Effect of Strapping on Achilles Tendon function during Gait

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Introduction:
The Achilles tendon (AT) is a highly structured peritendinous tissue with no synovial membrane formed by a single tendon of the gastrocnemius muscle merging with the soleus which inserts into the calcaneus (Cook *et al*, 2002). It has two main components, the medial and lateral heads, and its main action is to plantarflex the ankle. While previous studies (Kader *et al*, 2002; Werd, 2007) have investigated the treatment regimes involving AT and the effects of taping in specific conditions such as plantar fasciitis, there is a clear paucity of information on the effects of the strapping on the AT normally used for conditions such as Achilles Tendinopathy. The main objective of this study was to look at the effect of high dye strapping on the AT during gait. It was proposed to investigate the plantarflexor action of the AT by assessing the electrical activity of the gastrocnemius muscle during gait with and without the application of strapping in normal subjects.

Method:
25 subjects (19 females and 6 males) with an average weight of 67.24 kg (range 52–94 kg), average height of 162.64 cm (range 149–183.5cm) who gave a full informed consent and had no musculoskeletal pathology were recruited to participate in the study. Ethical approval for the study was sought and granted by the University Ethics Committee. A pocket EMG unit (BTS Bioengineering, Italy) was employed to record the electrical activity of Gastrocnemius. Foot switches were attached allowing gait information to be captured. The data acquisition system was attached around the subjects waist using an adjustable belt and allowed wireless data transmission. The data were sampled at 2000Hz. Subjects were tested under 2 conditions: 1) No Strapping; 2) High Dye strapping applied to the dominant foot. Strapping was applied by a trained Podiatrist using the same strapping material and technique. The location of the sensors were placed over the medial and lateral heads of the gastrocnemius muscle following the SENIAM guidelines. Subjects were asked to walk in a straight line while EMG data was collected. Each walk was repeated twice recorded as Walk 1 and Walk 2. This was repeated with strapping applied to the same leg and EMG data was collected. The procedure and data collection was in sequence with data being collected on the same day for each subject with the strapped walk following the non-strapped walk. The data from the medial and lateral muscle were analysed separately to extract the following variables: stride duration, time on single leg stance, percentage time on single leg stance, mean EMG, maximum EMG, time to reach peak EMG and integrated EMG.

Results: No significant differences were found in each of the variables collected on the application of high Dye strapping using pared t-tests. However there were general trends noted in muscle activity patterns and chi-square tests produced no significant differences suggesting variability in muscle activity on the application of tape. Tables 1, 2 and 3 summarise some of the results.

Conclusion: The study reports no statistically significant results on changes in EMG activity of the gastrocnemius muscle on the application of tape in any of the variables collected though trends were clearly visible suggesting the strapping had an effect on the muscle activation patterns. It is possible that this was due to a small sample size and normal subject group. The study may produce significant results with changes in study design such as pathological subjects and a larger sample size.

Table 1: P-Values: Time analysis and EMG activity for the Strapped walks (SW) 1 & 2, Normal walk (NW)

	NW & SW 1		NW & SW 2		SW 1 & 2	
StD	0.83		0.23		0.06*	
SLS	0.306		0.34		0.22	
% SLS	0.374		0.44		0.31	
	Med	**Lat**	**Med**	**Lat**	**Med**	**Lat**
Mn	0.28	0.04*	0.10	0.06*	0.12	0.92
Mx	0.24	0.36	0.74	0.56	0.05*	0.64
TTP	0.48	0.798	0.65	0.64	0.29	0.86
iEMG	0.21	0.04*	0.10	0.48	0.34	0.36

Table 2: Mean (SD) for EMG Time Analysis for Normal walk, Strapped walks 1 & Strapped walk 2

Mean (SD)	StD	SLS	% SLS
Normal walk	1.06 (0.09)	0.55 (0.11)	0.52 (0.09)
Strap walk 1	1.06 (0.08)	0.57 (0.16)	0.53 (0.13)
Strap walk 2	1.04 (0.09)	0.53 (0.14)	0.51 (0.11)

Stride duration (StD), Time in single leg stance (SLS), Percentage time in single leg stance (% SLS), EMG), Max EMG (Mx EMG), Time to reach peak EMG (TTP EMG) and integrated EMG (iEMG).
Paired t-test with Bonferroni correction (0.05/3 = 0.017). P- value < 0.017 for significantly different data. * denotes values closes to the P-value

Table3: Mean (SD) for EMG Muscle Activity for Normal walk, Strapped walks 1 & Strapped walk 2

Mean (SD)	Mn		Mx		TTP		iEMG	
	GM	GL	GM	GL	GM	GL	GM	GL
Normal walk	0.06 (0.045)	0.07 (0.028)	0.26 (0.16)	0.28 (0.123)	0.35 (0.120)	0.42 (1.80)	0.38 (0.371)	0.44 (0.231)
Strap walk 1	0.07 (0.034)	0.08 (0.031)	0.23 (0.108)	0.31 (0.204)	0.38 (0.208)	0.40 (0.189)	0.47 (0.295)	0.53 (0.283)
Strap walk 2	0.08 (0.048)	0.08 (0.033)	0.28 (0.145)	0.29 (0.168)	0.43 (0.181)	0.39 (0.146)	0.53 (0.32)	0.48 (0.246)

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Acknowledgements: Thanks to BTS Bioengineering, Suffolk, UK and BTS Bioengineering, Italy for lending the EMG system used within this study.