A new method for human digital pulley reconstruction using expanded polytetrafluoroethylene (ePTFE) and a transosseous technique of fixation

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Introduction: Current techniques of pulley reconstruction have marginal success because of high complication rates. A new technique utilizing expanded polytetrafluoroethylene (ePTFE) and a unique stainless steel prosthesis is described and tested for pullout strength. The authors hypothesize that this technique is as strong as current techniques and native pulleys.

Materials and Methods: Cadaver digital rays were dissected and the pulleys were removed. A2 pulley reconstructions were performed using ePTFE with a transosseous technique of fixation in combination with a unique stainless steel plate, in each of four different configurations. The configurations were single and double FiberWire® and double and triple 22G stainless steel wire. Pullout strength was tested using a hook device similar to that of previously published studies see Figure 1.

Failure mechanisms were suture cutout (tearing) through or tensile failure of ePTFE in most reconstructions, with sporadic FiberWire® knot failure (2), phalangeal fracture (1), and PIP hyperextension failure (1). Previously published native A2 pulley pullout strength ranges from <220N-407.49N, and our numbers ranged from 76.5-300N. The triple wire repair was statistically stronger than all other repair techniques. Double FiberWire® was statistically stronger than single FiberWire®. There was no statistical difference in stiffness between any of the repair techniques.

Discussion: ePTFE is an ideal material for pulley reconstruction because it is biologically inert. ePTFE has an adequate amount of tensile strength to serve as a human digital pulley, but is limited by its suture cutout or tear properties. An implant such as the metal prosthesis described in this study is necessary to augment tear properties of ePTFE. A transosseous technique of fixation is ideal in that it does not disrupt the extensor compartment, and allows for facile tensioning of the pulley graft. Both FiberWire® suture and 22G stainless steel wire are adequately strong methods of fixation, with a small rate of knot failure in the FiberWire® group. Other commercially available formulations of ePTFE may have improved tear strength and should be evaluated.


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