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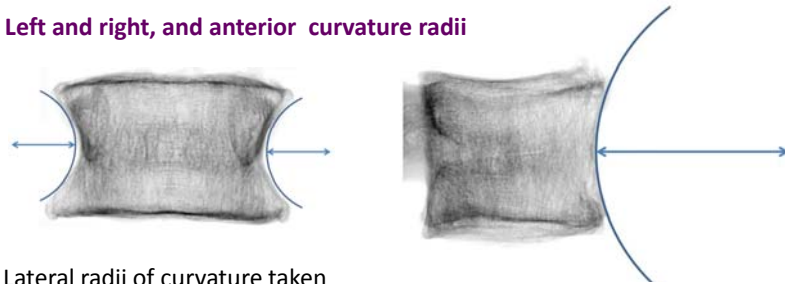
## Study aims

To investigate:

- 1) whether a general relationship can be defined between the cortical shell curvature at the anterior of the vertebra, and that at the lateral sides,
- 2) whether a small radius of curvature at any position around the cortical shell indicates a large shell thickness in that area.

## Cortical shell curvature

Left and right, and anterior curvature radii

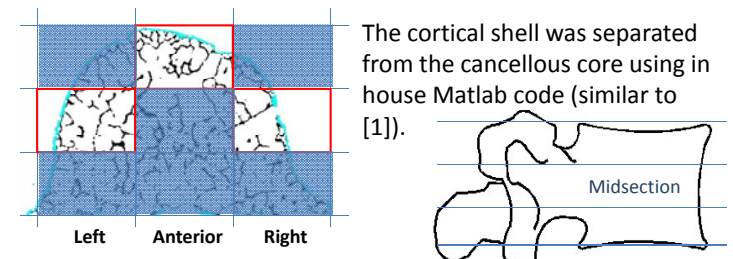


Lateral radii of curvature taken from a frontal plane section through the centre of the vertebral body.

Anterior radius of curvature taken from a sagittal plane section through the centre of the vertebral body.

## Cortical shell thickness

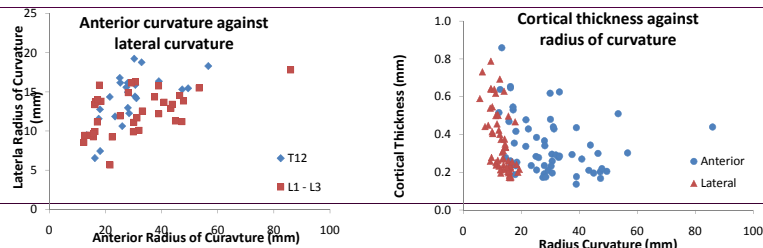
Cortical shell capture and sectioning of the vertebrae.



The cortical shell was separated from the cancellous core using in house Matlab code (similar to [1]).

The average cortical shell thickness was recorded for the anterior, left and right sections, within the superior-inferior midsection.

## Results



Graph 1: Correlation between the anterior and the mean right and left (lateral) radii of curvature for each of the 60 vertebral specimens.

Graph 2: Correlation between thickness and curvature of the cortical shell, for the anterior and an average of two lateral measurements.

Table 1: Linear best fit line and R2 values indicating the strength of correlations listed. \* Significant ( $\alpha=0.05$ ).

Relationship	R <sup>2</sup> value	Linear best fit
Anterior curvature & lateral curvature (whole bank, n=60)	0.25*	$y = 0.112x + 9.714$
Anterior curvature & lateral curvature (T12 subset, n=23)	0.40*	$y = 0.205x + 8.004$
Radius of curvature & local thickness (all positions, n=120)	0.06	$y = -0.003x + 0.419$
Radius of curvature & local thickness (lateral only, n=60)	0.40*	$y = -0.035x + 0.813$

- Anterior radius of curvature was larger than that of the left and right sides for every vertebrae (Graph 1).
- Correlation between anterior and lateral curvature was strongest for the subset of T12 vertebrae (Table 1, Graph 1).
- Correlation between cortical curvature and local thickness was strongest on the lateral sides (Table 1, Graph 2).

## Vertebral image bank

Micro computed tomography images of vertebral specimens (n=60) from 28 spines including levels T12 (n=23), L1 (n=23), L2 (n=5), L3 (n=7), cropped to capture the vertebral body only.

## Discussion & Significance

Only a limited number of patient-specific measurements can be made from planar x-rays. This work shows that single curvature measurements of the vertebral cortex can be used to approximate curvatures in other planes and potentially the underlying cortical thickness, enhancing the potential for patient-specific computational assessment.

### References

[1] Eswaran et al, *Comput. Methods Appl. Engrg*, 2007, 196, 3025-3032

### Financial Disclosure

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