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A review on the characterization of the enthesis (osteotendon junction) – From classic histology to approaches in material science and engineering

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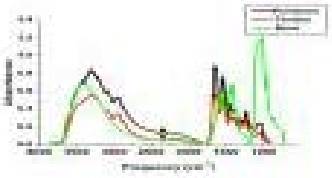
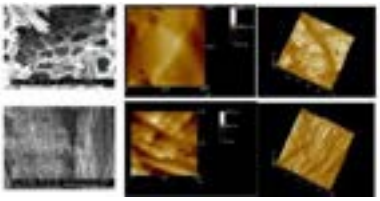
Statement of the Problem: Auto grafts and implants of the enthesis will play an important role in the health care in the 21st. Century due to the largely world-wide aging of populations and the debilitating effects of osteoarthritis and associated bone and tendon pathologies. It is well-documented that tendons avulsed from their skeletal attachment of limb bones do not heal well and are prone to rupture following reattachment. Theoretical Orientation: Failure of the enthesis repair may, or may not, be due to the use of unsuitable biomaterial implants at the bone tendon interface, altered tendon mechanics created by employing bone pins which change the contractile force ratio, and/or change in the configuration of collagen fibrils at the attachment site leading to rupture at subsequent stress points. Failure could also be attributed to cytological differences within the periostea or tissue mechanics. Findings: A review of the current literature demonstrates very little histological information on the periosteum or the enthesis and there are only a few publications on nanoindentation of these tissues. There is no known interdisciplinary publication to date. Further, current research demonstrates a lack of consistency between researchers with regard to biosample preparation for tribology; making it difficult for researchers to compare results and apply that information to the in-vivo state. Conclusion & Significance: An inter-disciplinary approach is needed to examine the histology of the periosteum as a material that is composite lamellar in nature and provide greater detail on constituent layers. A standard method for preparation and analysis of biosamples for tribology is needed. Techniques between the pure sciences and engineering are likely to provide better information to compare and contrast the enthesis nanomechanics. An interdisciplinary focus and participation with industry will allow us to create complex biological structures for implants to improve patient outcomes.



Biography

Mary E. Craig is a classically trained anatomist with extensive experience in skeletal biology. Mary has studied skeletal material from archaeological sites, bone excised from modern humans and animals, and the engineering of biomimetic bone. Mary is keenly interested in creating "off-the -shelf" enthesis (osteotendon junction) and the use of "green materials" in medicine – that is to say, materials that in their natural form (limited manufacturing processes) can be used for implant. There is some evidence that green materials reduce incidence of rejection and implant failure and further considerations for manufactures to reduce the toxic-foot print on the environment. In addition to her research interests Mary has instructed anatomy since being an undergraduate and has expertise in clinically-based human and veterinary anatomy, neuroanatomy, forensic and physical anthropology, osteoarchaeology, and the nanomechanics and histology of biological materials. She is a tenured faculty member of the Department of Biological Sciences at Oakland University.

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