The Bone Specific Surface of cortical bone and its influence on the Spatio-temporal Evolution of Cortical Porosity during Osteoporosis

Ch. Lerebours¹, P.R. Buenzli², C.D.L. Thomas³, J.G. Clement³, P. Pivonka*¹

¹Northwest Academic Centre, Australian Inst. Musculoskeletal Science, University of Melbourne, VIC 3021, Australia.  
²School of Mathematical Sciences, Monash University, VIC 3800, Australia.  
³Melbourne Dental School, University of Melbourne, VIC 3010, Australia.  

*Corresponding author: peter.pivonka@unimelb.edu.au

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Bone cells are well-known to be regulated biochemically and biomechanically. The notion that the microscopic availability of bone surface affects bone remodeling is, however, less established. Bone-resorbing and bone-forming cells require a bone surface to attach to and initiate the matrix renewal. For bone a characteristic relationship between porosity and specific surface has previously been proposed based on 2D histological measurements. In this paper we will first use 3D data derived from micro-CT of human cortical bone to establish the relationship between porosity and specific surface and compare these results with those reported in the literature. Secondly we will utilize a computational model of bone remodeling to investigate how porosity evolves in osteoporosis across a cortical bone section. Using this methodology we investigate the different mechanisms driving osteoporosis and their impact on the spatio-temporal changes in cortical porosity.