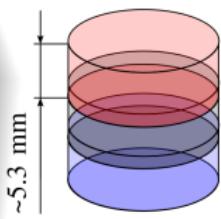
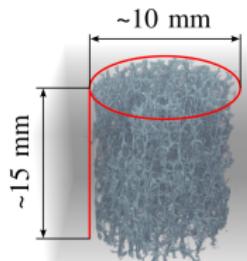


Fabric-Elasticity Relationships in Healthy and Diabetic Individuals

Mathieu Simon

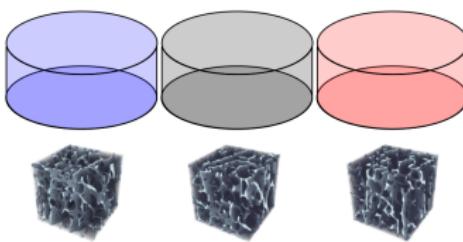
March 5, 2025

Samples



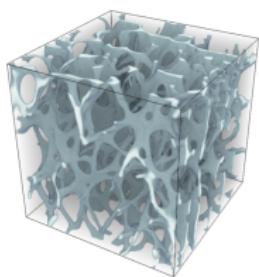
84 Samples
29 Distal femur (26 Ctrl + 1 T2D)
57 Femoral Head (28 Ctrl + 29 T2D)

3 Stacks

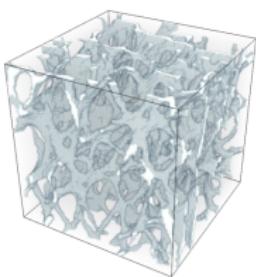
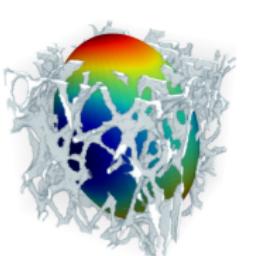


1 Cubic region of interest (ROI) per stack

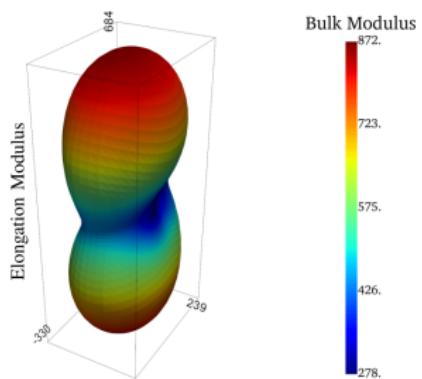
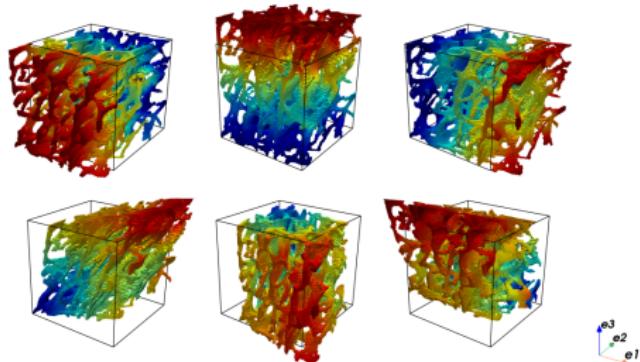
Medtool 4.8

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BERN

252 ROIs

Downsampling (Factor 4)
SegmentationMorphometry
Fabric

Abaqus 2023

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Control Samples



Diabetic Samples

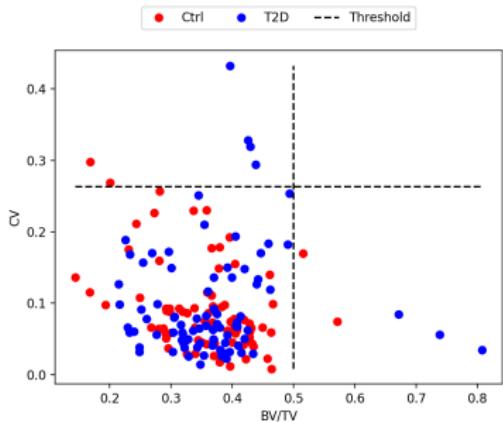


Bone Volume Fraction and Fabric

Thresholds

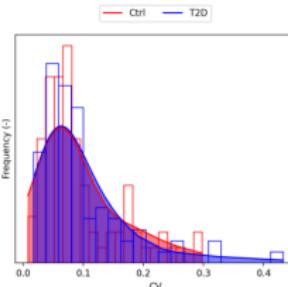
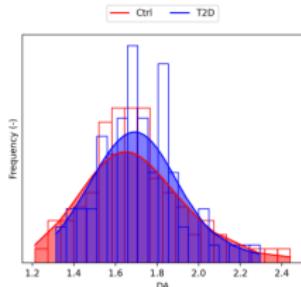
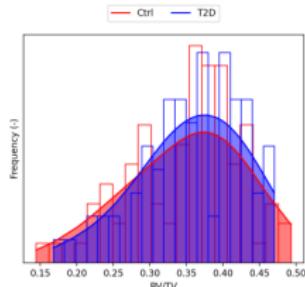
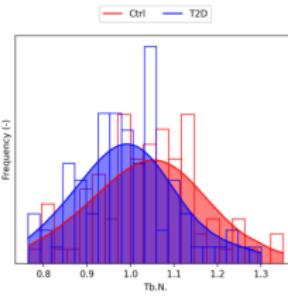
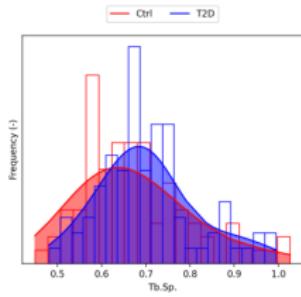
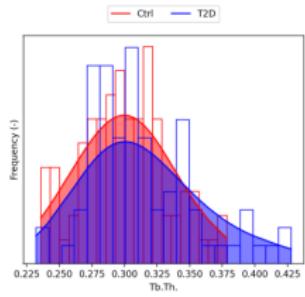
- Trabecular bone sample: $BV/TV < 0.5$
- Homogenous mass distribution: $CV < 0.263$ [1]

Femoral head samples only



Morphometry - Distributions

Samples with $BV/TV < 0.5$



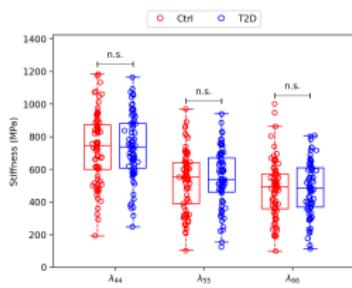
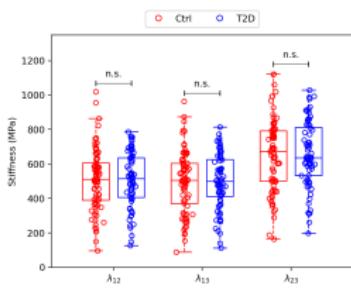
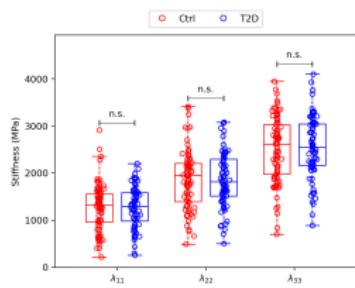
Morphometry - Statistics

Samples with BV/TV < 0.5

Variable	Distribution	Variances	Test	p-value	Ctrl	T2D
BV/TV	Not-normal	Equal	Mann-Whitney	0.77	0.37 [0.30-0.40]	0.36 [0.31-0.41]
Tb.N.	Normal	Equal	Mann-Whitney	0.06	1.04 [0.96-1.12]	1.02 [0.93-1.06]
Tb.Th.	Not-normal	Equal	Mann-Whitney	0.41	0.30 [0.28-0.32]	0.31 [0.28-0.33]
Tb.Sp.	Not-normal	Equal	Mann-Whitney	0.09	0.66 [0.59-0.74]	0.68 [0.63-0.75]
Tb.Sp.SD	Not-normal	Equal	Mann-Whitney	0.50	0.07 [0.07-0.08]	0.07 [0.07-0.09]
DA	Not-normal	Equal	Mann-Whitney	0.29	1.69 [1.59-1.82]	1.66 [1.54-1.81]
CV	Not-normal	Equal	Mann-Whitney	0.94	0.07 [0.05-0.11]	0.07 [0.05-0.14]

Mechanics - Statistics

Samples with $BV/TV < 0.5$ and $CV < 0.263$

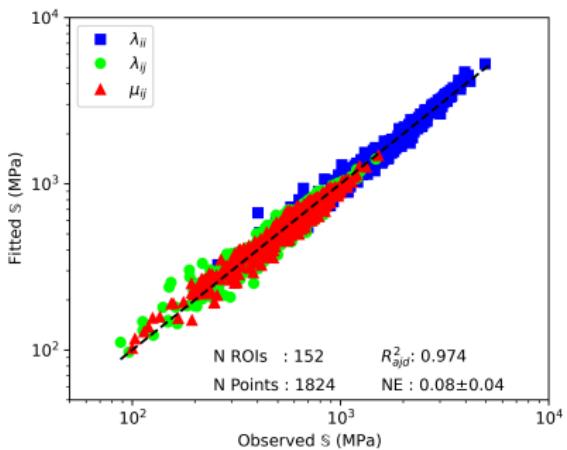


Grouped Linear Regression

Samples with $BV/TV < 0.5$ and $CV < 0.263$ [1]

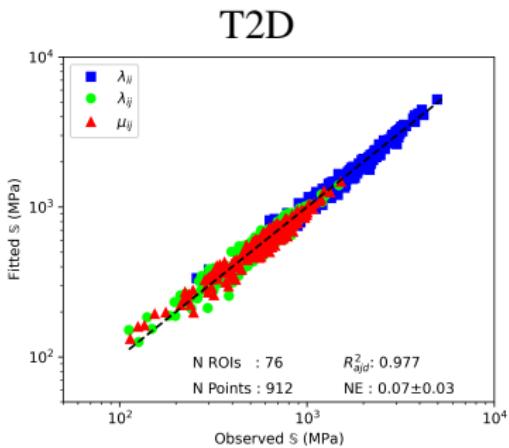
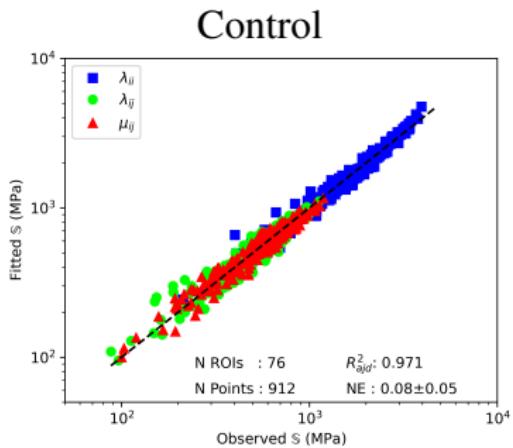
Matching femoral head Ctrl with T2D for BV/TV and DA [2]

⇒ 76 pairs of samples



Separated Linear Regressions

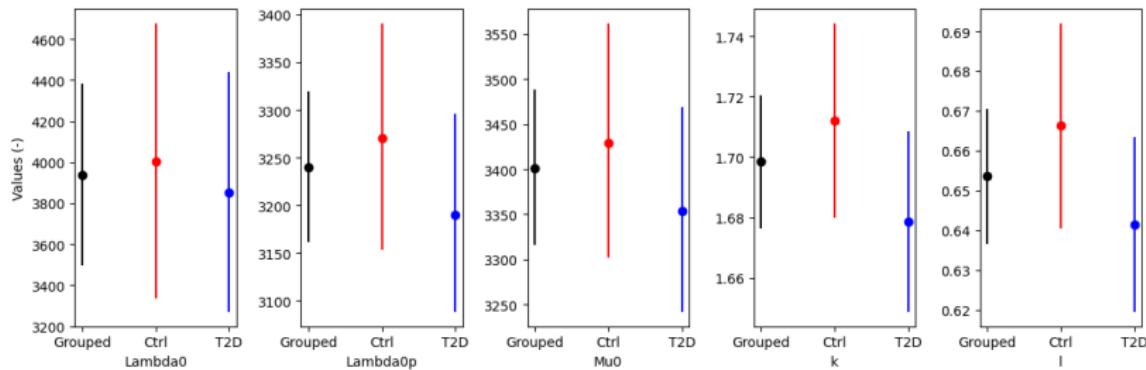
Similar regression quality



Separated Linear Regressions

Parameters

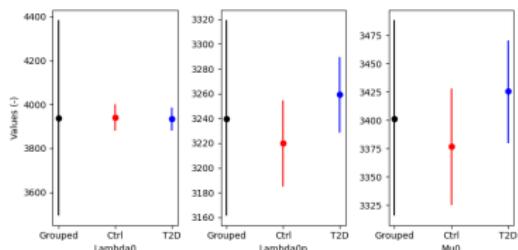
⇒ Overlapping confidence intervals



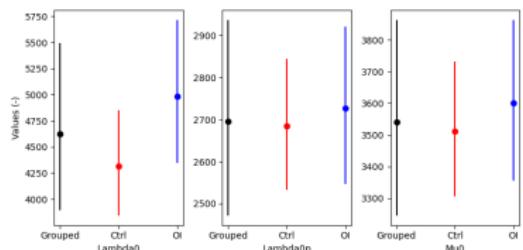
Stiffness Constants Comparison

Fixed exponents

⇒ Overlapping confidence intervals



Present Study

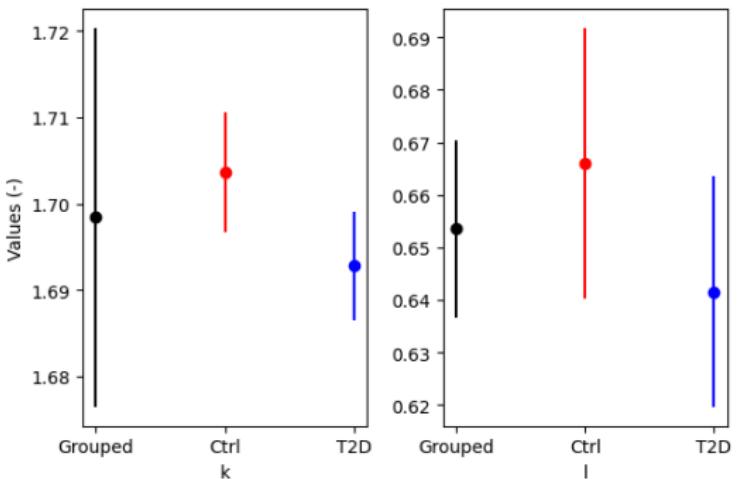


Simon et al. [2]

Exponents Comparison

Fixed Stiffness Constants

⇒ Overlapping confidence intervals



References

- ▶ Panyasantisuk, J., Pahr, D. H., Gross, T., and Zysset, P. K. (2015) Comparison of Mixed and Kinematic Uniform Boundary Conditions in Homogenized Elasticity of Femoral Trabecular Bone Using Microfinite Element Analyses
J Biomech Eng., 137(1)
<https://doi.org/10.1115/1.4028968>
- ▶ Simon M., Indermaur M., Schenk D., Hosseinitabatabaei S., Willie B.M., Zysset P. (2022) Fabric-elasticity relationships of tibial trabecular bone are similar in osteogenesis imperfecta and healthy individuals
Bone, 155
<https://doi.org/10.1016/j.bone.2021.116282>