Localized Mechanical Stiffness of Infarcted Myocardia

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Abstract

Maintaining the health of the heart is one of the largest challenges in medicine due to the proclivity of life threatening cardiovascular disease, such as myocardial infarctions. When the heart experiences an infarction, a scar begins to form within an hour of the event, which will continue to grow and begin to weaken the heart contraction. The increase in Young's Modulus or relative stiffness translates to a loss in compliance and loading capabilities. Research has shown that restoring the mechanical characteristics of the heart is vital to the restoring of functionality. Current literature is inconclusive as to the source of the tissue stiffening whether the greater contributor is the collagen matrix or the cardiomyocytes. Therefore, it is necessary to specify how each structural components contribute to the loss of functionality. In order to test the hypothesis that the increase in modulus in myocardium is largely attributed to the deformation of collagen in contrast to cardiomyocytes. This research aims to correlate the local mechanical stiffness from Atomic Force Microscopy to high-resolution Second Harmonic Generation confocal images of the tissue in order to directly attribute the loss in elasticity to the microstructures of the tissue.

Keywords: Atomic Force Microcopy, Second Harmonic Generation, Stiffness, Cardiomyocytes, Collagen