EFFICACY OF THE INTERFERENCE SCREW AND DOUBLE DOCKING METHODS USING PALMARIS LONGUS AND GRAFT JACKET FOR MEDIAL COLLATERAL ELBOW LIGAMENT RECONSTRUCTION

INTRODUCTION: Medial collateral ligament (MCL) reconstruction of the elbow is commonly performed in throwing athletes with chronic insufficiency. Numerous reconstruction techniques have been reported in the literature, primarily employing palmaris longus tendon grafts. These studies have primarily focused on the initial graft strength and fixation methods and the outcome of clinical series. Recently, a commercial allograft substitute, Graft Jacket® (Wright Medical Technology, Arlington, TN), has become available. This material holds promise by obviating the morbidity of palmaris longus or other tendon harvest. The initial strength of this allograft material for this application has not yet been reported. The purpose of this in vitro study was to compare the strengths of interference screw (IS) and double docking (DD) methods for medial collateral elbow ligament reconstruction using two different graft materials: the palmaris longus tendon (PL) and Graft Jacket® (GJ).

METHODS: Thirteen (six paired), fresh-frozen upper extremities (66.4 ± 4.5 years) were cleaned of all soft tissues except the joint capsule, lateral collateral ligament, and the MCL. The radius and ulna were fixed in pronation using screws. The ulna/radius and humerus were then individually potted in polymethylmethacrylate cement and mounted in a test fixture in valgus orientation and flexed to 90°. The anterior and posterior joint capsule and MCL were divided. The ulnar pot assembly was then weighed. The MCL was reconstructed using both the interference screw and the double docking methods with either PL (n=7) or GJ (n=6) as the reconstruction material. Paired specimens were randomized, with one side receiving the palmaris longus and the opposite receiving the GJ. All reconstructions were performed with #2 Fiberwire (Arthrex, FL). Single strand palmaris longus reconstructions of the anterior band of the MCL were performed using two tendon bands. Fixation using the DD technique was through drill holes on the lateral surface of the ulna and the medial supracondylar ridge. The IS method employed 5 mm metal screws (Arthrex, FL) to stabilize the grafts. The GJ reconstructions were prepared using 5.5 x 2.5 cm of rehydrated material rolled upon itself into a tube and sutured using a standardized technique. All grafts were pretensioned to 20N for 5 minutes prior to fixation. A specialized optical tracking system employing a digital camera and custom software was utilized. Spherical markers rigidly fixed to the specimen along the MCL line-of-action were used to measure the length change of the reconstructions. A cyclic valgus load was applied 12 cm distal to the medial epicondyle via a computer-controlled pneumatic actuator. The peak load (assembly weight plus applied load) equaled 40 N. If, after 500 cycles at 0.5 Hz, the reconstruction remained intact and its length change was less than 10 mm, the total load was increased by 10 N and repeated until either condition of failure was achieved.

RESULTS: As shown in Figure 1, the maximum load ± SD for the DD with GJ reconstruction was 65 ± 12 N; for the IS with GJ: 45 ± 5 N; for the DD with PL: 59 ± 11 N; for the IS with PL: 56 ± 14 N. The maximum number of cycles ± SD, Figure 2) endured by the DD with GJ reconstruction was 1292 ± 256; for the IS with GJ: 356 ± 292; for the DD with PL: 1104 ± 479; and for the IS with PL: 924 ± 690. For the maximum load and number of cycles, there was no significant difference between the GJ and the PL (P>0.05), but, the DD performed significantly better than the IS (P<0.05).

DISCUSSION: These data suggest that single strand MCL reconstructions using the DD outperform those using the IS. The favourable initial performance of the Graft Jacket® suggests that it may be considered as a viable alternative to the PL tendon. This has an important implication in clinical practice as harvesting the PL adds to the operating time and morbidity of the surgery. Nerve injuries and wrist stiffness have been reported following harvest of the PL. The remodeling and healing of this allograft tissue when compared to autograft tendons requires further study to ensure that the structural strength reaches acceptable levels for these high demand patients. It is unknown whether this new material maintains its initial structural strength over time. Clinical outcome studies are needed to confirm the efficacy of the material when employed in throwing athletes.

Figure 1: Mean (± 1 SD) maximum load of each MCL reconstruction. The DD outperformed the IS (P<0.05). There were no differences between PL and GJ (P>0.05).

Figure 2: Mean (± 1 SD) maximum number of cycles endured by each MCL reconstruction. The DD outperformed the IS (P<0.05). There were no differences between PL and GJ (P>0.05).

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REFERENCES