

Is paraspinal cross-sectional area a useful marker of degenerative lumbar disc disease? An exploratory study

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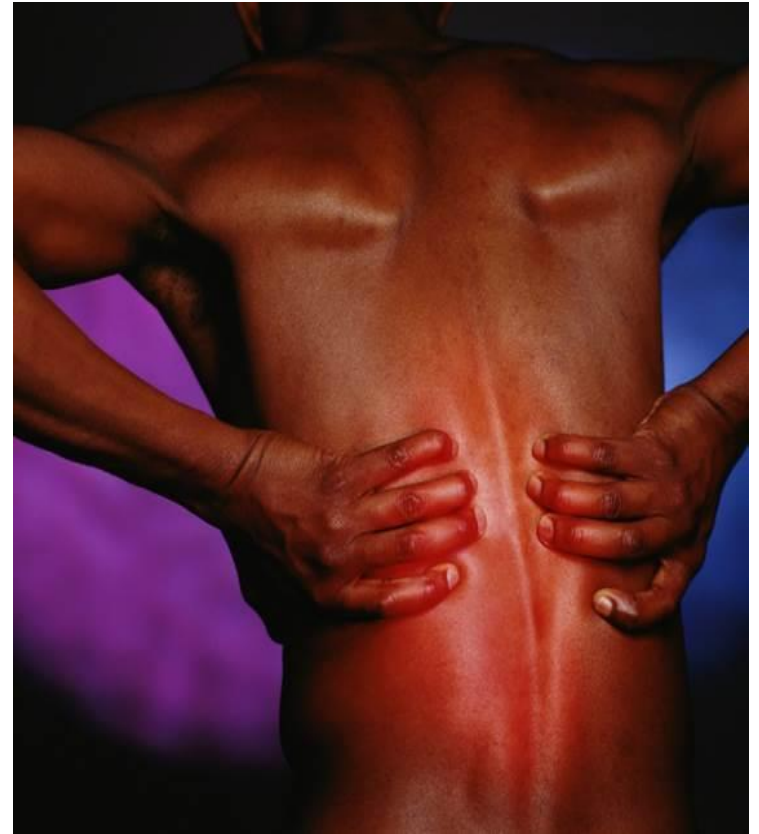
Introduction

Low back pain (LBP) is the leading cause of disability within the UK and effective treatment is lacking.

Degenerative lumbar disc disease (DLDD) is significantly associated with Modic changes (degenerative change of the vertebral end plates) and recurrent LBP.

Paraspinal cross-sectional area (CSA) and functional cross-sectional area (FCSA, fat free muscle area) are recognised as modifiable markers of LBP, with a 10% asymmetry indicative of lumbar pathology (1).

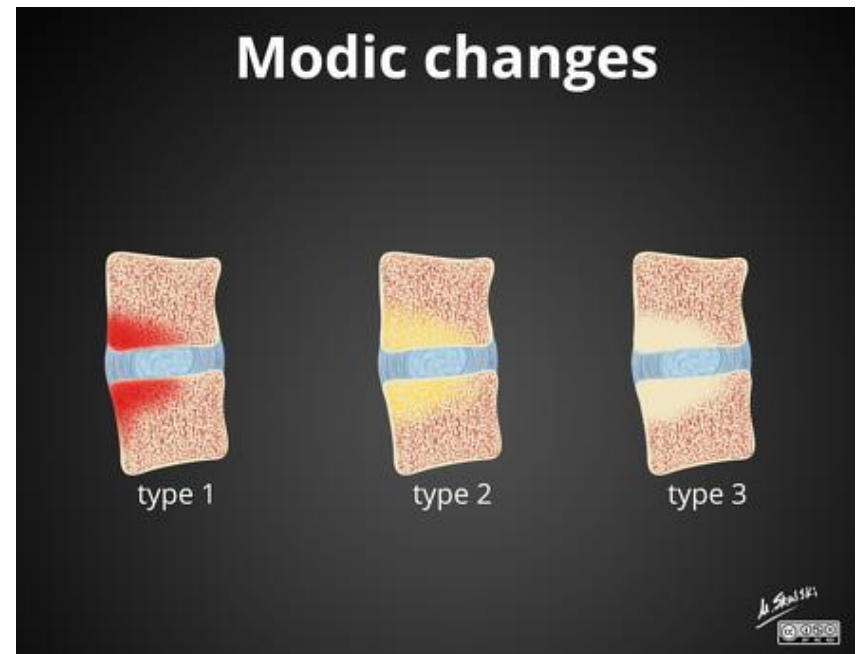
Potential modifiers of DLDD remain unexplored.



Aim & Hypothesis

Aim: to compare paraspinal muscle asymmetry and composition in asymptomatic adults with and without Modic changes in order to determine its potential as a modifiable marker of DLDD

Hypothesis: that asymmetry and composition of the multifidus and erector spinae muscles would be suitable modifiable markers of DLDD



Materials & Methods

- 13 healthy, asymptomatic subjects (45-70 yrs) participated.
- T2-weighted axial lumbar images were obtained using a 3T MRI scanner (mid disc slices L3/L4 to L5/S1 used) (Figure 1).
- Scans were examined by a consultant radiologist (AL) and divided into 2 groups dependent on Modic presence (M) or absence (NM).



Figure 1: Sagittal section of lumbar spine (left) indicating mid disc slice selection.

Materials & Methods

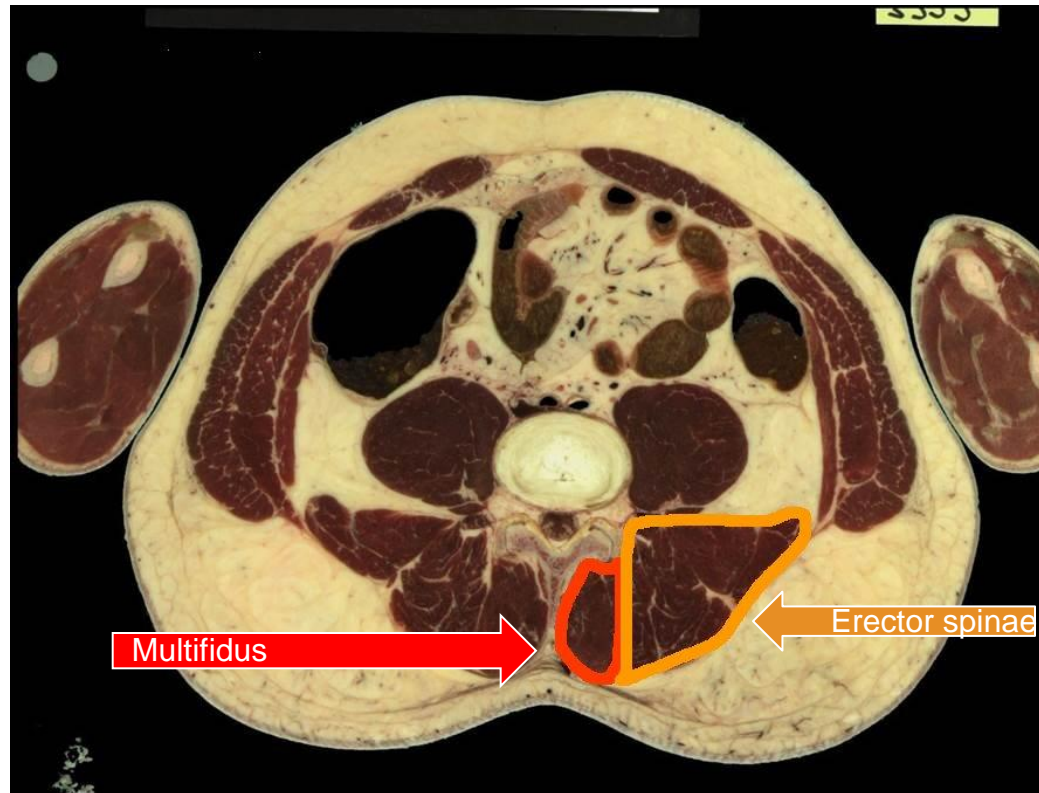
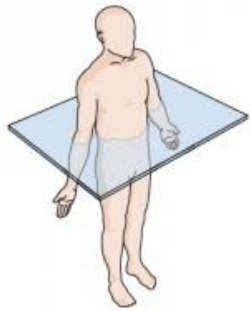


Figure 2: Lumbar anatomy: transection at L4/L5 disc level.
(courtesy of The Visible Human Project)

Materials & Methods

- The CSA and FCSA of the erector spinae and multifidus were measured blind at each lumbar level using ImageJ software (Figure 2)
- Muscle compositions was determined using the equation $[(FCSA/CSA)*100]$ and asymmetry using the equation $[(Largest\ FCSA - smallest\ FCSA) / largest\ FCSA * 100]$ (2).
- Intrarater variability was examined. Data were analysed using descriptive statistics and unpaired T-tests (p value set at ≤ 0.05).

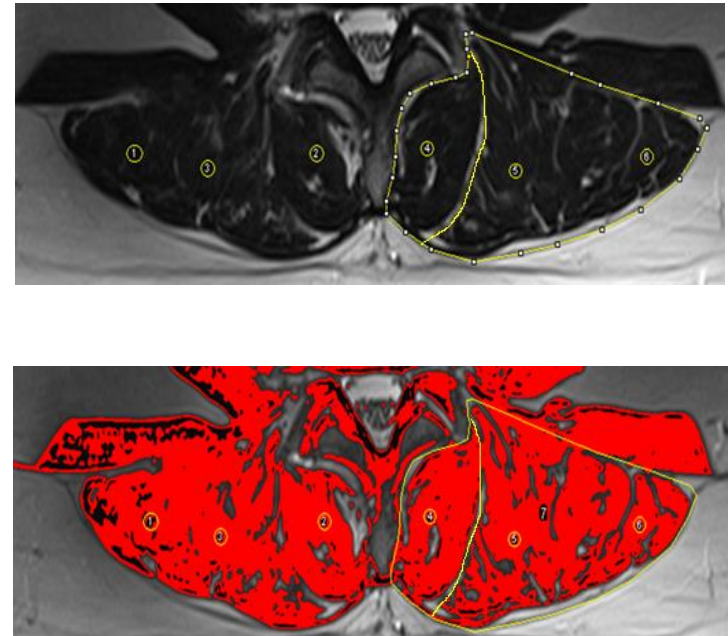
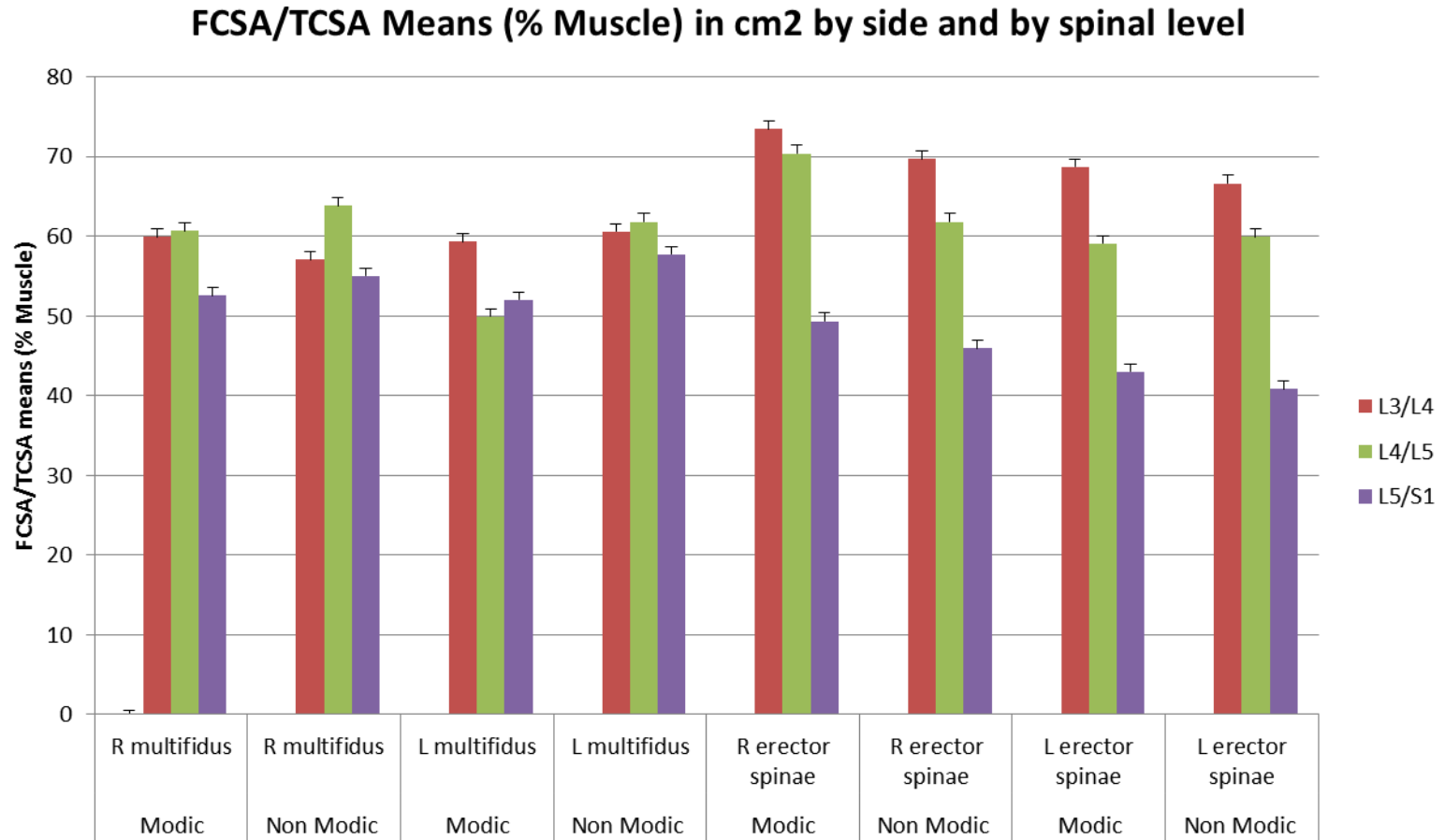


Figure 3: Transections from L4/L5 indicating segmentation process (above) with paraspinal muscle or FCSA (red) (below).

Results

- 62% of patients were classified in group M (Modic II changes).
- Intrarater reliability ICCs ranged between 0.6-0.9 for all area measurements.
- The mean multifidus asymmetry ranged between 6-10% (M) and 5-13% (NM), while erector spinae asymmetry varied between 7-23% (M) and 5-18% (NM).
- The mean multifidus FCSA /TCSA was 53%-62% (M) and 50-64% (NM), and for ES 41-70% (M) and 43-74% (NM).

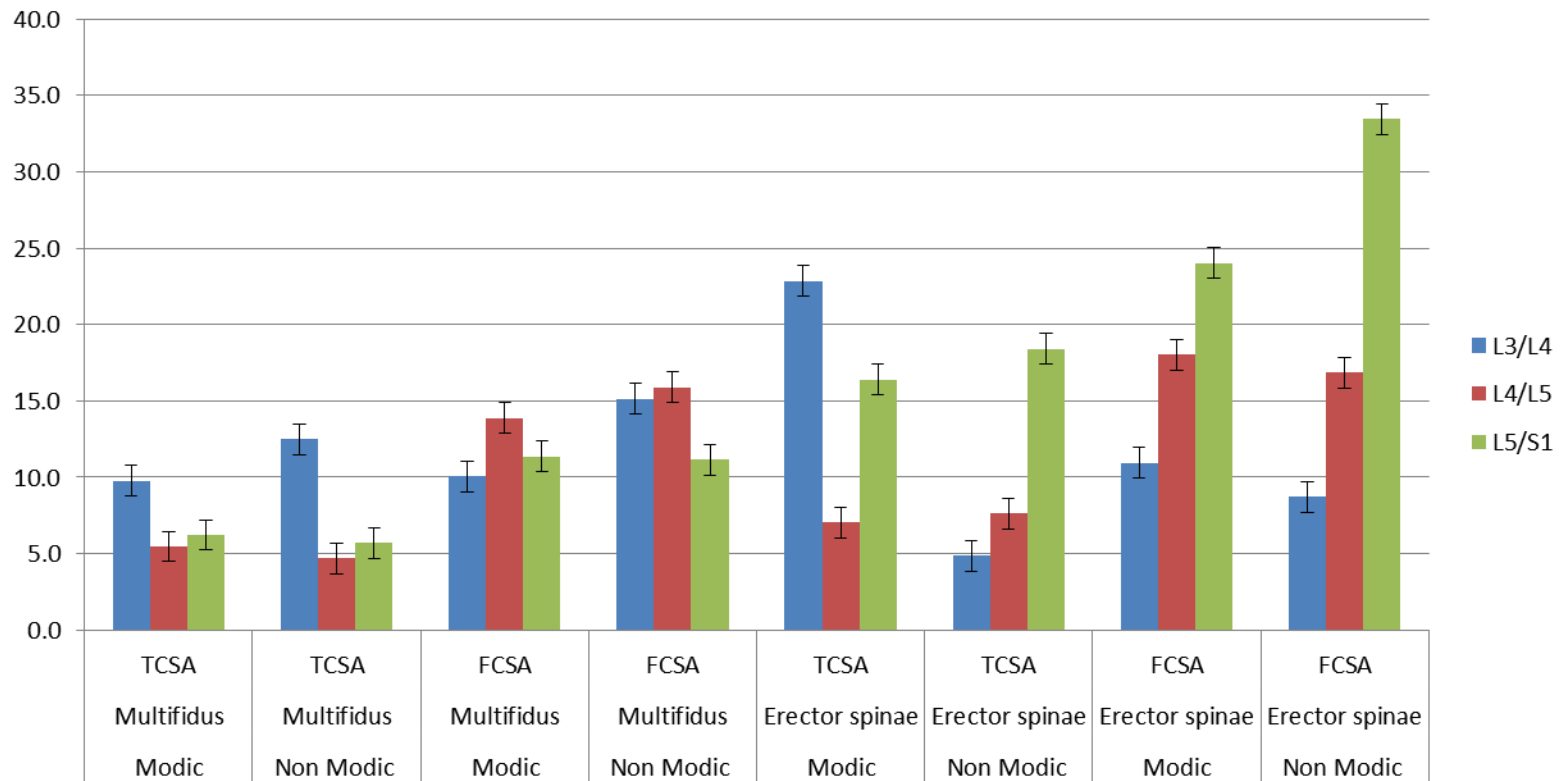
Results: Muscle Composition



No significant difference in multifidus and erector spinae muscle composition ($p=0.2-0.8$) between Modic and Non Modic groups at each lumbar level.

Results: Muscle Asymmetry

Asymmetry (% difference between sides) of Paraspinal Muscle CSA & FCSA Measurements



No significant difference in multifidus and erector spinae muscle asymmetry ($p=0.2-1.0$) between Modic and Non Modic groups at each lumbar level.

Conclusion

- There were no significant differences in paraspinal asymmetry or muscle composition between groups, in agreement with previous work in non specific LBP (2).
- Paraspinal muscle asymmetry of $\geq 10\%$ occurred in both asymptomatic Modic and non Modic groups indicating that this may not be a suitable benchmark of lumbar pathology.
- CSA remains a controversial marker of lumbar pathology.

References

- 1) Hides J., Gilmore C., Stanton W., et al. Multifidus size and symmetry among chronic LBP and healthy asymptomatic subjects. *Man Ther* 2008; 13; 43–9.
- 2) Niemeläinen, R., Briand, M., Battié, M. Substantial Asymmetry in Paraspinal Muscle Cross-Sectional Area in Healthy Adults Questions Its Value as a Marker of Low Back Pain Pathology. *Spine* 2011; 36; 25; 2152–2157.

Declaration of interest and funding

Conflicts of interest: There are no conflicts of interest.

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