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Mechanical and Morphological Characterization of Decellularized Umbilical Vessels as Tissue Engineering Scaffolds

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Cardiovascular diseases are the number one cause of morbidity and mortality globally. Numerous pathophysiological modifications that develop are associated with the stenosis and occlusion of blood vessels and tissue damage due to inadequate nutrient supply. Despite a variety of therapies available today, the preferred treatment for the long-term revascularization is artery bypass surgery. The autologous vessels are considered the "gold" standard treatment for this category of patients; unfortunately, they are often unavailable due to comorbidities or unsuitable for use. Synthetic scaffolds are suitable in large-diameter arteries (> 8,0 mm) and medium-diameter arteries (6,0−8,0 mm), but are of limited use in small-diameter vessels (< 6,0 mm) due to poor patency rates. However, tissue engineering may be an option to overcome the existing practical issue. Thus, tissue engineered vascular grafts (TEVGs), namely decellularized matrix, are suggested to present an appropriate graft alternative; as a result, increasing interest is dedicated to this field. By decellularization the loss of major histocompatibility complex (MHC) is induced. Consequently, the risk of development of an immunological response by the host is reduced. Undoubtedly, the acellular scaffolds have a lot of advantages. There are reports about different decellularization techniques already, such as physical, chemical and biological methods. Unfortunately, information about combination and comparison between them are not sufficient. This study aimed to contrast three different methods (the enzymatic method with 0.25% trypsin; the chemical method with 1% SDS and the combined method with 0.25% trypsin and 1% SDS) to decellularize umbilical vessels as a TEVG of a small diameter and test histological and physical properties. In addition, a short overview of advantages and disadvantages of existing protocols is also presented.