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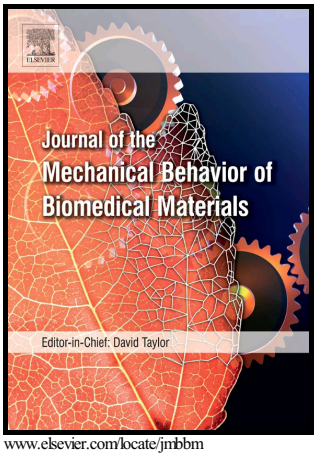

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Changes in Vickers Hardness during the Decomposition of Bone: Possibilities for Forensic Anthropology

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Abstract

The purpose of this study was to determine how the Vickers hardness (HV) of bone varies during soft tissue putrefaction. This has possible forensic applications, notably for determining the postmortem interval. Experimental porcine bone samples were decomposed in surface and burial deposition scenarios over a period of 6 months. Although the Vickers hardness varied widely, it was found that when transverse axial hardness was subtracted from longitudinal axial hardness, the difference showed correlations with three distinct phases of soft tissue putrefaction. The ratio of transverse axial hardness to longitudinal axial hardness showed a similar correlation. A difference of 10 or greater in HV with soft tissue present and signs of minimal decomposition, was associated with a decomposition period of 250 cumulative cooling degree days or less. A difference of 10 (+/- standard error of mean at a 95% confidence interval) or greater in HV associated with marked decomposition indicated a decomposition period of 1450 cumulative cooling degree days or more. A difference of -7 to +8 (+/- standard error of mean at a 95% confidence interval) was thus associated with 250 to 1450 cumulative cooling degree days' decomposition. The ratio of transverse axial HV to longitudinal HV, ranging from 2.42 to 1.54, is a more reliable indicator in this context and is preferable to using negative integers These differences may have potential as an indicator of postmortem interval and thus the time of body deposition in the forensic context.

Keywords: Bone, Human, Porcine, Forensic, Archaeology, Anthropology

Introduction

The Vickers hardness test is widely used and provides a convenient method of carrying out non-destructive measurements of a material's resistance to plastic deformation. Macro-, micro- and nanohardness tests have been widely used to evaluate the behaviour of bone on these different scales. With regards to the current literature, the level of hydration in bone, particularly water associated with its organic matrix can be seen to contribute significantly to its hardness. A literature review by Bandini et al (2013) showed a consensus that soft tissue removal modifies the water