

S. Rehman, P. E. Garner, J. E. Aaron, R. K. Wilcox
 Institute of Medical and Biological Engineering, University of Leeds, LS2 9JT, UK
 s.rehman@leeds.ac.uk

INTRODUCTION

It is desirable to recruit dry-bone or embalmed specimen to generate large population data sets for statistical modelling. Studies on fresh vertebrae have shown that complex geometries can be mapped from micro computed tomography (μ CT) images to build finite element (FE) models, and material properties assigned can be derived from the bone volume fraction (BV/TV)¹. The advantage here is that providing bone can be segmented from the image background, the specimens do not need to be scanned in the same state.

AIM

Determine the threshold level to capture the BV/TV of fresh, embalmed and dry-bone specimens. Establish whether this allows preserved tissue to predicted the behaviour of the tissue in its fresh state.

SIGNIFICANCE

Specimen-specific FE models of bones and joint are increasingly being generated from μ CT images to complement in vitro studies. In addition there has been a recent drive towards statistical FE models that represent cohorts of patients. The scope of these models is to provide a virtual platform to aid the development of surgical treatments and orthopaedic implants.

References
 [1] Wilcox, RK. J. Biomech. Eng 2007

METHODS

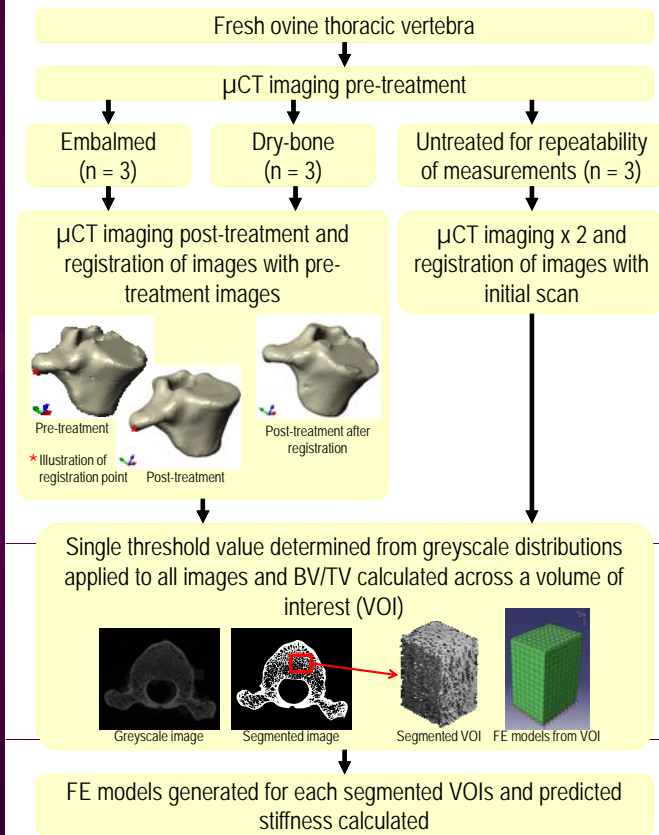


Figure 1: Flow diagram of methods

NB: Repeatability of BV/TV and predicted FE stiffness determined as maximum variability in measurements

RESULTS

Variation in image greyscale values mainly observed in the background pixels
 Less than 5% variation found in the mean greyscale value of bone pixels.

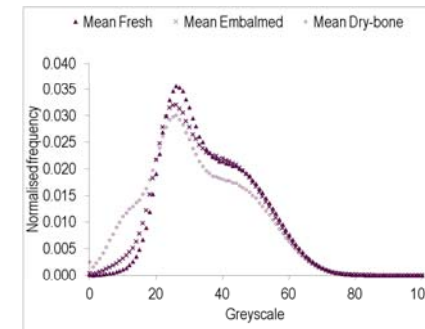


Figure 2: Mean distribution of greyscale values

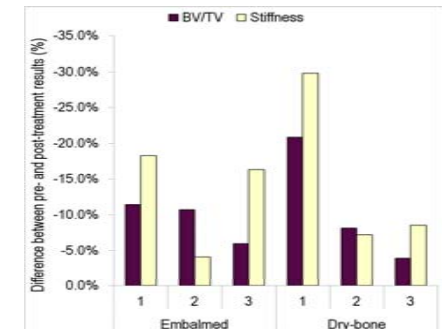


Figure 3: Difference in BV/TV and FE predicted stiffness pre- and post-treatment

Table 1: Mean % difference between pre- and post-treatment

	BV/TV	FE Stiffness
Embalmed	-9.4	-12.9
Dry-bone	-11.0	-15.2
(Repeatability)	(2.9)	(12.9)

SUMMARY

- A small change in the mean greyscale indicates the same threshold is applicable to fresh and preserved specimens.
- Variability in the FE models is of a similar level to the repeatability study.
- Preservation effects can alter the tissue but this is not sufficient to have an effect on FE models over and above the usual variation due to assignment of loading or boundary conditions.

Financial Disclosure

Research support was received from the Engineering and Physical Sciences Research Council (UK) through grant EP/F010575/1