#1643

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Comparison of Static Testing per ASTM F2077 Using a Constrained, Semi-Constrained and Unconstrained Test Setup

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LEARNING OBJECTIVES

To evaluate and determine whether the hypothesis is true

Test a mock Interbody fusion device in static axial compression testing, static compressive shear testing and static torsion testing in a constrained test setup, a semi-constrained test setup and an unconstrained test setup per ASTM F2077.

Null Hypothesis:

There is no difference between the mechanical performance of static axial compression testing, compressive shear testing and torsion testing in a constrained test setup, a semi-constrained test setup and unconstrained test setup per ASTM F2077

PRESENTATION DESCRIPTION

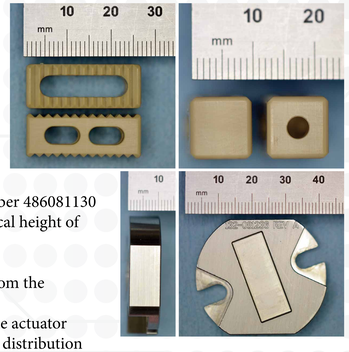
Introduction

Test methods:

- ASTM F2077 static axial compression testing
- ASTM F2077 static compressive shear testing
- ASTM F2077 static torsion testing

Materials:

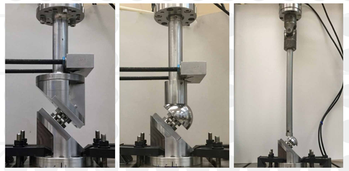
- Fifty-Four (54) PEEK Lumbar Cage – 10 mm x 10 mm x 26 mm, catalog number 486081130
- Two (2) stainless steel test blocks with device matched pockets and an intradiscal height of 6.0 mm as defined per ASTM F2077 -
- Servo-hydraulic test frame in accordance with ASTM E4.
- ASTM F2077 constrained static test fixtures with a rigid connection directly from the actuator to the test specimen
- ASTM F2077 semi-constrained static test fixtures with a rigid connection to the actuator and a hemispherical dome feature that can freely rotate to maintain equal load distribution without translation.
- ASTM F2077 unconstrained static test fixtures with a universal joint or a ball joint at the actuator connection in addition to a hemispherical dome that can freely rotate allowing for equal load distribution to the device.



Tests Setups—Static Axial Compression

Constrained Semi-Constrained Unconstrained

Tests Setups—Static Compressive Shear



Constrained Semi-Constrained Unconstrained

Tests Setups—Static Torsion

Constrained Semi-Constrained Unconstrained

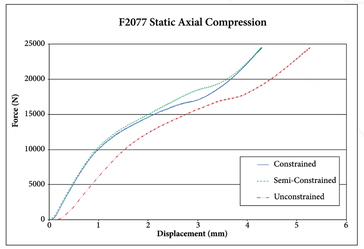
Test Parameters

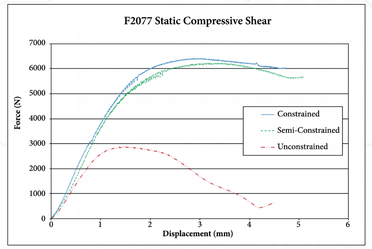
6 specimens tested in a constrained, semi-constrained and unconstrained test setup with each of the following parameters:

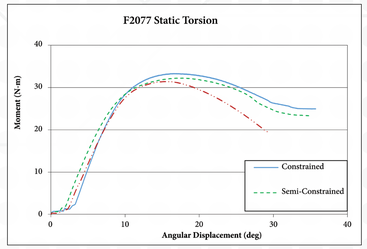
- ASTM F2077 static axial compression testing at a rate: 12 mm/min
- ASTM F2077 static compressive shear testing (at a 45˚ angle) at a rate: 12 mm/min
- ASTM F2077 static torsion testing at a rate: 60˚/min with a 500 N axial preload held in displacement control for the duration of testing

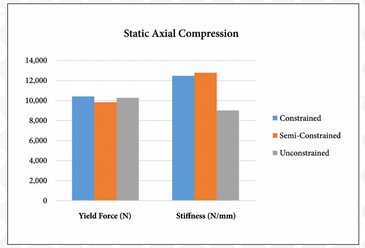
RESULTS & CONCLUSIONS

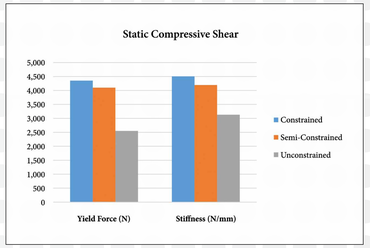
Results

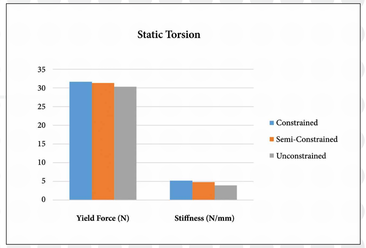












Conclusions

- No statistical difference could be shown between the constrained and semi constrained test setups in all test methods.
- For static axial compression testing, the testing results showed approximately a 30% lower stiffness and no statistical difference in yield in the unconstrained test setup versus both the constrained and semi constrained setup.
- For static compressive shear testing, the testing results showed approximately a 30% lower stiffness and approximately a 40% lower yield in the unconstrained test setup versus both the constrained and semi constrained setup.
- For static torsion testing, the results showed approximately a 22% lower stiffness and no statistical difference in yield in the unconstrained test setup versus both the constrained and semi constrained setup.

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