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Design and activity of intelligent cellulose-based dressings for growth factor protection in chronic wounds

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Intelligent dressing design has been a goal of chronic wound dressing development for more than a quarter century. Since the report of the first dressing that modulated water vapor transmission rates numerous approaches to semi occlusive dressing designs have enabled improvement in chronic wound healing rates. Among the approaches to improved wound healing, the delivery of therapeutic growth factors like platelet derive growth factor has played an important role. However, maintaining stability and controlled release of growth factor activity has met with mixed success. This in part is due to the high proteolytic activity in chronic wounds which degrades growth factors and extracellular matrix proteins. Accordingly, we report here an approach to an intelligent dressing design based on protease point of care sensors combined with protease sequestrants and/or inhibitors in semi occlusive dressing motifs. Protease biosensors detected levels of elastase at those found in chronic wound fluid (0.025 U/mL). A sensor-based dressing is applied to monitor protease activity while release of the protease inhibitor oleic acid (18:1) is triggered and taken up by albumin binding to the dressing and subsequent inhibition of elastase. Transfer from albumin to inhibition of elastase was observed when four per cent albumin solutions were used and it was most effective in binding cellulose bound-18:1. However, 2% albumin was sufficient to transfer quantities of 18:1 necessary to achieve a significant elastase-lowering effect. Formulations with 128 mg 18:1/g cellulose gauze had equivalent elastase lowering with 1 - 4% albumin. 18:1 bound to cotton wound dressings may have promise in the selective lowering of cationic serine protease activity useful in topical application for chronic inflammatory pathogenesis.

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