

Stiffness comparison between commercial titanium metacarpal plate and bioresorbable X3 fiber composite prototype plate

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Objectives

X3 fiber composite prototype plate is a prototype bioresorbable fixation plate manufactured using Arctic Biomaterial's X3 fiber composite technology. The objective of the study was to investigate the initial stiffness properties of X3 fiber composite prototype plate compared to a commercial metacarpal plate.

Materials and methods

The designs of the bioresorbable X3 fiber prototype plate and the commercial metacarpal plate are shown in Figure 1., Figure 2. and Figure 3.

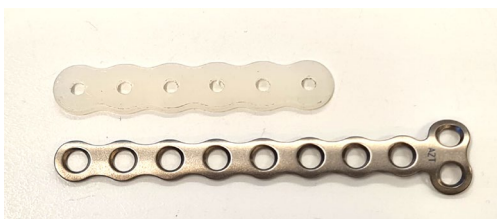


Figure 1. Bioresorbable X3 fiber composite plate and commercial titanium metacarpal plate side by side.



Figure 2. Commercial titanium metacarpal plate on top of the bioresorbable X3 fiber composite plate.



Figure 3. Bioresorbable X3 fiber composite plate behind the commercial titanium metacarpal plate, view from the side.

The testing consisted of 3-point-bending test following the principles of the ASTM D790-10. In the 3-point-bending test setup, support noses were fixed into 30mm distance. Loading and support nose radius was R5. The test setup is shown in Figure 4- and Figure 5.

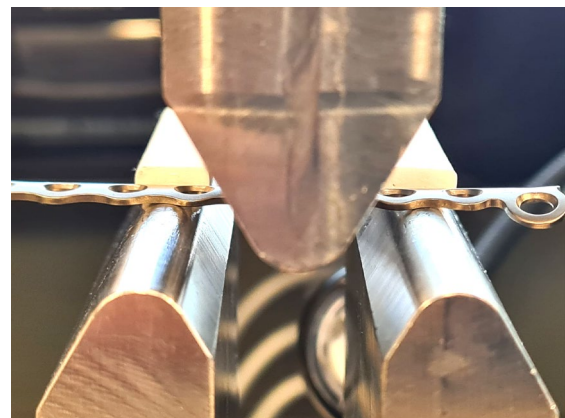


Figure 4. The 3-point-bending setup for the commercial titanium metacarpal plate.

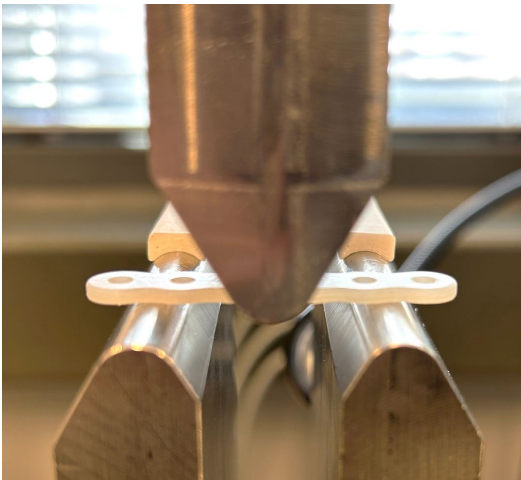


Figure 5. The 3-point-bending setup for the Bioresorbable X3 fiber composite plate.

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 bioresorbable X3 fiber technology, similar studies and possible further analyses need to be conducted.

References

1. ASTM D790-10 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

Results

The results for the initial stiffness test are presented in Figure 6.

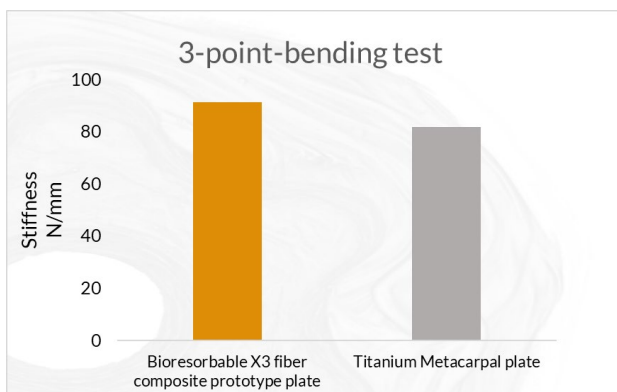


Figure 6. The stiffness comparison between bioresorbable X3 fiber composite prototype plate and commercial titanium metacarpal plate.

The initial stiffness of the bioresorbable X3 fiber composite plate with this prototype design was 11% higher than the commercial titanium metacarpal plate.

Conclusions

In conclusion, the bioresorbable X3 fiber composite prototype plate appears to have a similar initial stiffness compared to similar-sized commercial titanium metacarpal plate.