

# Biomechanical Testing of Prototype AFP Distal Radius Plate – Cantilever Bending and Axial Compression

Arctic Biomaterials Research and Development  
Tampere, Finland

## Objectives

AFP Distal Radius Plate is a prototype bioabsorbable fixation plate manufactured using Arctic Biomaterial's proprietary Automated Fiber Placement (AFP) technology. The objective of the study was to compare mechanical properties of AFP Radius Plate with a commercial bioabsorbable radius plate and commercial titanium radius plate of similar sizes.



Figure 1. The AFP Radius plate on the left, Commercial Bioabsorbable Radius Plate in the middle and Commercial Titanium Radius plate on the right. Note: figures taken on already tested samples.

## Materials and methods

The Prototype AFP Distal Radius Plate design and comparison designs are in Figure 1. The AFP material was 96L/4D PLA with 40% (w/w) of X3 continuous mineral fiber to reinforce the structure mechanically. The commercial reference products were made of bioabsorbable polymer and titanium.

The cantilever bending test setup is shown in Figure 2. The testing was conducted in water bath at +37°C after soaking for 24h.

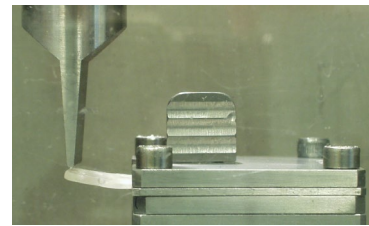


Figure 2. Cantilever bending test setup.

The axial compression was tested by fixing the plates onto anatomical Sawbone models according to Figure 3 using seven screws. The biomaterial plates were fixed with commercial bioabsorbable screws, and the titanium plates were fixed with titanium screws.

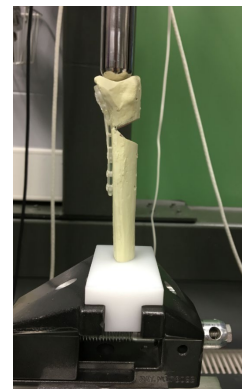


Figure 3. Biomechanical axial compression test setup

## Results

The results for the *in vitro* cantilever bending test are presented in Figure 4. The results are averages of three samples.

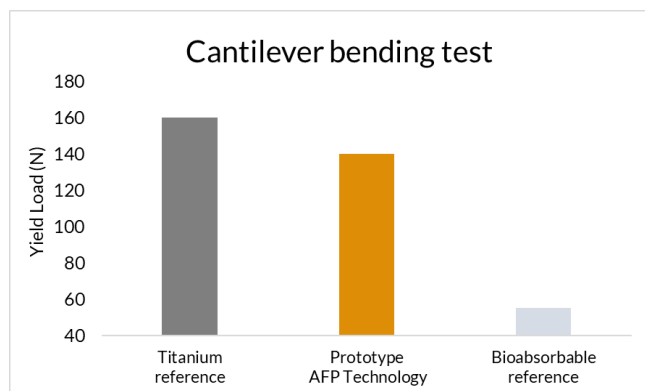


Figure 4. *In vitro* cantilever bending test results.

The results for the biomechanical axial compression test are presented in Figure 5 and 6. The results are averages of three samples.

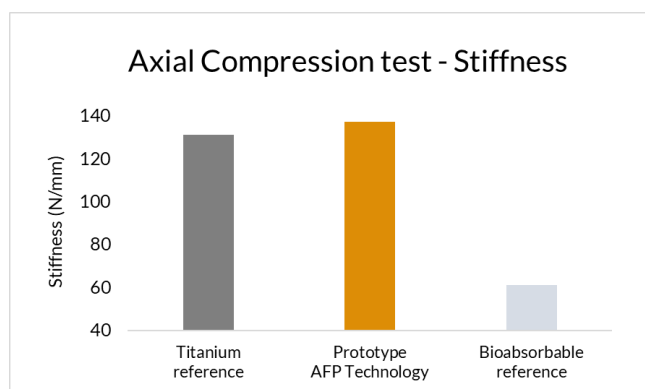


Figure 5. Biomechanical axial compression test result for Stiffness.

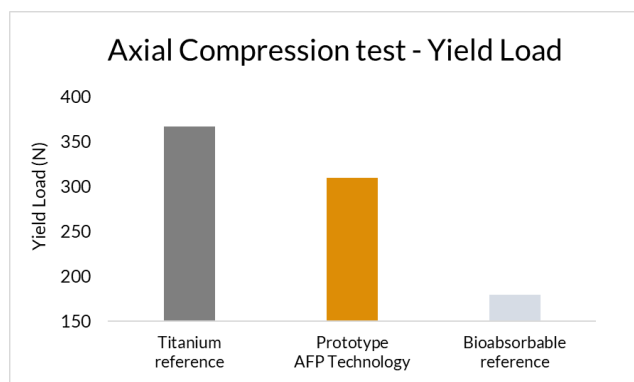


Figure 6. Biomechanical axial compression test result for Yield Load.

## Conclusions

The mechanical properties tested for the Prototype Distal Radius Plate manufactured using AFP technology are close to titanium plate reference. In the cantilever bending test comparison with commercial titanium plate reference, the mechanical properties are over 85% of the titanium reference strength. The biomechanical axial compression gives the AFP plate the strength that is in average 84% of the titanium reference.

In conclusion, the Prototype Distal Radius Plate appears to have initial mechanical properties suitable for load bearing indications. All the results presented in this paper pertain to an example case using a prototype implant design. When proving the behavior of actual products composed by AFP Technology, similar studies and possible further analyses need to be conducted in order to verify the mechanical and degradation characteristics of actual products.

## References

1. ISO 15814:1999 Implants for surgery - Copolymers and blends based on polylactide - In vitro degradation
2. ASTM D747-02 Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam