Editorial Commentary: Time-Zero Biomechanical Shoulder Instability Studies Are Valuable But Limited Because They Do Not Replicate Clinical Dynamics

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Abstract: Severe anterior shoulder instability with glenoid bone loss can be very difficult to treat. A recent cadaveric, biomechanical, time-zero study compared the stability of Bankart repair with long head of the biceps brachi transfer versus conjoined tendon transfer in the scenario of 20% anteroinferior glenoid bone loss. The result is long head of the biceps tendon transfer in combination with the Bankart repair provided the best overall condition compared to Bankart repair alone, or with a conjoined tendon transfer. However, a limitation is that this does not confirm that this surgical approach would provide sufficient long-term noncontractile shoulder stability to withstand repetitive soft-tissue loading in a dynamic, clinical situation.

See related article on page 2628

Severe anterior shoulder instability with glenoid bone loss can be very difficult to treat. In their study "Bankart Repair With Transferred Long Head of the Biceps Provides Better Biomechanical Effect Than Conjoined Tendon Transfer in Anterior Shoulder Instability With 20% Glenoid Defect," Kang, Wang, Wang, Wei, Li, Jiang, Yu, Zhao, and Xie[1] have gone to great efforts to test the biomechanical stability of Bankart repair with long head of the biceps brachi transfer compared with conjoined tendon transfer in cadaveric specimens with 20% anteroinferior glenoid bone loss. Using information obtained from previous studies, they designed a biomechanical laboratory test apparatus that combined careful glenohumeral joint specimen positioning and adjacent tendon loads to determine joint stability under 5 different translational loading conditions (intact, with a 20% glenoid defect, after standard Bankart repair, after Bankart repair with the addition of a dynamic conjoined tendon sling, and after Bankart repair with the addition of a dynamic long-head biceps tendon sling) while carefully measuring anterior, inferior, and total humeral head translation under progressive loads. They concluded that the Bankart repair with the addition of a dynamic long-head biceps tendon sling condition provided superior stability under greater loading conditions.

The authors are to be commended for helping to shed some valuable insight on this important topic.[1] It is not easy to effectively evaluate dynamic loading using in vitro biomechanical techniques. In this study, each of 12 specimens was tested twice, at progressive loads of 20, 30, 40, and 50 N, under 5 different conditions. For each specimen, the final condition tested appeared to be the best condition. Given that the condition order was the same for each specimen, the researchers may have become more skilled with practice at specimen positioning, clamping, tendon suturing, force application, etc. With counter-balancing the biomechanical test order other than the intact condition, they may have been better able to negate the potential influence of order bias.

Considering the 2- to 3-mm more posterior test start positions for the long head biceps tendon transfer and conjoined tendon transfer conditions, the 3- to 4-mm total translation that was observed may not be clinically meaningful, since it may primarily represent more

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neutral humeral head repositioning. Similarly, superoinferior translation group differences amounted to approximately 2 to 3 mm, about the thickness of 2 stacked pennies.[2] While statistical significance was demonstrated, we are not sure about study clinical significance, bearing in mind the many challenging manual operational steps. These included: Step #1. fixing the scapula to a metal plate; Step #2. mounting the metal plate on a jig; Step #3. aligning the superior-inferior glenoid axis within the scapular plane at 30° relative to the ground; Step #4. fixing the humeral shaft to an intramedullary rod on a moveable arch at 60° abduction, with scapular rotation positioning the shoulder in 90° abduction; and Step #5. suturing individual tendons to a pneumatic actuator to provide 5 N loads to each muscle, except for the supraspinatus, long head of the biceps tendon, and the conjoined tendon which each received 10 N loads.[3,4] Although specimen loading was standardized, each needed to be manually removed from the custom rig and prepared accordingly for the next condition (by 1 of the 9 authors), and then reinstalled before testing.

Lastly, study results suggest that long head biceps tendon transfer in combination with the Bankart repair provides the best overall scenario compared with Bankart repair alone, or with a conjoined tendon transfer. However, it does not confirm that this would provide sufficient long-term noncontractile shoulder stability to withstand repetitive soft-tissue loading in the presence of a 20% glenoid defect. Lastly, in addition to using a counter-balanced test order, it would have been interesting if the authors had included a Latarjet procedure group in the study design.

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