Cardiology-2014

OMICS Group Conferences
Accelerating Scientific Discovery

4th International Conference on
Clinical & Experimental Cardiology

April 14-16, 2014 San Antonio, USA

Ceramic coating prevents corrosion of cardiovascular stainless steel stents

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Abstract

Ninety percent of coronary percutaneous interventions (PCI) consist in stenting to restore blood flow. Arterial re-obstruction due to restenosis and thrombosis represent a limitation of PCI. These physiological responses are mainly attributed to the release of corrosion products from the metallic stents direct to endothelial tissue and blood flow. This work presents the corrosion phenomena observed in commercially available stents and the relations with its metallurgical condition, composition of the physiological environment in which they are implanted and manufacturing processes. It also includes a comparison with ceramic coated stents. Commercially available stents made of 316L steel were used. EDX, AES, SEM and metallographic techniques were used for chemical analysis, surface composition, topography and determination of metallurgical states, respectively. Stents were immersed in PBS saline solution at 37 ° C for 8 weeks. Periodically, the stents were withdrawn from the physiological environment to monitor the progress of corrosion. After 2 weeks of incubation, stents showed a dendritic corrosion pattern. This is associated with chemical segregation of alloying elements in the metal matrix for the effect of temperature at which the stent are subjected during its laser manufacture. At 4 weeks, the surface showed a pattern of vermicular corrosion located at the curved sections of the stent. This is related to the presence of residual stresses in the curved sectors as a result of stent crimping process made after the laser draft. After 6 weeks, stents exhibited large pits due high chloride content on the physiological medium. In the ceramic coated stents corrosion was practically zero until 6 weeks of incubation. Ceramic coating after surface passivation could be a way to reduce endothelial proliferation and restenosis.