Assessing Interobserver Replicability in the Scoring of Entheseal Markings through 3D Technology

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This study is aimed at 3D technologies and their potential to advance research methods in the physical anthropology field. The focus of the research was on entheseal markings, or where muscles and tendons attach to bones. These boney sites' physical appearances will change over time, depending on use or lack of their use during a lifespan. These physical changes can give us insight into the activities in which the individual took part. For example, Shuler et al. (2012) assessed entheses from a site in Moundville, Alabama, in comparison to small farmsteads and villages in other parts of Alabama and Mississippi and found that entheseal development in these groups is consistent with predictions that some early agriculturalists (1000-1500 CE) experienced greater activity-related stress than hunter-gatherers (500-900 CE) regionally. Others such as Noldner (2013) have examined the variation of entheseal markings for individuals by burial locations within sites, such as a colonial Spanish mission Tipu, Belize. The researchers reported that individuals with robust and rugged entheses who were buried far away from the church at this site were more likely to have been low-status laborers.

In research, entheses are given a score based on a standard of physical descriptions. However, there is often a lack of agreement between researchers and their scores because scoring depends on how a researcher interprets the enthesis' appearance. The goal of this study was to determine whether scanning and printing an enthesis would lead to more agreement among researchers' scores. Forty-two entheses (subscapularis, pectoralis major, extensor carpi radialis longus, quadriceps femoris, and soleus) from the Newton Plantation osteological series were scored from seven bones used to create three identical scoring sets: dry bones, corresponding 3D-scans, and 3D-replicas. NextEngine© scans (29K resolution) were printed via Makerbot Replicator©. Entheses were then scored independently by two observers of varying experience levels using a set of standards. Results indicated scoring agreement about 50% of the time for each representation of the entheses. Low replicability may stem from subjectivity in scoring, although experience did not seem to impact agreement. Small samples scored within a brief (one-hour) period allowed observers see the same enthesis back to back across the bone, scan, and print. This methodology may have influenced the observers' scores; however, more intraobserver study is needed to determine if this is the case. This preliminary study does not suggest a major difference when scoring entheses from real bone versus 3D technology, or between observers, though the lack of agreement between observers may suggest the need to refine the scoring method.

References:

1. Shuler et al. 2012. Upper limb entheseal change with the transition to agriculture in the southeastern United States: A view from Moundville and the central Tombigbee River Valley. Journal of Comparative Human Biology. 63, 413-434.

2. Noldner, Lara. 2013. Spanish Missionization and Maya Social Structure: Skeletal Evidence for Labor Distribution at Tipu, Belize.

Statement of Research Advisor:

Skeletal muscle attachment sites are commonly evaluated by biological anthropologists to gain insight into patterns of labor and lifetime activities in past communities. Kyle's research compared interobserver differences in two of the most commonly used methods of assessment in the field with novel three-dimensional (3D) scanning and printing methods.
—Kristrina Shuler, Anthropology