

Hardness map of Human Tarsals, Meta Tarsals and Phalanges of Toes

Authors : Irfan Anjum Manarvi, Zahid Ali kaimkhani

Abstract : Predicting location of the fracture in human bones has been a keen area of research for the past few decades. A variety of tests for hardness, deformation, and strain field measurement have been conducted in the past; but considered insufficient due to various limitations. Researchers, therefore, have proposed further studies due to inaccuracies in measurement methods, testing machines, and experimental errors. Advancement and availability of hardware, measuring instrumentation, and testing machines can now provide remedies to these limitations. The human foot is a critical part of the body exposed to various forces throughout its life. A number of products are developed for using it for protection and care, which many times do not provide sufficient protection and may itself become a source of stress due to non-consideration of the delicacy of bones in the feet. A continuous strain or overloading on feet may occur resulting to discomfort and even fracture. Mechanical properties of Tarsals, Metatarsals, and phalanges are, therefore, the primary area of consideration for all such design applications. Hardness is one of the mechanical properties which are considered very important to establish the mechanical resistance behavior of a material against applied loads. Past researchers have worked in the areas of investigating mechanical properties of these bones. However, their results were based on a limited number of experiments and taking average values of hardness due to either limitation of samples or testing instruments. Therefore, they proposed further studies in this area. The present research has been carried out to develop a hardness map of the human foot by measuring micro hardness at various locations of these bones. Results are compiled in the form of distance from a reference point on a bone and the hardness values for each surface. The number of test results is far more than previous studies and are spread over a typical bone to give a complete hardness map of these bones. These results could also be used to establish other properties such as stress and strain distribution in the bones. Also, industrial engineers could use it for design and development of various accessories for human feet health care and comfort and further research in the same areas.

Keywords : tarsals, metatarsals, phalanges, hardness testing, biomechanics of human foot

Conference Title : ICCB 2015 : International Conference on Computational Biomechanics

Conference Location : Paris, France

Conference Dates : November 19-20, 2015