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A plant derived human recombinant type-I collagen: A novel scaffold for regenerative medicine with outstanding mechanical and biological performance

Oded Shoseyov[1, 2], **Amit Yaari**[1], **Tsvika Stein**[1], **Racheli Gueta**[2], **Tal Amzel**[2], **Jasmine Seror**[2] and **Nadav Orr**[2]
[1]The Hebrew University of Jerusalem, Israel
[2]CollPlant Ltd., Israel

Consequential to its essential role as a mechanical support and affinity regulator in extracellular matrices, collagen constitutes a highly sought after scaffolding material for regeneration and healing applications. However, substantiated concerns have been raised with regard to quality and safety of animal tissue-extracted collagen, particularly in relation to its immunogenicity, risk of disease transmission and overall quality and consistency. In parallel, contamination with undesirable cellular factors can significantly impair its bioactivity, vis-a-vis its impact on cell recruitment, proliferation and differentiation. Large scale production of recombinant human collagen type-I (rhCOL1) in the tobacco plant provides a source of a homogenic, heterotrimeric, thermally stable "virgin" collagen which self assembles to fine homogenous fibrils displaying intact binding sites and has been applied to form numerous functional scaffolds for tissue engineering and regenerative medicine which have already reached the clinic. In addition we have shown that rhCOL1 can form liquid crystal structures, yielding well-organized and mechanically strong fibers 6 times tougher than human achiles tendon, two properties indispensable to extracellular matrix (ECM) mimicry. Combining resiline, an elastic protein derived from insects, further increased collagen fiber toughness and strain at break. Injections of fibrillated rhCOL1 combined with PRP (platlet rich plasma) to patients suffer from tendinopathy (in tennis elbow) forms *in situ* matrix composed of collagen and fibrin. The rhCOL1/PRP matrix reduces inflammation and promotes cell proliferation and tissue healing, promotes *in situ* growth factors generation and release while gradually degrading. Both *in vivo* and *in vitro* studies showed superior performance of rhCOL1/PRP compared to PRP alone.

Biography

Oded Shoeyov is a Faculty Member of the Hebrew University of Jerusalem. His research is in plant molecular biology, protein engineering and nano-biotechnology. He has authored or co-authored more than 170 scientific publications and is the Inventor or Co-Inventor of 46 patents. He has received the 2012 Israel Prime Minister Citation for Entrepreneurship and Innovation. He is the scientific Founder of 10 companies; among them are Collplant Ltd., an agro-biotech/regenerative medicine company producing human recombinant type-I collagen in transgenic plants for medical implants used in tissue repair.

Shoseyov@agri.huji.ac.il

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