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MICROSTRUCTURAL CHANGES IN POLYESTER BIOTEXTILES DURING IMPLANTATION IN HUMANS

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ABSTRACT

We have previously reported that polyester arterial prostheses experience losses in strength and molecular weight while implanted in humans over extended periods. This study used thermal analysis, FTIR spectroscopy and vapor phase dyeing techniques to characterize changes in the microstructure of poly(ethylene terephthalate) biotextiles retrieved from patients after 2 to 16 years in vivo. It found that polyester fibers become increasingly more crystalline due to hydrolytic biodegradation near the surface, which results in a loss of amorphous material, and through a slow annealing effect of the body, which at 37 ºC causes the larger crystalline domains to grow at the expense of the smaller ones.

KEYWORDS: biotextile, biodegradation, crystallinity, implant retrieval, infrared spectroscopy, polyester, thermal analysis, vapor phase dyeing

INTRODUCTION

Biotextile structures, woven, knitted, felted and braided from poly(ethylene terephthalate) (polyester) fibers are currently implanted in humans during various types of surgical operations. Because of their superior tensile and bending properties, these polyester fibers and the structures made from them are considered mechanically suitable and biocompatible for use as sutures, internal patches, pledgets, ligamentous prostheses, hernia repair meshes, heart valve sewing cuffs, and endovascular stent grafts (Figures 1-5).

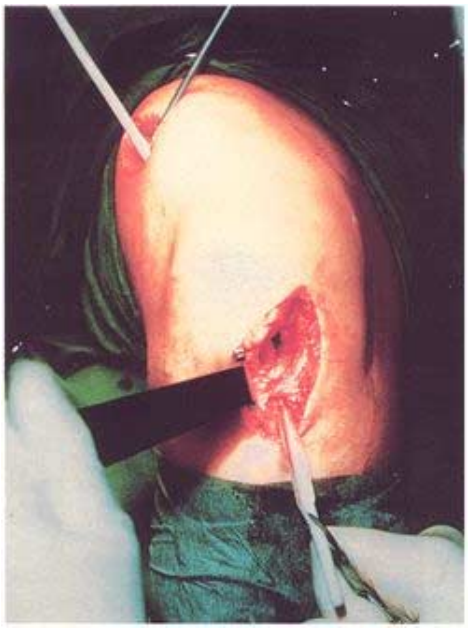

Figure 1: A replacement braided polyester anterior cruciate ligament prosthesis being implanted in a 25 year old football player following an injury in order to stabilize the left knee.