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Alloying pure zinc with copper leads to reduced thrombogenicity in *in-vitro* blood coagulation assays.

Cole A Baker[1], Jennifer Johnson[1], Jeremy Goldman[2], Monica T Hinds[1], Deirdre EJ Anderson[1]

[1]Oregon Health & Science University, Portland, OR, [2]Michigan Technological University, Houghton, MI

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Abstract

Coronary artery disease, a leading cause of death in the United States, is commonly treated with arterial stents. Common issues with cobalt chromium (CoCr) and stainless-steel cardiac stents are thrombosis and in-stent restenosis from the growth of neointimal hyperplasia. To address these issues, researchers have investigated alternative stents, such as bioresorbable stents, which could open the artery upon implantation and degrade after re-endothelization of the lumen. In addition to appropriate mechanical properties, these bioresorbable stents should be non-thrombogenic. Recent focus of biodegradable metals (magnesium, iron, zinc) has been on their alloy composition. Specifically, zinc alloyed with copper or magnesium alloyed with zinc can improve mechanical, antibiotic, and angiogenic properties. Thus, our group tested the thrombogenicity of two different zinc alloys (zinc with 1.5% copper and zinc with 0.8% copper) against pure metal (pure zinc, pure copper) and a clinical control (CoCr). We incubated all metal wires in pooled platelet-poor human plasma to compare the initiation time and rate of fibrin generation and total FXII activation. These biochemical assays interrogate blood coagulation, specifically the common coagulation pathway and contact pathway, respectively. The fibrin activation times of all metals were significantly faster than pure plasma. The Zn-0.8Cu wire had a significantly lower fibrin activation time than pure zinc, indicating a reduction of thrombogenicity of the Zn-0.8Cu wire from a small addition of copper. No metals had significantly different fibrin generation rates compared to plasma or clinical controls. Interestingly, Zn-0.8Cu caused significantly less FXII activation compared to pure zinc while Zn-1.5Cu did not. No metals had a significant effect in reducing FXII activation compared to plasma control. These results indicate a benefit of reduced thrombogenicity for the Zn-0.8Cu alloy compared to pure zinc metals, as pure zinc had a faster fibrin activation time and more activated FXII than the Zn-0.8Cu alloy.