

Comparing Medartis APTUS 2.8 TriLock Fibula Plates vs 3.5 One-Third Tubular Plates

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Introduction

Ankle fractures are one of the most common injuries requiring surgical treatment and account for about 11% of all fractures [1]. Simple lateral malleolar fractures have been treated using one-third tubular plates either laterally as neutralization plates or posterior laterally as antiglide plates with interfragmentary lag screws.

Medartis has developed two types of 2.8 TriLock distal fibula plates which give surgeons the option to use narrow low profile multidirectional plates to repair distal fibula fractures. The plates have a staggered screw geometry and a 3-screw distal fixation option to provide extra fixation in osteoporotic bone.

Materials and Method

The 1.6 mm thick APTUS 2.8 TriLock fibula plates in both straight (A-4854.05) and distal 3-screw (A-4854.01) profiles were evaluated for construct fatigue performance versus DePuy Synthes 3.5 LCP one-third tubular plates (441.381) (Fig. 1).

A 3D printed fixture was used to simulate a long bone with a cortical outer layer and a cancellous core (Fig. 2, left). In order to

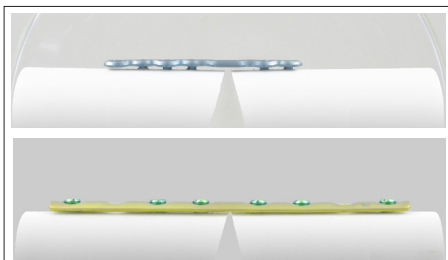


Fig. 1: Medartis APTUS 2.8 TriLock plate (top) and one-third tubular plate (bottom) before testing.

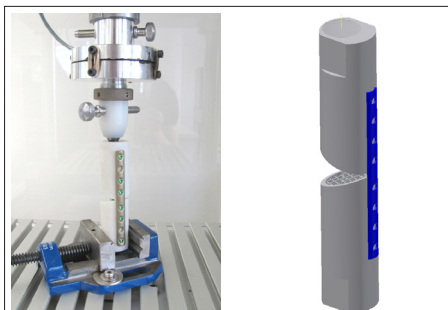


Fig. 2: Test setup showing loading (left) and the trabecular structure of the 3D printed fixtures.

mimick a multifragmentary diaphyseal fibula fracture (AO 44-C2), a wedge-shaped fragment was removed. Plates were attached to the fixture with their respective locking screws while maintaining a 1 mm gap between the plate and the fixture. The construct was subjected to an axial loading. The constructs (n=6 each) were sinusoidally loaded at 4 Hz using a modified Locati approach with 50 N initial load for 50,000 cycles followed by a 15% increase at 50,000 and each additional 10,000 cycles until plate or screw fracture.

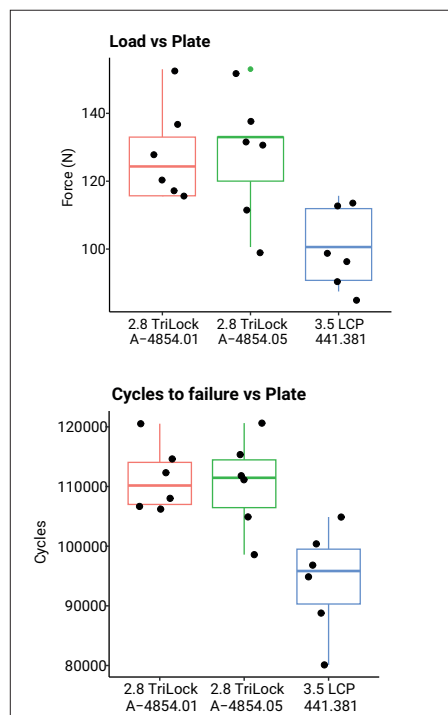


Fig. 3: Fatigue performance for the constructs, in load at failure (top) and cycles to failure (bottom).

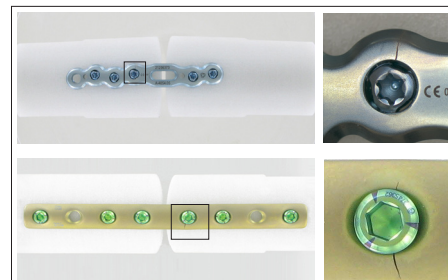
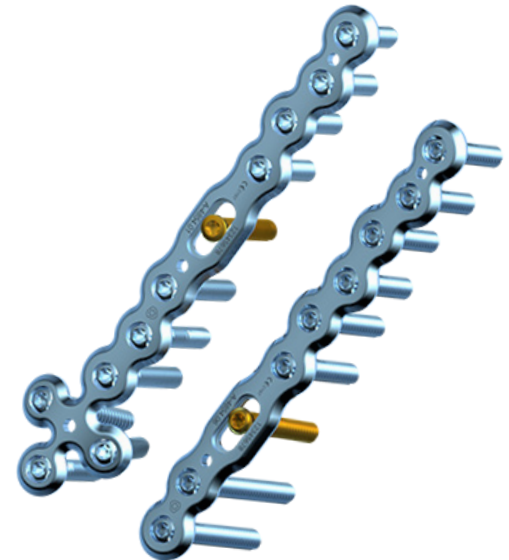


Fig. 4: Medartis APTUS 2.8 TriLock plate (top) and one-third tubular plate (bottom) after testing; the insert shows a magnification of the fracture zone.



Results

The construct fatigue performance is depicted in Fig. 3. The 2.8 TriLock straight plate configuration failed at 128 ± 17 N and 110 ± 8 kCycles and the distal 3-screw plate failed at 128 ± 15 N and 111 ± 6 kCycles. The 3.5 LCP one-third tubular plate failed at 101 ± 12 N and 94 ± 9 kCycles. The differences between both 2.8 TriLock plates and the 3.5 LCP plate were significant for failure load and cycle number (one sample ANOVA followed by Tukey pairwise comparison ($p < 0.05$)).

All constructs failed within the plate and not at the screw level, Fig. 4.

Conclusion

It has been customary to use one-third tubular locking plates with 3.5 mm screws for fibula fractures while plates with smaller screws have been considered too weak. However, a recent report discusses the use of minifragment plates (≤ 2.8 mm systems) in fibula fractures finding adequate fixation with lower rates of hardware removal versus 3.5 mm systems [2]. Though smaller in footprint and screw diameter, the Medartis APTUS 2.8 mm TriLock fibula plates have superior construct fatigue strength versus a 3.5 mm LCP one-third tubular plate in an axial closing wedge model.

References

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- Penning D et al. Minifragment plating of the fibula in unstable ankle fractures. *Arch Orthop Trauma Surg*. 2023; 143:1499-1504