

Comparison of the “Pull-Back” Effect of Rotator Cuff Anchors

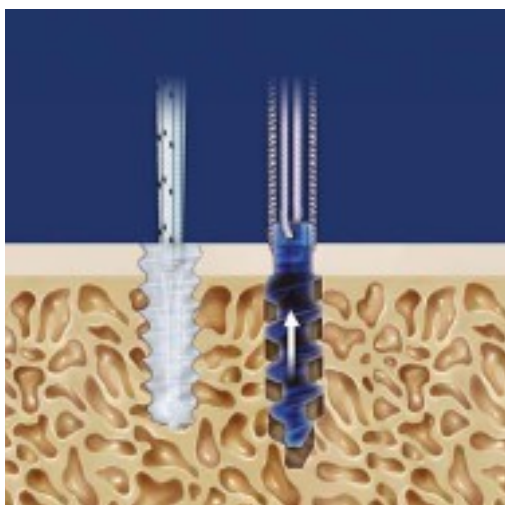
Steve Flores, M.D.

Arthrex Research and Development

Objective

It is common for surgeons to tug on the sutures of an inserted anchor to ensure adequate fixation of the anchor. Occasionally, anchors pull back until the threads catch on the cortical layer which causes the eyelet of the anchor to become proud. The “pull-back” effect is a term used to describe this displacement of the anchor. “Pull-back” may also occur due to a lack of thread purchase in the cortical bone with anchors that have protruding eyelets. The Bio-Corkscrew FT is fully threaded which allows thread purchase in the cortical bone, which may in turn, prevent “pull-back.” The object of the study is to compare the “pull-back” effect of the 5.5 mm Arthrex Bio-Corkscrew FT to the 5.0 mm Mitek SpiraLok, the 5.0 mm Smith & Nephew TwinFix AB, the 6.0 mm ConMed Linvatec Duet, and the 5.0 mm Stryker BioZip. Figure 1 illustrates the contrasting suture anchor designs.

Figure 1:
Example of fully threaded and non-fully threaded anchor



Methods and Materials

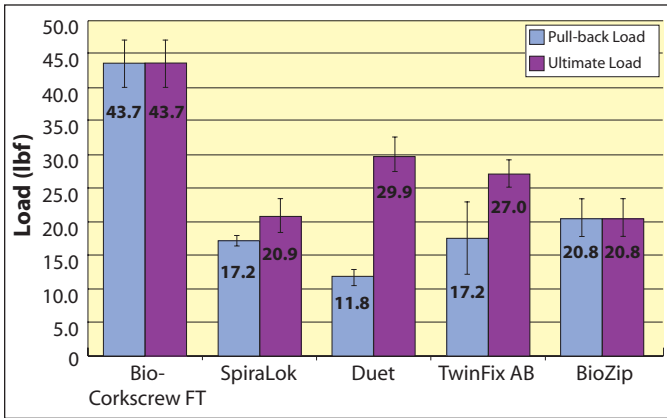
A test medium of 5 lbf/ft³ polyurethane foam block with a 2 mm 20 lbf/ft³ foam block laminate surface was used for testing to simulate poor quality cancellous bone with a cortical layer. The anchors were inserted in the foam block using the appropriate instruments. The constructs were secured in an Instron material testing machine, and tensile forces were applied to the anchors. Yield or “pull-back” load, ultimate load, and mode of failure were recorded. “Pull-back” load was defined as 0.5 mm displacement without any increased load on the load-elongation curve. Six constructs were tested from the 5.0 mm TwinFix AB, the 5.0 mm BioZip, and the 6.0 mm Duet anchor groups. Eleven constructs were tested from the 5.5 mm Bio-Corkscrew FT and 5.0 mm SpiraLok anchor groups.

Results

The 5.0 mm Mitek SpiraLok demonstrated “pull-back” at 17.2 ± 0.4 lbf and an ultimate pull-out force of 20.9 ± 2.7 lbf. The 5.0 mm Smith & Nephew TwinFix AB demonstrated “pull-back” at 17.2 ± 5.6 lbf and an ultimate pull-out force of 27.0 ± 2.0 lbf. The 6.0 mm ConMed Linvatec Duet demonstrated “pull-back” at 11.8 ± 0.9 lbf and an ultimate pull-out force of 29.9 ± 2.2 lbf. The 5.0 mm Stryker BioZip demonstrated no “pull-back” and had an ultimate pull-out force of 20.8 ± 2.2 lbf. The Bio-Corkscrew FT demonstrated no “pull-back” and had an ultimate pull-out force of 43.7 ± 2.9 lbf.

A Kruskal-Wallis One Way Analysis of Variance on Ranks test ($\alpha = 0.05$), using the Bio-Corkscrew FT as the control, was conducted to compare the “pull-back” loads amongst the different screws. The greater “pull-back” load of the 5.5 mm Arthrex Bio-Corkscrew FT is significantly different from that of the 5.0 mm Smith & Nephew TwinFix AB, the 5.0 mm Mitek SpiraLok, and the 6.0 mm ConMed Linvatec Duet ($p < 0.001$). The greater ultimate load of the 5.5 mm Arthrex Bio-Corkscrew FT is significantly different from that of the other three anchors tested ($p < 0.001$).

Figure 2: “Pull-back” effect data



Conclusion

The 5.0 mm Mitek SpiraLok, the 5.0 mm Smith & Nephew TwinFix AB, and the ConMed Linvatec Duet clearly demonstrate a “pull-back” effect in a poor bone quality model. This may lead to gap displacement which could lead to unsuccessful outcomes. The Bio-Corkscrew FT and Stryker BioZip did not demonstrate “pull-back”; however, the Bio-Corkscrew FT has a statistically greater ultimate load. It is hypothesized that any non-fully threaded anchor could demonstrate “pull-back.”