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ENHANCED ENDOTHELIAL MIGRATION AND FUNCTION ON MICRO-GROOVED, PLLA-COATED COBALT CHROMIUM SURFACES

Poster Contributions
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Background: Stents coated with or totally comprised of bioresorbable PLLA (poly-L-lactic acid) have potential to avoid some of the problems associated with permanent polymer coatings or stents. Our studies have demonstrated that the presence of grooves on surfaces significantly increases the rate of endothelial cell migration in vitro and, further, that grooved compared to smooth stent surfaces double the rate of stent endothelialization in a pig coronary artery model. Importantly, this early endothelial coverage results in a significant decrease in restenosis at these stented sites. The study objective was to determine whether this benefit of grooved surfaces would extend to bioresorbable PLLA (poly-L-lactic acid) polymer coated surfaces.

Methods: An established in vitro arterial wall model to evaluate migration rate on to different vascular biomaterials. A confluent layer of cultured human aortic endothelial cells (HAEC) was established on the surface of a cross-linked collagen gel. Flat 1x1 cm, 600mμ thick PLLA-coated cobalt chromium coupons with or without grooved surfaces as well as uncoated grooved coupons were implanted into the endothelialized surface. Grooved surfaces were prepared to create 12 mμ wide, 3 mμ deep grooves with12 mμ separations. After 10-days, the HAEC were stained and migration distance on to the coupon surface was measured. HAEC on the different surfaces were also compared for nitric oxide production and expression of intracellular mTOR .

Results: Endothelial migration rate on to grooved PLLA-coated surfaces was increased by more than three-fold (5.0 vs 1.45 mm) compared to non-grooved PLLA-coated surfaces and equal the rate observed on uncoated grooved cobalt chromium surfaces (Figure 1). Further, significant increases in nitric oxide production and mTOR expression were observed in cells that migrated on to either grooved surface compared to PLLA-coated non-grooved surfaces.

Conclusions: Our results indicate that the presence of grooves on a PLLA-coated surface can significantly enhance in vitro endothelialization. These data have potential implications for of bioresorbable stent design that would promote rapid endothelial healing.

Figure 1.