Dr. Elizabeth Zimmermann
Faculty of Dentistry - McGill University

Bone is a composite material comprising assemblies of collagen molecules and hydroxyapatite mineral crystals, forming an extremely tough, yet lightweight and multi-functional material. Like many mineralized tissues, bone can resist deformation and fracture from the nature of its hierarchical structure, which spans molecular to macroscopic length-scales. In fact, bone derives its fracture resistance with a multitude of deformation and toughening mechanisms that are active at most of these dimensions and which can become degraded by biological factors associated with aging and disease. Furthermore, bones have the capacity to adapt their macroscale shape and potentially their material properties to their biomechanical environment. With this framework, I will speak about two areas of ongoing research. First, is a clinical study in in cerebral palsy. Children with cerebral palsy have abnormal muscle tone and movements. This abnormal biomechanical environment can result in lower limb bone deformities. Selective dorsal rhizotomy is a surgery that reduces abnormal muscle tone. Here, we are investigating whether rhizotomy surgery improves gait, bone quality and prevents bone deformities at 6 and 12 months post-surgery with clinical imaging techniques. Second, recent anabolic treatments for post-menopausal osteoporosis increase bone formation and are being explored as a possibility to improve bone mass in genetic disorders, such as osteogenesis imperfecta. Here, we investigate the effects of the anabolic agent on the bone material level, by comparing multi-scale bone quality in regions with the same tissue age.