

A pilot study comparing blinded instrumentally obtained resting muscle tonus (RMT) in low back pain subjects with a control group

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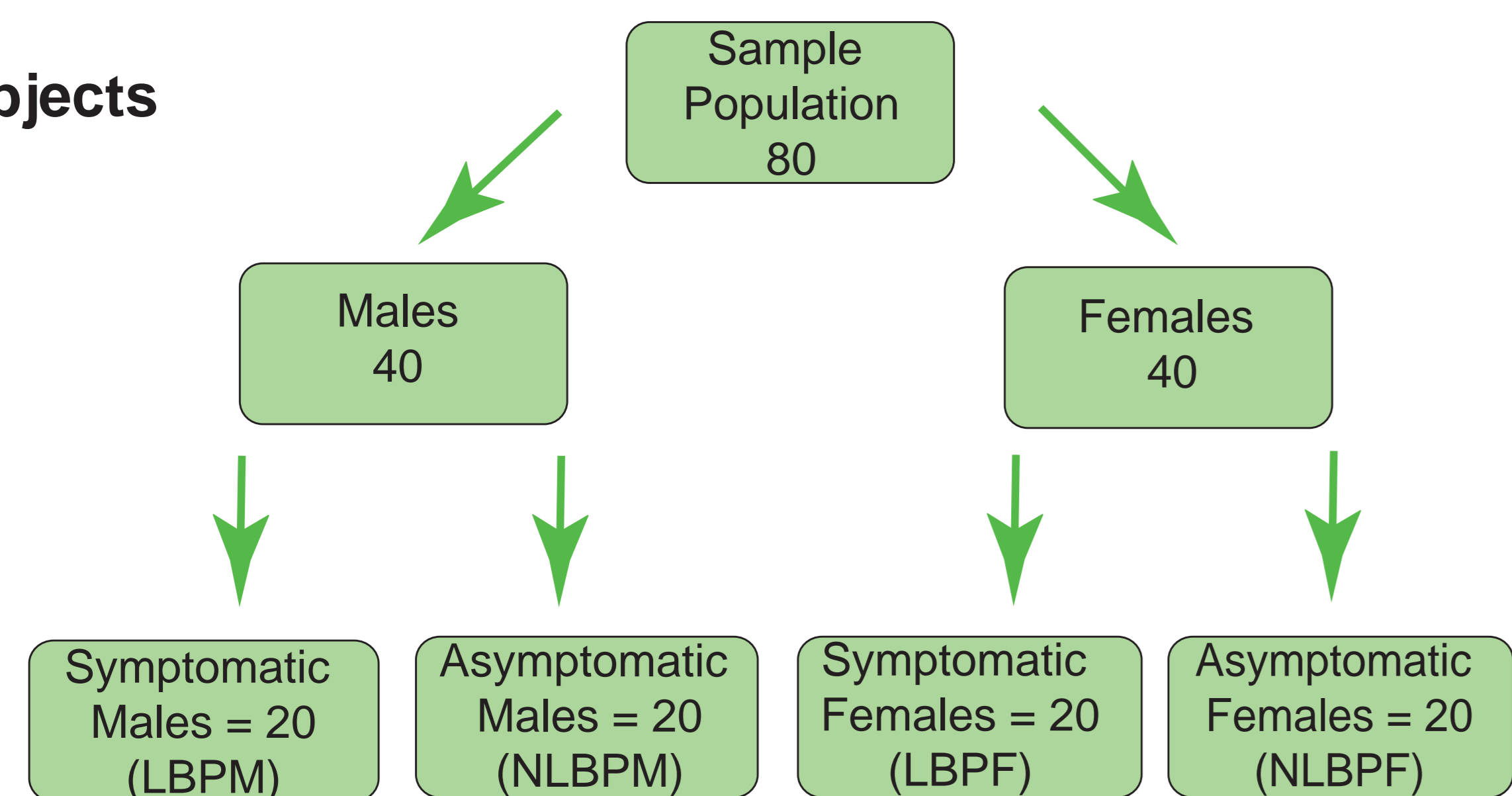
Background

- Over the last 50 years much data has been obtained to support the hypothesis that RMT is independent of spinal reflexive activity and is a passive phenomenon.
- Inter- and intra-rater reliability of manual palpation traditionally used to quantify tissue textural changes when diagnosing a somatic dysfunction have demonstrated non-existent reliability ($Kappa \geq 0.4$).
- But instrumental measurement demonstrates high inter- and intra-rater reliability (0.71–0.92). This study used an electromyotonometer® (EMT) which has been subjected to published clinical validation and reliability studies and demonstrated Kappa coefficient ratings of 0.84–0.99 (almost perfect) for intra-rater reliability, and 0.75–0.96 (substantial) for inter-rater reliability.

Objectives

- To compare RMT (in terms of work done by the EMT) of 10 pre-determined sites on resting lumbar erector spinae musculature (LESM) in gender-matched lower back pain (LBP) and non-lower back pain (NLBP) groups.
- To determine whether there was a correlation between RMT and various social and anthropometric data: age, height, weight, body mass index, percentage fat mass, percentage water mass, handedness, occupation title and in the female groups, number of days since last menstrual period.

Subjects



Inclusion Criteria	
Symptomatic	Asymptomatic
Up to 6 month history of low back pain	Non-spinal related problems
European descent	
Aged 18 – 55yrs	
Vertebrogenic, posterior element or discogenic pain	
Able to tolerate application of 2 kg mass via EMT probe without reporting pain or generating avoidance movements	
Exclusion Criteria	
Symptomatic	Asymptomatic
Pre-existing compressive neuropathies or myelopathies	Previous history of low back pain within the last 6 months
Prescribed medicines affecting muscle tonus, fluid or electrolyte balances e.g. diuretics, systemic steroids or benzodiazepines	
Pacemaker, osteoporosis, pregnancy, neoplasia or pre-existing systemic pathology	

Methods

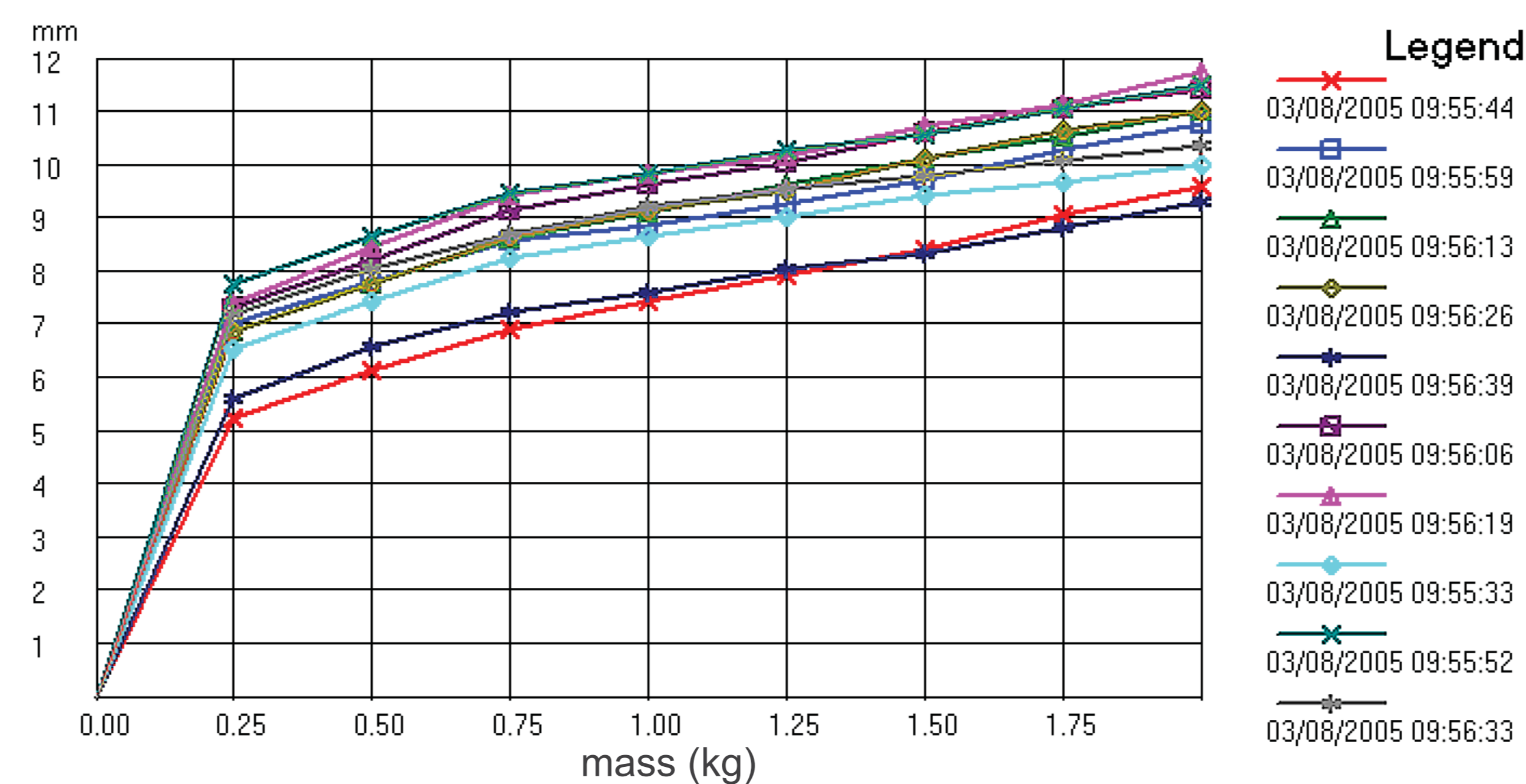
The EMT was aligned on skin markings.

Prone lumbar spinous process (SP) levels were marked relative to Tuffier's line; a rule was used to locate the apices of the LESM adjacent to SPs of L1 to L5 and marked with a 2cm line. Additionally 2 vertical lines were drawn along the longitudinal axis of the LESM.



The EMT probe applied a 2kg mass perpendicular to the sagittal plane of the LESM at the intersection of the skin marks.

The transparent collar of the EMT allowed correct orientation on the skin markings.



Typical graph produced by EMT, each line the mean of three measurements. Coloured lines represent each site measured in random order.

Using the EMT, the mean of the areas under 3 blinded mass/distance curves (AUC) was obtained for each of the 10 LESM sites in all 80 relaxed subjects lying prone on a plinth. In addition an eleventh was obtained; the mean of all 10 AUCs.

Sites were measured in a randomised order; any subject who reported pain during EMT measurement was replaced (n=2). Data collection was temporally controlled between 10.00 and 13.00 hours.

Study approved by Research Ethics Committee of the ESO.

Analysis

All data sets demonstrated normal distribution and variance. A between-subjects Student's t-test was used to compare AUC means of symptomatic versus asymptomatic gender-matched groups.

Results

Females showed no significant difference in AUC at any lumbar level between LBPF and NLBPF and no significant differences in anthropometric data ($p \geq 0.05$).

Females: comparison of AUC data (LBPF vs NLBPF)

Level / Side	L1 L	L1 R	L2 L	L2 R	L3 L	L3 R	L4 L	L4 R	L5 L	L5 R	Mean AUC
t	0.23	0.13	0.73	0.3	0.51	-0.00	-0.00	0.54	0.12	0.12	0.31
$p \leq 0.05$	no	no	no	no	no	no	no	no	no	no	no

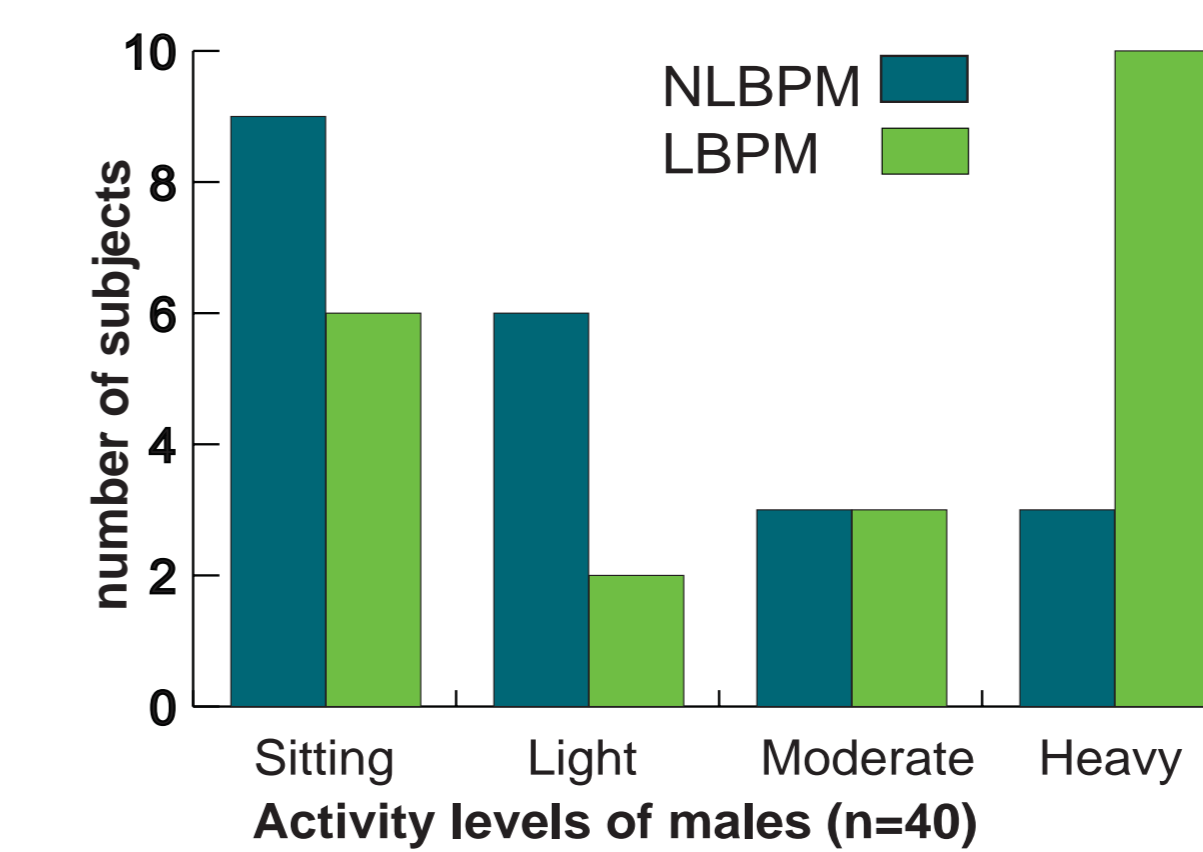
Males showed statistically significant differences in AUC at left L2, right L4, and L5 bilaterally ($p \leq 0.05$) but not at any other levels.

Level / Side	L1 L	L1 R	L2 L	L2 R	L3 L	L3 R	L4 L	L4 R	L5 L	L5 R	Mean AUC
t	1.74	1.2	2.27	2.01	1.54	1.38	1.75	2.33	2.84	3.17	2.49
$p \leq 0.05$	no	no	yes	no	no	no	no	yes	yes	yes	yes

Males: comparison of AUC data (LBPM vs NLBPM)

Gender / anthropometry	Height (cm)	Weight (kg)	Body fat (%)	Body water (%)	BMI
Females n=40	t value 0.16	0.84	0.25	-0.49	0.79
$p \leq 0.05$	no	no	no	no	no
Males n=40	t value -0.62	2.76	2.41	-2.85	3.21
$p \leq 0.05$	no	yes	yes	yes	yes

In contrast with both female groups, there was a statistically significant heterogeneity of anthropometric data between male groups (LBPM vs NLBPM).



50% of LBPM subjects (n=10) were involved in jobs with very high levels of repetitive strenuous activity (e.g. roofer, scaffolder, tiler, etc.) compared with 15% (n=3) in the NLBPM group.

Conversely 45% (n=9) of NLBPM subjects had jobs that were mainly sitting (accountant, manager etc) compared with 25% (n=5) of subjects in the LBPM group.

Discussion

The heterogeneity in male anthropometric data may be related to contrasting activity levels within the two male groups, perhaps caused by the temporal control of the experiment. This may account for the difference in AUC findings between males and females.

Conclusions

- There is no significant difference between RMT (as measured by EMT AUC) in LESM of low back pain versus non-low back pain subjects when anthropometric data is not heterogeneous.
- Traditional osteopathic models founded upon reflexive muscle activity may need to be revised to encompass current theories on RMT.
- Future studies should utilise a larger sample size and a matched-pairs design to control for anthropometric data and occupation.