Enthesis directional asymmetry: the effect of occupation

Charlotte Henderson
CIAS – Research Centre for Anthropology and Health, Department of Life Sciences, University of Coimbra, Portugal. c.y.henderson@uc.pt

1.0 Introduction
Entheseal changes (ECs) have been widely used to infer activity patterns in past populations, based on the principle that repetitive (or heavy) muscle use causes increasingly severe modifications to entheses1. Recent research has shown that this is an oversimplification of the relationship, with other factors, including the ageing process, playing a significant role2,3. Importantly studies of comparing cross-sectional properties with ECs has shown that they are recording different processes4–6.

Research on the development of entheses, focussing on their size, has shown that, like muscle cross-sectional area, enthesis area continues to increase during adolescence, but only in boys7. It was therefore assumed that those undertaking manual work in adolescence, whose muscle cross-sectional area should be larger, would have a larger enthesis area than non-manual workers, but this was not found to be the case. Directional asymmetry in bone size, has however, been shown to relate to activity patterns8. The aim of this poster is to test whether directional asymmetry in enthesis area is related to activity-patterns.

2.0 Materials and Methods
Males aged over 15 without signs of boneforming disease9 (n=221) were recorded in the Coimbra identified skeletal collection10. Occupations from the documentation were categorised into four groups: heavy manual, manual, non-manual and soldier11. Two measurements of the humerus were taken: vertical head diameter and epicondylar width. Two measurements were made of two perpendicularly bisecting chords (Fig. 1) of three rotator cuff entheses alongside the common flexor and extensor origins12. These measurements were multiplied together to approximate area and were also standardised by bone size: by vertical humeral head for the rotator cuff entheses and using the epicondylar width for the others.

Percentage directional asymmetry was calculated (%DA)13, for the enthesis areas and the size-standardised enthesis areas. Statistical graphs were plotted in R (Rstudio version Version 0.98.493) using package ggplot214 and, where differences in means were present (without overlapping standard errors), ANOVAs were run.

Figure 1. Subscapularis insertion showing area (back and blue) with chords marked in red

3.0 Results
The descriptive plots show almost no difference in asymmetry between occupations, except for the supraspinatus insertion which shows a difference between soldiers and other occupational groups. An ANOVA showed that, for this enthesis alone, it was a statistically significant effect not mediated by ageing. Vertical head diameter and epicondylar width %DA did not show differences between groups.

4.0 Discussion and conclusions
If enthesis area is related to muscle cross-sectional area then enthesis area should be an indicator of physical strength. A previous study has shown that, like muscle cross-sectional area, enthesis area continues to enlarge during adolescence in males6. However, it has been found that occupations (undertaken during adolescence) did not affect enthesis size13. Directional asymmetry in body size has been linked to handedness and shown to be affected by occupation7. However, these results indicate that directional asymmetry: 1) varies by enthesis 2) is not linked to occupation as categorised in this poster. In vivo studies are needed to determine the link between enthesis and soft tissue size.

References:

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