kinesiology tape techniques were used within previous studies and how were they applied in order to gain such effects.

There is a deficiency of research into the leg spiral kinesiology tape technique and its proposed effects on postural sway. Some literature has supported the use of the leg spiral technique to sustain the medial foot arch and ankle by announcing the ankle to have doubled the role of sway detection by somatosensory input and sway control¹⁸. Very little research has been conducted into the effects of leg spiral taping techniques on bodily balance, however one study¹⁹ found spiral taping to have better effects on balance when applied to the cervical region due to stimulation of the somatic senses of which influence body proprioception. This current research study is looking at the leg spiral kinesiology taping technique; therefore these previous findings are ineffectual at supporting the use of leg spiral taping in this research context, thus providing justification for further research into this field and of which populations the findings can be applied.

Research into the use of leg spiral kinesiology tape technique on MS clients is yet to be distinguished. Therefore, with previous research to support the need for further development in the field of symptomatic treatment for patients with MS, and with particular interest into kinesiology tape application on postural sway, this research thesis will assess the effectiveness of leg spiral kinesiology tape application on postural sway in clients with multiple sclerosis.

Material and Methods

Stratified random sampling was used to recruit participants ($n= 6$; 2 male; age, 57.3 ± 9.6 years; height, $168.7\text{cm} \pm 15.1\text{cm}$; weight, $73.4\text{kg} \pm 13.2\text{kg}$) receiving regular care from a specialist MS physiotherapy clinic in the north of England. Inclusion criteria included; completion of informed consent and an ability to produce a quiet stance without the support of a walking aid. The research employed the use of an experimental crossover design to reduce the possibility of a learning, placebo or Hawthorne effect²⁰ during data collection. As a result it was randomised as to whether participants underwent data collection with tape first or without tape first.

The study took place in a controlled rehabilitation gym, specially equipped with relevant supports and assisting aids for disabled clients. Participants were asked to stand on a Nintendo Wii fit Balance Board (Nintendo Co Ltd, Kyoto, Japan), to provide a control and input variable result of their postural sway measured by centre of pressure. The control results required no tape application and subjects were asked to provide a natural quiet stance for 30 seconds followed by a 30 second rest period and then a repetition of the previous stance.

During data collection the Wii Balance Board was placed in-between a set of parallel bars in order to provide support for participants in the event of fatigue or loss of balance. The variable result required a similar replicate of the previous stance protocol, the only difference being the subjects now had a kinesiology leg spiral taping technique applied to both legs to decrease hip internal rotation and knee flexion using RockTape (RockTape UK, Wilvenhoe, UK) The leg spiral technique was applied with a one inch anchor (under 0% tension) applied to the lateral boarder of the foot at the base of the 5th metatarsal extending across the plantar surface of the foot through the medial arch with around 70% tape tension. Tension was then reduced to 20% over the anterior ankle and around the back of the calf complex, a further 70% stretch is applied when moving across the medial aspect of the tibiofemoral joint, spiralling across the anterior thigh to the gluteals, finishing at the posterior superior iliac spine with a final inch of 0% tape tension (fig. 1).

Postural sway measurements were taken immediately after tape application. The two results taken from both variable groups were used to calculate a mean score. The Wii fit Balance Board was synced with a laptop via the Bluetooth function. Data output was generated though a customised centre of pressure and centre of mass software package developed at Teesside University (Middlesbrough, UK) and then exported to Microsoft Excel for interpretation.

Kinesiology tape for postural sway in MS

Before participation within this study each subject completed a health screen questionnaire and informed consent form in order to assess their suitability for the project and gain their approval, gate keeper consent was also enforced. All informed consent forms were stored in a locked filing cabinet. The research proposal for this study was sent and approved by the York College (York, UK) ethics committee. Participants were given the right to withdraw from the project at any time, and all data collection was conducted under the supervision by a qualified physiotherapist.

Figure 1. Kinesiology taping application



Statistical Methods

A paired samples t test was used to calculate statistical significance with significance level at $p < 0.05$ (SPSS version 21) and a custom spreadsheet²¹ was used to calculate magnitude based inferences. Given the relatively small sample size used it was concluded that magnitude based inferences would help to provide more robust conclusions on the sample than using p value alone as null-hypothesis testing can be misleading by failing to provide information on the magnitude of the statistic and error of measurement²². For this reason p value was calculated only to be used in magnitude based inference calculations and not reported as a measure of effect.

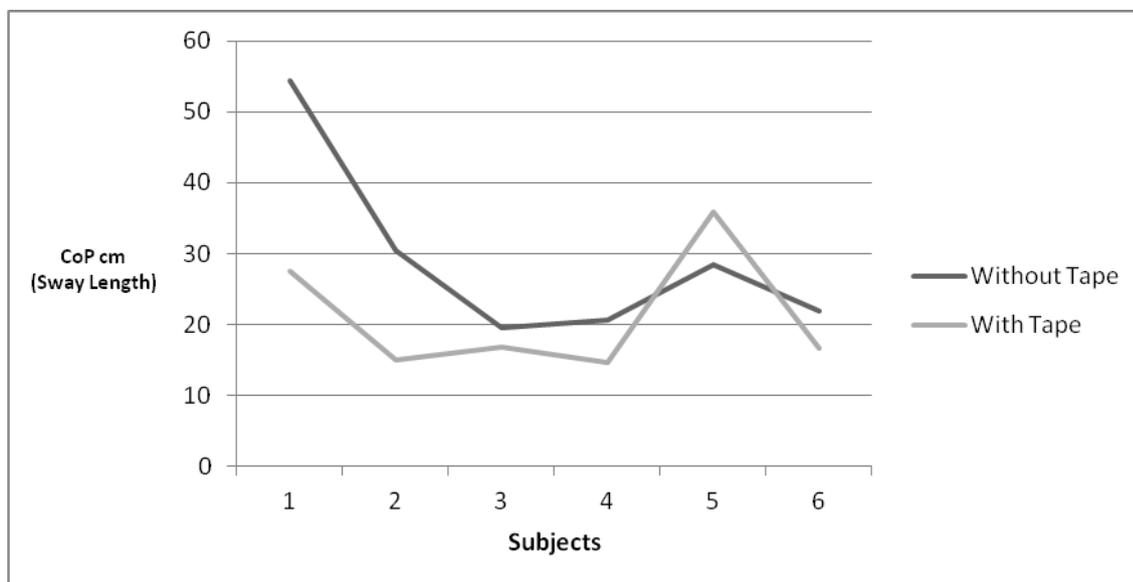
The smallest worthwhile effect was calculated at -2.21cm in raw units with uncertainty of estimates expressed as 90% confidence intervals (CI). The chances of the effect being considered substantial or trivial was interpreted using the following scale as suggested by Hopkins, Marshall and Batterham²³; 25-75%, possibly; 75-95%, likely; 95-99.5%, very likely; >99.5% most likely.

Results

A mean difference in Centre of Pressure (CoP) during quiet stance (cm) without the use of spiral application kinesiology tape application ($29.2\text{cm} \pm 13.07$) and with the use of spiral application of kinesiology tape ($21.08\text{cm} \pm 8.67$) was calculated at -8.12cm ($\pm 11.71\text{cm}$; 90% CI $-18\text{cm} - 1.5\text{cm}$). The percentage changes that the difference in means was beneficial/trivial/harmful were calculated at 87/9/4 and therefore likely small beneficial, very unlikely harmful.

Figure 2 shows a line graph of which easily displays the correlation of the results, the graph clearly shows visual differences between control and independent variable values. Figure 2 shows how most subjects displayed lower centre of pressure (CoP) measurements when tape has been applied, for example subject 1 shows a decrease in CoP when tape has been applied by around 25cm. Subject 5 however is exempt from this pattern as they showed an increase in CoP when tape had been applied by around 7cm. The exact difference of these values can be seen in table 2.

Figure 2: Mean CoP (cm); with and without tape application.



Discussion

Multiple Sclerosis has seized over 100,000 suffering patients in the UK alone. Previous research has attempted to understand the growing rehabilitation strategies used throughout all medicine, however the endeavour to work specifically within the MS population is sparse and the need for research into this area has been critiqued and analysed concluding the necessity for beneficial rehabilitation techniques on problematic symptoms.

The raw data results of this study displayed kinesiology taping to have a positive effect on postural sway within MS subjects with statistical analysis suggesting a likely small beneficial effect. These findings are contrasting to that of research by Halseth *et al*¹⁰, Murray and Husk¹¹ and Simoneau *et al*¹², where kinesiology taping on the ankle did not conclude a significant difference when researching into proprioception measures, the present study however, used a taping technique of which incorporated full lower limb proprioceptive enhancers, therefore the findings of the present study may not be a cofounder of other previous research. On the contrary, Atkas and Baltaci¹³ did suggest tape as a beneficial mechanical correction technique, which in turn can assist muscular performance.

With the present study using a kinesiology taping technique of which combines supported proprioceptive benefits and mechanical correction techniques^{18,19}, it can be suggested that the protocol of this present study builds a combination of kinesiology taping benefits and styles of which have not been used throughout research and literature to date.

The results suggest that the taping application had a likely small beneficial effect on MS clients to assist with postural sway with only a 9% chance of the events being trivial and 4% harmful. Through raw data and analysis this study suggests that kinesiology taping had initial positive effects on postural sway of the clients used. Previous research studies^{10,11,12,13,14} have failed to obtain inferences based on magnitudes within their results; for that reason it is difficult to compare this studies inference results to that of previous research, in consequence this study can claim higher analysis and statistical value than those studies investigated formerly. The magnitude based inference calculation is important to determine a conclusion based on the size of effect the intervention has had on the dependant variable, it has been explained that statistical differences are not always the major result needed within research²⁴ and actually research should apply less attention to *p* values²⁵. Therefore

Kinesiology tape for postural sway in MS

because recording of magnitude based inferences in previous research has been unsuccessful, it can be announced that this current study is more useful in displaying the positive effects of kinesiology tape on postural sway in MS clients. It can also state that this present research has more in depth data analysis of which can be applied more successfully to its target audience.

It is highly unlikely the results of this research are concluded positively due to a learning effect as a cross over design was implemented to avoid such outcomes. Although this learning effect was addressed through the research design it does not exclude the possibility of results being affected by a placebo or Hawthorne effect.

A major limitation of this study is the sample size of subjects used. The effect size calculated indicates kinesiology tape to be a positive intervention of reducing postural sway. Previous research has found significance within their results used sample sizes of between 11 and 30 subjects^{14,15,16}. This suggests that sample size has a major role in the significance of results and therefore with larger sampling size this present study may have obtained results of some significance.

Previous studies have found the Wii Balance Board to be a valid and reliable assessment tool for balance and postural sway^{4,5,26,6}. All of these studies however have not specified the source or type of computer software used in conjunction with the Wii Balance Board, therefore poses the question of whether the software used in the present study has had an effect on the results obtained. The software used is able to provide centre of pressure and centre of mass measurements, however there is limited previous research to support the validity and reliability of this specific software. During data collection issues were encountered whereby the software had a tendency to crash during assessment and needed recalibrating before each platform measurement was taken implying each measurement had a different calibration, this in turn could affect the CoP results. As a result, further research into this software programme should be carried out to eliminate the possibility of its usage affecting the results of this current research paper, thus increasing validity of the study.

Previous research has shown the Wii Balance Board to not be the most affective and accurate tool for measuring centre of pressure^{26,27,28,17}; therefore there are alternative methods of measurement of which can be used throughout future assessments. Many research studies have assessed and compared the use of a Kistler forceplate and found results to be consistently valid and reliable^{29,30,31}. Research has also been carried out to assess similar methods such as the use of a Bioware Gaitrite force plate; this has also

Kinesiology tape for postural sway in MS

proven a valid and reliable tool for measuring centre of pressure in healthy and disabled clients^{32,33}. Research has shown these appliances to be the 'gold standard' for force plate analysis and therefore further research on this topic should consider using these more advanced assessment tools.

Further recommendations would also suggest that the kinesiology tape application is extended to a 48 hour period. Some studies with positive outcomes applied kinesiology tape to their subjects for a total of 48 hours before CoP measurements were taken^{15,16}. Therefore it is suggested for future research to measure a control postural sway, postural sway when tape has been immediately applied and measurements taken again on the day of tape removal. This will increase the reliability of the results as three measurements will now be taken and as supported by Stedje, Kroskie and Docherty³⁴ the kinesiology tape has more time to take effect upon sensory and muscular structure and the dependant variable being investigated.

With previous research into the symptomatic management of MS being controversial and somewhat unspecific, this research study intended to assess new found technological methods of rehabilitation and apply them to specific populations in order to manage, assist and potentially regress problematic symptoms. The results of the current study support a likely small beneficial effect of spiral kinesiology taping application for acutely improving postural sway in MS populations. Although there is a need for more robust research with samples which more accurately represent the MS population, the results of this preliminary investigation suggest that kinesiology taping may be a relatively low cost means of producing beneficial effects for MS patients.

Acknowledgements

The authors would like to extend gratitude to the staff of Cyclone Mobility Plus, Ottingham, UK for support during data collection, use of clinic facilities and advertising for client requirement for the study. Thanks also go to Tom MacPherson of the School of Social Sciences and Law of Teesside University for providing the centre of pressure software used to collect data.

References:

1. Rolak, L. A. (1992) Multiple Sclerosis. In. Evans, R., Baskin, D. and Yatsu, F. (eds). *Prognosis of Neurological Disorders*. New York: Oxford University Press Inc.
2. Bigi, S. and Yeh, E. A. (2013) Symptomatic Treatment in Multiple Sclerosis. *European Neurological Review*, **8**, 130-135.
3. Mertin, J. (1994) Rehabilitation in muscle sclerosis. *Annals of Neurology*. 36, pp.s130-s133.
4. Clark, R. A., Bryant, A. L., Pua, Y., McCory, P., Bennell, K. and Hunt, M. (2010) Validity and Reliability of the Nintendo Wii Balance Board for Assessment of Standing Balance. *Gait and Posture*, **31**, 307-310.
5. Park, D. and Lee, G. (2014) Validity and Reliability of Balance Assessment Software Using the Nintendo Wii Balance Board: Usability and Validation. *Journal of NeuroEngineering and Rehabilitation*, 11-99.
6. Holmes, J. D., Jenkins, M. E., Johnson, A. M., Hunt, M. A. and Clark, R. A. (2012) Validity of the Nintendo Wii(R) Balance Board for the Assessment of Standing Balance in Parkinson's Disease. *Clinical Rehabilitation*, **27**, 361-366.
7. Castro-Sanchez, A. A., Lara-Paloma, I. C., Mataaran-Penarrocha, G. A., Fernandez-Sanchez, M., Sanchez-Labraca, N. and Arroyo-Morales, M. (2012) Kinesio Taping Reduces Disability and Pain Slightly in Chronic Non-Specific Low Back Pain: A Randomised Trial. *Australian Physiotherapy Association*, **58**, 89-95.
8. Yasukawa, A., Patel, P. and Sisung, C. (2006) Pilot Study: Investigating the Effects of Kinesio Taping in an Acute Paediatric Rehabilitation Setting. *American Journal of Occupational Therapy*, **60**, 104-110.

9. Gonzalez-Iglesias, J., Fernandez-de-las-Penas, C., Cleland, J., Huijbregts, P. and Gutierrez-Vega, M. D. R. (2009) Short Term Effects of Cervical Kinesio Taping on Pain and Cervical Range of Motion in Patients with Acute Whiplash Injury: A Randomised Clinical Trial. *Journal of Orthopaedic Sports Physical Therapy*, **39**, 515-521.
10. Halseth, T., McChesney, J. W., DeBeliso, M., Vaughn, R. and Lien, J. (2004) The Effects of Kinesio Taping on Proprioception at the Ankle. *Journal of Sports Science and Medicine*, **3**, 1-7.
11. Murray, H. and Husk, L. (2001) Effect of Kinesio Taping on Proprioception in the Ankle. *Journal Sports Physical Therapy*, **31**, A-37.
12. Simoneau, G. G., Degner, R. M., Kramper, C. A. and Kittleson, K. H. (1997) Changes in Ankle Joint Proprioception Resulting from Strips of Athletic Tape Applied Over the Skin. *Journal of Athletic Training*, **32**, 141-147.
13. Aktas, G. and Baltaci, G. (2011) Does Kinesiologytaping Increase Knee Muscle Strength and Functional Performance. *Isokenetics and Exercise Science*, **1**, 149-155.
14. Kim, W., Choi, Y., Lee, J. and Park, Y. (2014) The Effect of Muscle Facilitation Using Kinesio Taping on Walking and Balance in Stroke Patients. *Journal of Physical Therapy Science*, **26**, 1831-1834.
15. Tamburella, F., Scivoletto, G. and Molinari, M. (2014) Somatosensory Inputs by Application of KinesioTaping: Effects on Spasticity, Balance and Gait in Chronic Spinal Cord Injury. *Frontiers in Human Neuroscience*, **8**, 367.
16. Cortesi, M., Cattaneo, D. and Jonsdottir, J. (2011) Effect of Kinesio Taping on Standing Balance in Subjects with Multiple Sclerosis: A Pilot Study. *NeuroRehabilitation*, **28**, 365-372.

17. Mazzei, G. and Giovannelli, T. (2014) Kinesio Taping Does Not Improve Standing Balance in Subjects with Multiple Sclerosis: A Pilot Single Blind, Randomised Controlled Trial. *Italian Journal of Physiotherapy*, **4**, 84-89.
18. Lakie, M., Calpan, N. and Loram, I. D. (2003) Human Balancing of an Inverted Pendulum with a Complaint Linkage: Neural Control by Anticipatory Intermittent Bias. *Journal of Physiology*, **551**, 357-370.
19. Lee, B. H., Lee, H. R., Kim, K. M., Lee, J. H. and Kim, K. Y. (2015) Effects of Spiral Taping Applied to the Neck and Ankle on the Body Balance Index. *Journal of Physical Therapy and Science*, **27**, 79-82.
20. Pilot, D. F. and Beck, C. T. (2008) *Nursing Research: Generating and Assessing Evidence for Nursing Practice*. Philadelphia: Lippincott Williams and Wilkins.
21. Hopkins, W.G., (2007) A spreadsheet for deriving a confidence interval, mechanistic inference and clinical inference from a p value. *Sportscience* 11, 16-20 Available: sportssci.org/2007/wghinf.htm [accessed: 24.11.2015].
22. Batterham, A. M., and Hopkins, W. G., (2006) Making Meaningful Inferences About Magnitudes. *International Journal of Sports Physiology and Performance*. **1**, pp. 50-57.
23. Hopkns, W. G., Marshall, S., Batterham. A., and Hanin, J. (2009) Progressive statistics for studies in sports medicine and exercise science. *Medicine and Science in Sports and Exercise*. 41(1), pp. 3-12.
24. Kline, R. B. (2004) *Beyond Significance Testing: Reforming Data Analysis Methods in Behaviour Research*. Washington DC: American Psychological Association.

25. Cohen, J. (1990) Things I have Learnt (So Far). *Journal of American Psychology*, **45**, 1304-1312.
26. Young, W., Ferguson, S., Brault, S. and Craig C. (2011) Assessing and Training Standing Balance in Older Adults: A Novel Approach Using the 'Nintendo Wii' Balance Board. *Gait and Posture*, **33**, 303-305.
27. Wikstrom, E. A. (2012) Validity and Reliability of Nintendo Wii Fit Balance Scores. *Journal of Athletic Training*, **47**, 306-313.
28. Goble, D. J., Come, B. L. and Fling, B. W. (2014) Using the Wii Fit as a Tool for Balance Assessment and Neurorehabilitation: The First Half Decade of "Wii Search". *Journal of NeuroEngineering and Rehabilitation*, **11**, 1-9.
29. Haas, M, B., and Burden, M, A. (2000) Validity of Weight Distribution and Sway Measurements of the Balance Performance Monitor. *Physiotherapy Research International*, **1**, 19-32.
30. Walshe, D, A., Wilson, G, J., Murphy, A, J. (1995) The Validity and Reliability of a Test of Lower Body Musculotendinous Stiffness. *European Journal of Applied Physiology and Occupational Physiology*, **3**, 332-339.
31. Mickleborough, J., Van Der Linden, M, L., Richards, J. and Ennos, A, R. (2000) Validity and Reliability of a Kinematic Protocol for Determining Foot Contact Events. *Gait and Posture*, **1**, 32-37.
32. McDonough, A, L., Batavia, M., Chen, F, C., Kwon, S. and Ziai, J. (2001) The Validity and Reliability of the GAITRite Systems Measurements: A Preliminary Evaluation. *Archives of Physical Medicine and Rehabilitation*, **3**, 419-425.

33. Bilney, B., Morris, M. and Webster, K. (2003) Concurrent Related Validity of the GAITRite Walkway System for Quantification of the Spatial and Temporal Parameters of Gait. *Gait & Posture*, **1**, 68-74.
34. Stedje, H., Kroskie, R. and Docherty, C. (2012) Kinesio Taping and the Circulation an Endurance Ratio of the Gastrocnemius Muscle. *Journal of Athletic Training*, **47**, 635-642.