Headless Compression Screw Cutting Performance:

Mechanical Testing of DePuy Synthes CCHS vs. Stryker® Fixos®/Fixos 2 and Acumed® Acutrak® 2

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Introduction: Self-drilling/tapping orthopaedic screws[1-6] are designed to cut into bone efficiently and evacuate bone chips, so as to not require additional instrumentation or surgical steps for hole preparation. The design of the screw's tip affects the screw's ability to cut into bone. A screw with poor cutting performance requires higher axial load to self-tap (linearly advance at a rate equivalent to one thread pitch per rotation), increasing the frequency at which a drill and/or tap would be required.

The cutting tip of the DePuy Synthes Cannulated Compression Headless Screws (CCHS) is designed to reduce insertion force[7-8]. Figure 1 shows the difference between generic cutting tips and the tip on the CCHS screw family. CCHS feature a positive rake angle and primary/secondary relief surfaces which promote chip evacuation away from the hole.

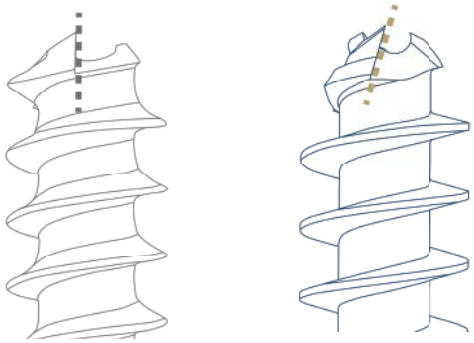


Figure 1: Generic cutting tip (left) with neutral rake angle vs CCHS cutting tip (right) with positive rake angle.

Materials and Methods: Insertion testing of headless compression screws was conducted using methods based upon those described in ASTM F543 Annex A2 and Annex A4 to compare the axial load required for each screw to self-tap into bone-simulant foam over a guide wire, per Figure 2.

Results: Testing demonstrated that for all comparisons, the DPS CCHS required less axial load to self-tap than the Stryker and Acumed headless screws, with observed confi dence >99% ($p<0.01$)[7].

Conclusion: This study demonstrated that DPS CCHS have superior cutting performance to Stryker and Acumed headless screws. The DPS CCHS require less axial load than competitive headless screws to self-tap into the same medium.

Cutting performance as described reduces screw insertion force and minimizes the need to predrill for the CCHS screws, as compared to competitive headless compression screws[7-8].

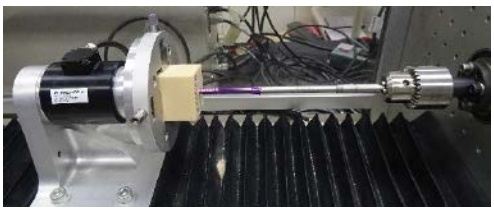
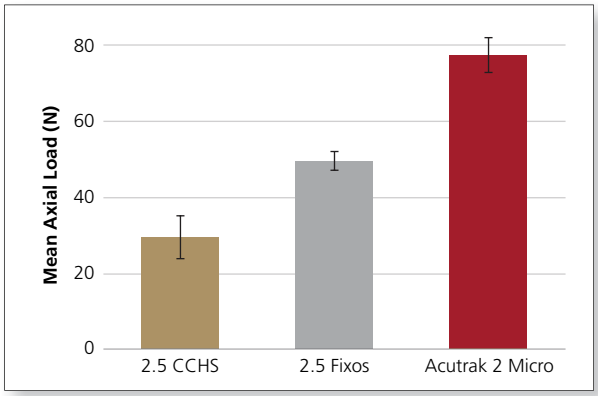
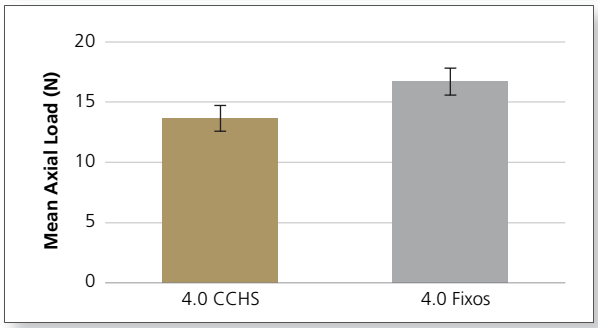


Figure 2: Representative test setup

Table 1: Headless compression screws tested

Group	Product	Foam Density
1 (Ø2.5)	DePuy Synthes CCHS Ø2.5 mm	40 pounds/ft^3 (pcf)
	Stryker Fixos Ø2.5 mm	
	Acumed Acutrak 2 Micro	
2 (Ø4.0)	DePuy Synthes CCHS Ø4.0 mm	20 pcf
	Stryker Fixos Ø4.0 mm	
3 (Ø6.5–Ø7.5)	DePuy Synthes CCHS Ø6.5 mm	20 pcf
	DePuy Synthes CCHS Ø7.5 mm	
	Stryker Fixos 2 Ø7.0 mm	





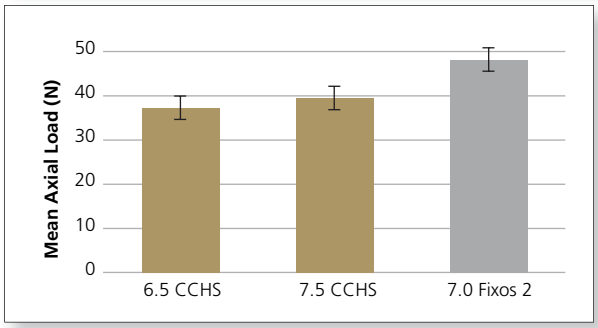


Figure 3: Axial load required for screws to self-tap. Lower results indicate that less load needs to be applied for a screw to self-tap.

Full white paper on this topic available: *"Mechanical Comparison of Headless Compression Screw Cutting Performance: DePuy Synthes CCHS vs. Stryker®Fixos®/Fixos 2 & Acumed® Acutrak® 2". 127117-191106 DSUS/EM.*

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References:

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2. Stryker Surgical Technique Guide: Fixos Midfoot & Rearfoot Screw System. 2015. Content ID: OT-ST-2_Rev-4_6/2015.
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7. DePuy Synthes Report: CCHS Screw Cutting Performance Test. 2019. Ref: 0000288513.*
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*Bench testing may not be indicative of clinical performance.

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