Use of a Polyurethaneurea Membrane for Repair of Chronic Achilles Rupture

Eric Giza, MD
Sacramento, California

Named after the Greek warrior, the Achilles tendon is the largest tendon in the body, comprised of the fibers from both the gastrocnemius and soleus muscles that spiral 90 degrees to insert into the posterior calcaneus. The tendon can withstand loads of up to 4000 and 5500 N during running and jumping, and is usually able to meet the physiologic needs of daily activities and athletics. Chronic changes such as Achilles tendonosis, vascular disease, neuropathy or rheumatologic disease may cause a decrease in the mechanical load that the tendon can withstand.

Acute rupture usually occurs in patients between 30 to 45 years old during recreational athletic activities, after a fall or stumble causing sudden acceleration or deceleration movements. The most common symptom is sudden calf pain with an audible snap. The incidence of Achilles tendon rupture in the general population is 7 per 100,000 and this injury plagues competitive and recreational athletes as well as sedentary people, occurring 4 to 5 times more often in men than women.

For acute ruptures, non-operative bracing or simple repair without augmentation are preferred due to a smaller incision, shorter operative time and lower incidence of infection. Conversely, neglected or repeat ruptures may have muscle and tendon atrophy, retraction, and short distal tendon stumps which necessitate reconstruction with exogenous or endogenous materials to bridge the defect of the tendon. Fascia lata, peroneus brevis transfer, flexor digitorum longus, and flexor hallucis longus have all been used as endogenous materials for repairs. Exogenous materials include carbon fiber, Marlex mesh, Dacron grafts, PLA implant, polypropylene braid, and the Artelon® Tissue Reinforcement implant (ATR) (Artimplant AB, Västra Frölunda, Sweden).

The ATR scaffold is a readily available synthetic degradable poly(urethane urea) material used to augment tendon repair. The Artelon® implant is a degradable polyurethaneur that is sutured over torn tissue to strengthen a repair of a neglected tendon rupture.

It acts a scaffold for cellular ingrowth to facilitate healing as well as allowing angiogenesis and neocollagenesis. Angiogenesis with a lack of inflammatory cells indicates stromal cell migration, tissue formation and differentiation. This material has shown good biocompatibility in soft tissue and bone in animal studies and clinical use.

Integration into the host tissue occurs after six months, which promotes the return of the normal physiological properties of the tendon. Over a period of years the implant will completely degrade. The implant is synthetic and has no risk of disease transmission or immunologic reactions toward donor collagen. The implant is readily available at room temperature storage and costs less than dermal allo/xeno grafts. It is these properties that make the ATR scaffold a reasonable option to strengthen a direct tendon repair or flexor hallucis longus tendon transfer.

REFERENCES


