

STUDY OF BOVINE ARTICULAR CHONDROCYTES ON THIN FILM POLYCAPROLACTONE SURFACES

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INTRODUCTION: In tissue engineering significant progress has been made in the development of biodegradable polymer scaffolds for tissue culture (see [1] for review). Applications for tissue growth and replacement using donor or animal cells are under investigation for a range of tissue types including; cardiac cells, neural tissue, tendon, bone and cartilage. A number of factors are important in achieving successfully engineered tissue such as; polymer type, surface chemistry, oxygenation, nutrient delivery and expression of extracellular proteins. It has also been shown in the field of microchip-cell devices that microstructure is critical to growth and alignment of many cell types (see for example [2]).

The effect of local micro or nanostructure on tissue-engineered cultures has largely been neglected by the field in favour of porous or fibrous scaffold development. Some work on the effects of microstructure exists in this field for fibroblasts, endothelial and epithelial cells and macrophages [3-5]. Cartilage engineering is one aspect of tissue engineering that might benefit from a study of microstructure effects within scaffold materials. To fully study this in a scientific manner it will be necessary to develop micropatterns with controlled 2-D and 3-D structures for use in chondrocyte cultures. This study reports initial results which use an excimer laser system to introduce microstructures on poly- α -caprolactone (PCL), a biodegradable polymer, which has been used as a cartilage scaffold material.

METHODS: Uniform thin films of poly- α -caprolactone (PCL) were generated by spin-casting PCL (Birmingham Polymers, Inc.) in acetone solution onto 76mm*26mm glass slides.

An Excimer Laser (M2000-E, Exitech) was used to treat the PCL films and introduce local microstructures. The system incorporates a 100Hz laser, with a sample positioning accuracy $\sim 1\mu\text{m}$, sample motions of up to 100mm/sec and maximum fluence levels of $\sim 50\text{J}/\text{cm}^2$.

Bovine cartilage cells were obtained from metatarsophalangeal joint and seeded on the PCL films (pre-sterilised with 70% ethanol) and on

60mm*15mm tissue culture plate (TCP)(Falcon) and tested for a range of cell densities.

RESULTS: Cartilage cells seeded on TCP showed differing behaviours according to cell seeding densities. Cells at lower densities de-differentiated to fibroblasts within several days, as shown in Figure 1. The behaviour of cells on PCL under similar culture conditions will be discussed.

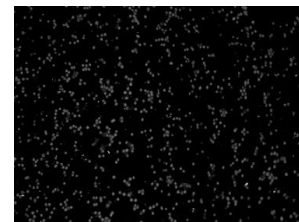


Fig. 1: Cartilage cells seeded on TCP at a cell density of 5×10^6 cells/ml. Normal chondrocytes (left) after 24hrs culture and normal and de-differentiated chondrocytes (right) after 7 days culture.

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