Polymer Cerclage Eliminates a Significant Source of Metallic Debris in Revision Arthroplasty

Fretting from ancillary fixation devices, such as braided metal cerclage cables, can generate a substantial volume of metallic debris that contributes to local and systemic particulate burden (Fig. 1).[1] Fretting is defined as *"A special wear process that occurs at the contact area between two materials under load and subject to minute relative motion by vibration or some other force."*[2] Metal cerclage cables are highly susceptible to fretting because they are comprised of bundles of metal wire filaments that wear against each other during cyclic loading. These wire filaments (Fig. 2) act as wear couples and sites for initiation of fretting wear. In addition, existing metal cable/bone-plate combinations allow for direct contact between the fixed plate or grip and the cyclically loaded metal cable.

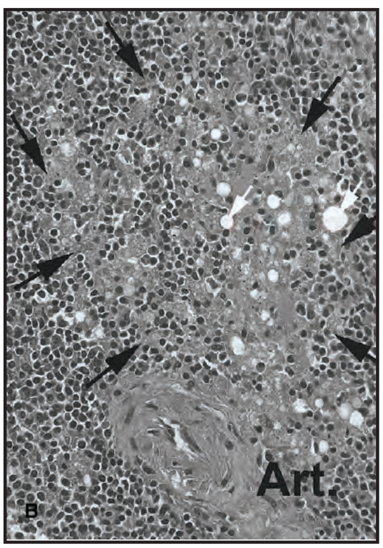

Fig. 1. Postmortem photomicrograph of white pulp of the spleen shows macrophages (black arrows) containing abundant submicrometer particles of cobalt-chromium-nickel-tungsten alloy generated by metal cerclage cables.[1]

Released metal particles are thought to have a cumulative effect on the body. When threshold levels of metal particulate are exceeded in an arthroplasty patient, hypersensitivity, "ALVAL" and other forms of toxicity can result.[1,3,4] Since metal particles are generated from various implant interfaces (including braided metal cerclage cables, MoM articulations, modular junctions, and implant/bone interfaces), and are cumulative, care should be taken to reduce or eliminate sources of debris generation wherever possible so that the overall metal particulate burden is minimized.

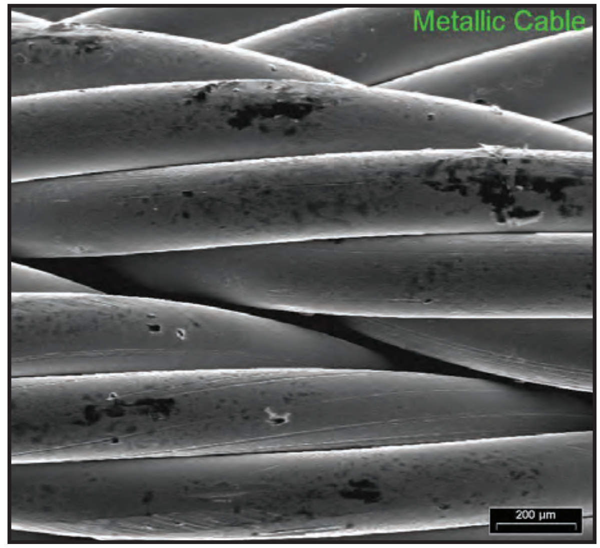

Fig. 2. SEM photo of a metal cerclage cable. Strands of braided metal cable exhibit substantial metal-on-metal interface area that can produce metallic particles and debris during cyclic loading *in situ.*

The polymer SuperCable system (Fig. 3) offers an alternative cerclage cable that eliminates cerclage fixation as a source of metal debris burden. Constructed from high-strength polyethylene

Fig. 3. Polymer SuperCable comprised of UHMWPe fiber and nylon filament with a titanium locking clasp.

fibers and nylon, and fixed with a titanium clasp, immunogenic metals such as chromium and cobalt are avoided. The pliable polymer fibers offer extraordinary fatigue strength and resistance to abrasion.[7] The "Iso-Elastic" nature of the SuperCable is designed to allow it to move with the bone during cyclic loading in order to help prevent "digging in" and to remain tight during the bone healing phase.

Fig. 4. Radiograph showing broken and frayed metallic cable.[5]

Braided metal cables have also been shown to release large amounts of metallic debris when individual constituent wires fail due to metal fatigue (Fig. 4). Such particles can become 3rd body abraders in implant articulations, leading to significant additional wear and contributing to osteolysis and implant loosening (Fig. 5).[6] The polymer SuperCable system eliminates the potential for this type of 3rd body abrasion and thus eliminates the potential for catastrophic prosthesis failure and bone loss attributable to metal cable debris.

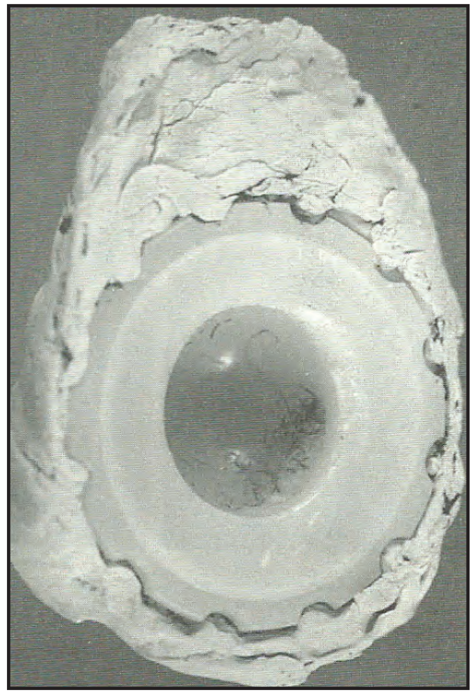

Fig. 5. Retrieval of Charnley acetabular component with metal cable debris embedded in its articular surface.[6]

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