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Innervation and Muscle Cell Infiltration of Plastic Compressed Collagen Constructs

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INTRODUCTION: Conventionally, tissue engineering aims to convert an initial cell-scaffold construct into a tissue-like architecture, with biomimetic function. This occurs by cell mediated remodelling in vitro and has proved to be slow, costly and difficult to control. Using a novel technique termed plastic compression (PC), cellular and acellular collagen constructs were fabricated (1). Plastic compression enables rapid production of tissue like constructs without the need for cell based remodeling. The constructs have been tested in-vivo in a rabbit model (2). We have previously shown that cell seeded constructs elicit increased cellular infiltration, angiogenic response, mechanical integrity and decreased inflammatory response compared to acellular constructs (2). In this study the constructs were further tested for muscle and nerve infiltration.

METHODS: The constructs were implanted across the intercostal space of a rabbit model designed to provide cyclical tensile loading in-vivo for up to 5 weeks (1). Constructs were harvested, sectioned and stained for the myoblast marker desmin and neuronal marker neurofilament using an immunoperoxidase technique. Nuclei were counterstained with haematoxylin.

RESULTS: Pre-implantation constructs showed no positive staining for desmin or neurofilament. By 5 weeks desmin positive staining was abundant at the periphery of both cellular and acellular constructs. There was no positive staining for neurofilament in cell seeded or acellular constructs at 5 weeks.

DISCUSSION & CONCLUSIONS: Plastic compressed collagen shows good potential as a biomaterial for tendon and ligament repair. The results indicate that the collagen constructs were infiltrated by host myoblasts in-vivo but did not become innervated. This is an important finding as myoblast infiltration would be useful in the engineering of myotendinous junctions.

ACKNOWLEDGEMENTS: (1) Brown, R. A., Wiseman, M., Chuo, C. B., Cheema, U., & Nazhat,

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(2) Mudera, V., Morgan, M., Cheema, U., Nazhat, S. N., & Brown, R. A. *Tissue Engineering and Regenerative Medicine* 2007.

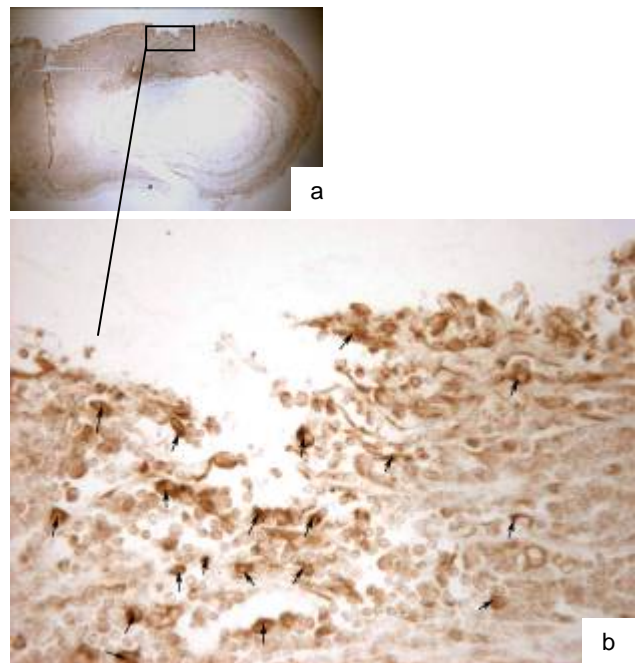


Fig. 1: Desmin staining 5 week post-implantation, cell free PC constructs with DAB chromogen. (a) x4 magnification. (b) x50 magnification. Arrows indicate positive stained cells