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PROCEEDINGS

An In Vitro Study of Correlation Between the Compositions, Structure and Mechanical Properties of the Arterial Plaque

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ABSTRACT

Atherosclerosis developed in the arterial wall is the major cause of cardiovascular events such as stroke and heart failure. Atherosclerosis, also referred to as arterial plaque can be classified as stable, unstable, and vulnerable plaque. In terms of the features of compositions and structures, atherosclerosis also can be classified as calcified plaque, the plaque with a lipid core, and plaque with a thin fibrous cap. It is expected that the compositions, structures, and mechanical properties of the plaques interrelate with each other. The correlations between the compositions, structure, and mechanical properties are expected to characterize the nature of the rupture of the arterial plaque and provide important clinical information. To date, comprehensive knowledge about the correlation of the compositions, structure, and mechanical properties of the plaque is lacking. In this project, various artificial arterial plaques with different compositions and structures were fabricated. Porcine fat extracted when it was exposed to the sun at 30c0, was used to represent the lipid core of the artificial plaque specimen, while gelatine from bovine skin and collagen from human placenta were used to fabricate the fibrous cap of the specimen. The calcification of the specimen was prepared using calcium from calcium chloride hexahydrate and collagen. The mechanical properties of eight types of artificial plaques were evaluated through the unconfined compression test. The experimental results demonstrate that the plaque with a high percentage of collagen and with a thicker fibrous cap tends to possess the large Youngs Module. There is a strong positive correlation between the percentage of collagen, the thickness of the fibrous cap, and the Youngs Module in both calcified and lipid plaque. A negative correlation was found between the percentage of lipid plaque and the Youngs Module.

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