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Cross linkers for heart valve tissue engineering

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Background: Currently, an effective cross linking reagent to treat xenogenic decellularized heart valve matrices is lacking. Matrices still elicit an intense cell-mediated immune response and calcification. The aim of this study was to evaluate the cross linking effect of Quercetin, Catechin, Caffeic Acid and Tannic acid on porcine aortic valve matrices.

Materials and methods: Cytotoxicity of the different cross linkers was evaluated. Mechanical properties of cross linked porcine matrices and control matrices (non-fixed) were examined by tensile strength testing. Cytocompatibility of the fixed matrices was examined. Cross linked and control matrices were implanted subcutaneously in Wistar rats (n=9). After 2 weeks the explants were examined by light microscopy. Calcium content was determined using inductively coupled plasma-mass spectrometry. Antibody reaction against porcine tissue in the rat serum was determined.

Results: Cytotoxicity studies demonstrated that cross linkers, even at high concentrations, did not inhibit cell viability. All cross linkers, except Tannic acid, improve mechanical strength of acellular porcine matrices. Moreover, tensile strength of Quercetin fixed matrices was comparable with glutaraldehyde-fixed leaflets. Light microscopic evaluation showed that cross linked matrices showed only a mild lymphocytic inflammatory reaction. Furthermore, Quercetin fixed leaflets exhibited a well preserved matrix without infiltration of CD3+ cells. Calcium levels after 2 weeks were for controls (non-fixed): 206.33µg/mg; Quercetin: 151.33µg/mg; Catechin: 181µg/mg and Caffeid acid fixed matrices: 163.66µg/mg.

Conclusion: Quercetin is the most suitable candidate for heart valve cross linking and could be used as alternative for glutaraldehyde. Whether, Quercetin allows for autologous cell repopulation in order to create a viable tissue engineered heart valve still needs to be investigated.

Biography

Pamela Somers has completed her PhD in Medical Sciences at the age of 29 years from Ghent University. At the moment she performs postdoctoral research in cardiac tissue engineering at Ghent University. She has published more than 29 papers in reputed journals.

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