

Scapholunate Ligament Augmentation System for Rapid Functional Restoration

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The scapholunate ligament serves a critical role in stabilizing the wrist and providing support during physical activities. However, its prominent role and complexity within the carpal system make ruptures of the scapholunate ligament (SLL) one of the most common and complicated types of wrist injuries. Multitudes of methods exist to surgically repair the system to regain functionality, but these methods are inadequate, and many have long-term side effects such as high re-tear rates, reduced range of motion and flexibility, and an inability for the patient to return to peak performance. The current procedures are highly dependent on the stage of the scapholunate dissociation (SLD). The six stages are categorized by quantifying the degree of tear (complete or partial), the possibility of repair of the ligament, alignment or malalignment of the scaphoid, and cartilage health. Our device will be applicable to complete tears of the ligament with and without malalignment of the scaphoid, which correspond to stages 2 through 4. Our team proposed to work towards solving this medical problem with applications of mechanics and surgical engineering principles. Under the guidance of our clinical mentor, Dr. R. Frank Henn III, an orthopedic surgeon at the University Of Maryland School Of Medicine, we designed a reliable method for surgically augmenting the ruptured scapholunate ligament to restore functional mobility without sacrificing long-term stability. Our intent was to establish a method of repair that is common across orthopedic practices and replaces the multitude of less desirable methods used today. The purpose of our device is to augment the scapholunate ligament as it heals for stage 2 SLD or to replace the native ligament for stages 3 and 4 SLD. Our design consists of two spacers made of polypropylene that can be inserted into the scaphoid and lunate. Much like drywall anchors, these spacers expand with the insertion of polyether ether ketone (PEEK) screws and are held in tension with polyethylene suture. The maximum force the native SLL ligament can withstand is 260 N. Both FEA simulations and mechanical testing have shown our device is capable of holding far greater loads than required, with a safety factor above 2. Our device provides the load-bearing capabilities to effectively hold the scaphoid and lunate in tension while providing the flexibility necessary to return to functional movement quickly.