The degree of anisotropy from 1.22 to 3.03. The average tissue density was 1.865±0.096. With a few exceptions, all mechanical tests provided stress-strain curves with a well-defined linear part followed by a stress maximum, allowing the determination of the yield and ultimate stress properties. The yield and failure stress states were fit in a two step procedure to a conewise quadratic Hill model that is formulated with power relationships of both volume fraction and fabric eigenvalues. The conewise property ensures that distinct strength can be predicted in tension and compression. In the first step, the combined yield data of compression, tension and torsion was fit and found to correlate significantly with both volume fraction and fabric (n=59, r²=0.92, p<0.001). The corresponding failure data provided also significant correlations (n=53, r²=0.89, p<0.001). In a second step, the multiaxial 3 distinct ratios of axial versus radial stress. All tests were performed with a minimal resolution of 30x30x50 µm. Volume fraction and mean intercept length based fabric eigenvalues were calculated from a central 6mm core of each specimen.

Discussion
To our knowledge, this study represents the first attempt to identify experimentally a multiaxial failure criterion for human trabecular bone specimen and will be void of pathologies. However, due to the limited sample size, no attempt was made to compare the results between different anatomical sites or various degrees of osteoporosis. Despite the highly significant and good correlations obtained for yield and failure data with respect to volume fraction and fabric, the relative errors shown in Fig. 2 are important but lower than previous data in compression [3] and consistent with previous predictions of elastic properties. These errors are attributed in priority to the fragile continuum assumption underlying any human trabecular bone specimen and will likely not be reduced by improving the testing protocols. Nevertheless, we expect these experimental results to provide valuable input for numerical simulations and failure predictions of human bones and bone-implant systems.

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