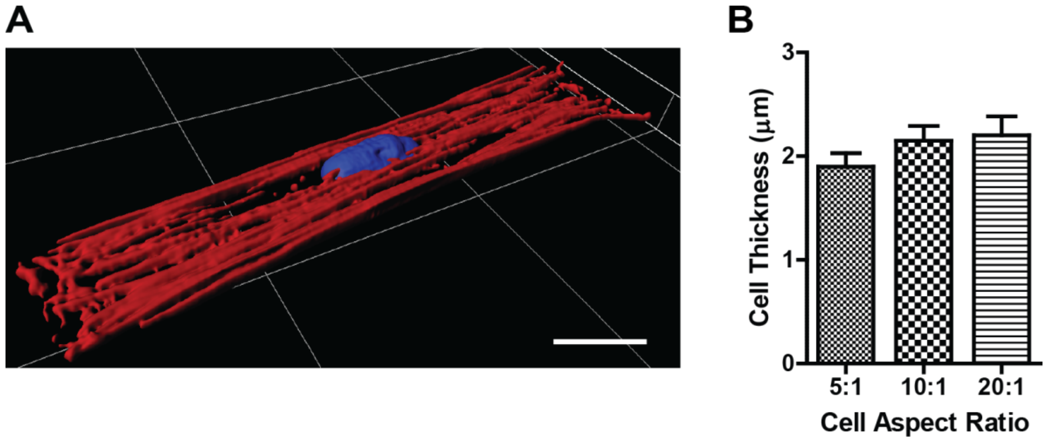
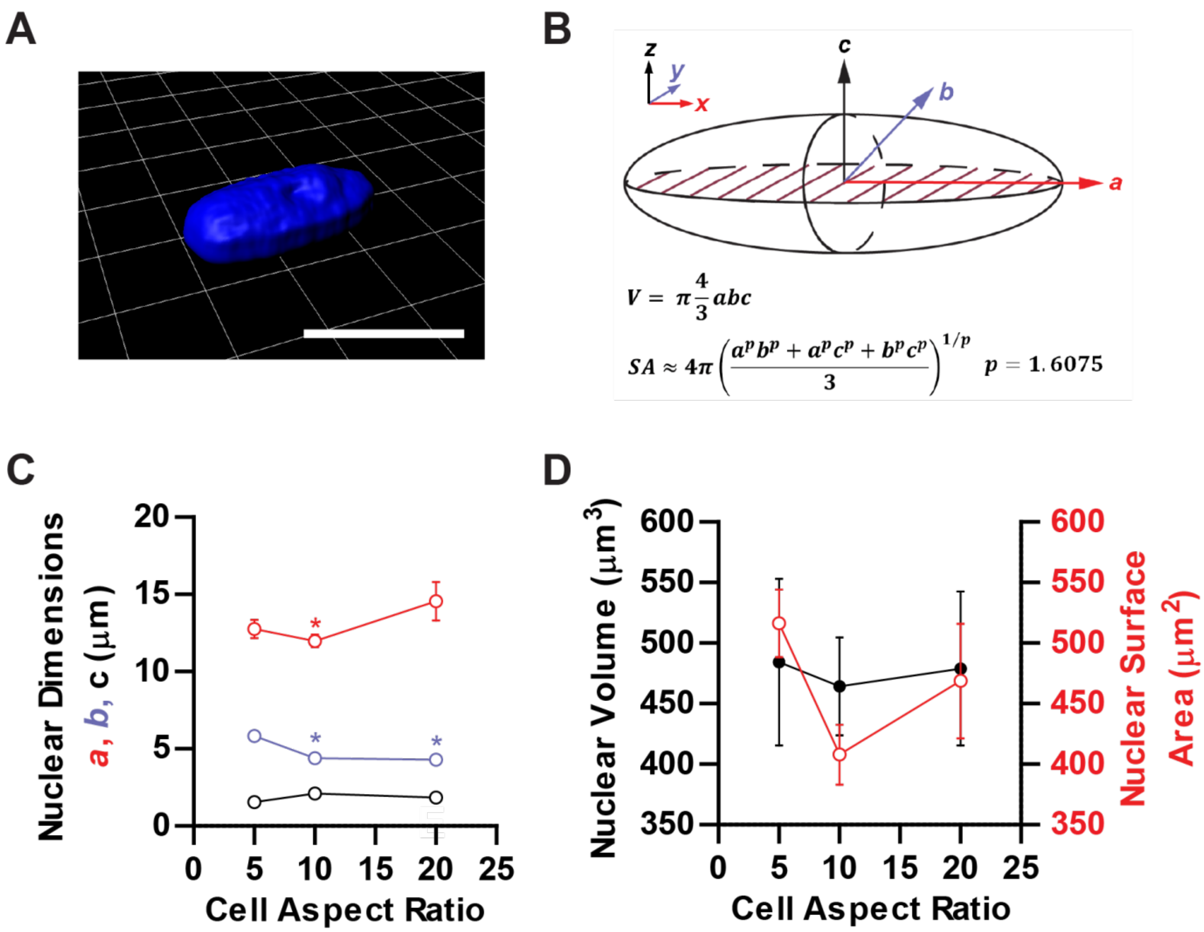


Supplementary Fig. 1 VSMC thickness is similar for different cell ARs. (A) Three dimensional rendering of a 5:1 AR VSMC patterned on PAA gel. (Red: F-actin, blue: nucleus). Scale bar = 20 μm. (B) Cell thickness as a function of cell AR (mean ± SEM). *n* = 7-12 cells per AR.



Supplementary Fig. 2 Nuclear volume and surface area calculation for isolated VSMCs. (A) A Three-dimensional rendering of 5:1 AR VSMC nucleus. Scale bar = 20 µm. (B) Schematic representation shows the half-length (*a*, red), the half-width (*b*, blue) and half-height (*c*, black) of a nucleus with assumed ellipsoid shape. (C) Measured nuclear dimensions from three-dimensional confocal Z-stack images as a function of cell AR. (D) Nuclear volume and surface area are similar between different cell ARs. (C-D) mean ± SEM. *n* = 7-12 cells per AR.

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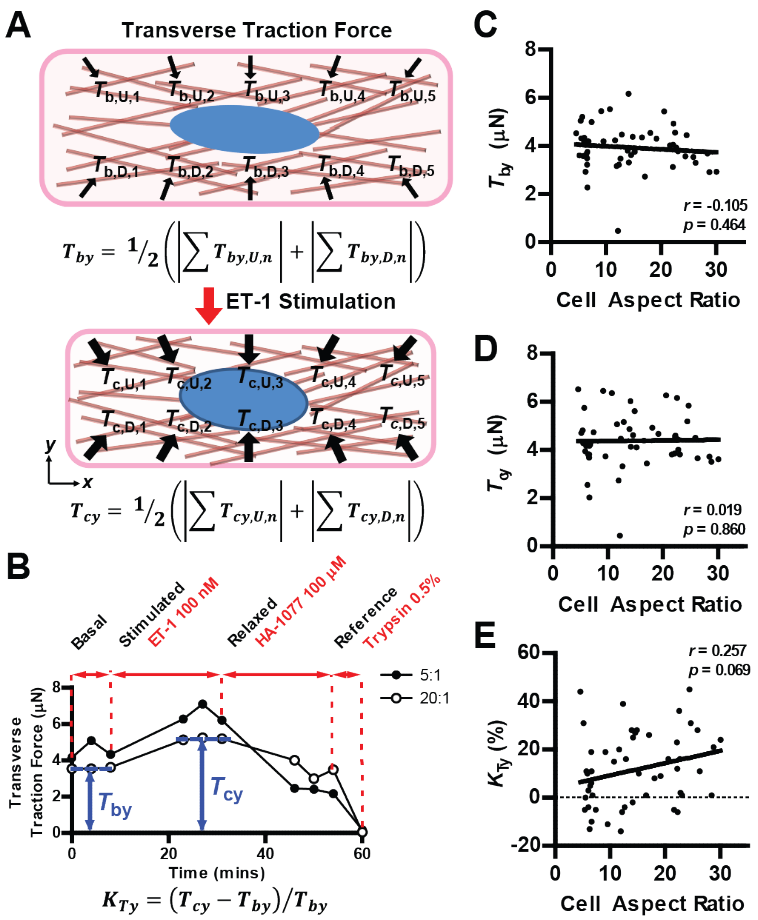

Supplementary Fig. 3 Transverse traction force is similar for all cell ARs. (A) Schematics illustrating calculations for transverse traction force of an isolated VSMC at basal (T_{by}) and after stimulation with ET-1 (T_{cy}). (B) Representative temporal transverse traction force profiles of isolated VSMCs with AR 5:1 (lower bound) and 20:1 (upper bound) prior to and after stimulation. Relative contractile increase in transverse traction force (K_{Ty}) is defined as the per cent change in transverse traction force from basal to ET-1 stimulated. T_{by} (C), T_{cy} (D) and K_{Ty} (E) plotted as a function of isolated VSMC ARs. (C-E) n = 14-17 cells from 4-6 experiment per AR. The correlation efficient, r, is determined by linear regression analysis. Reported p values for Pearson correlations are two-tailed, demonstrated that the correlation is significantly different from zero.

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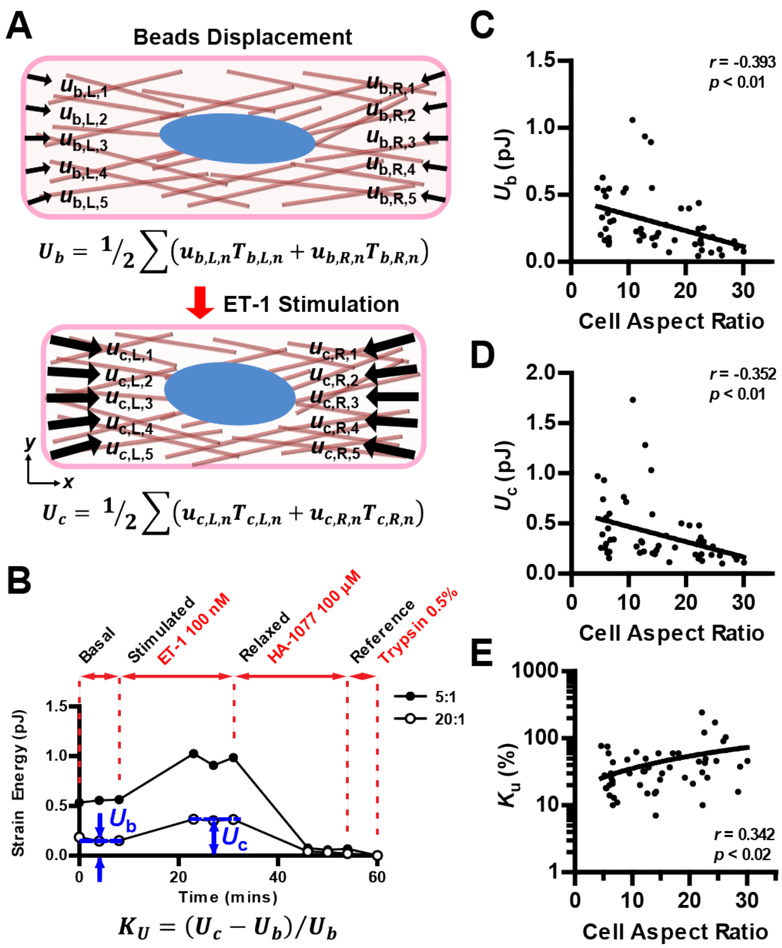
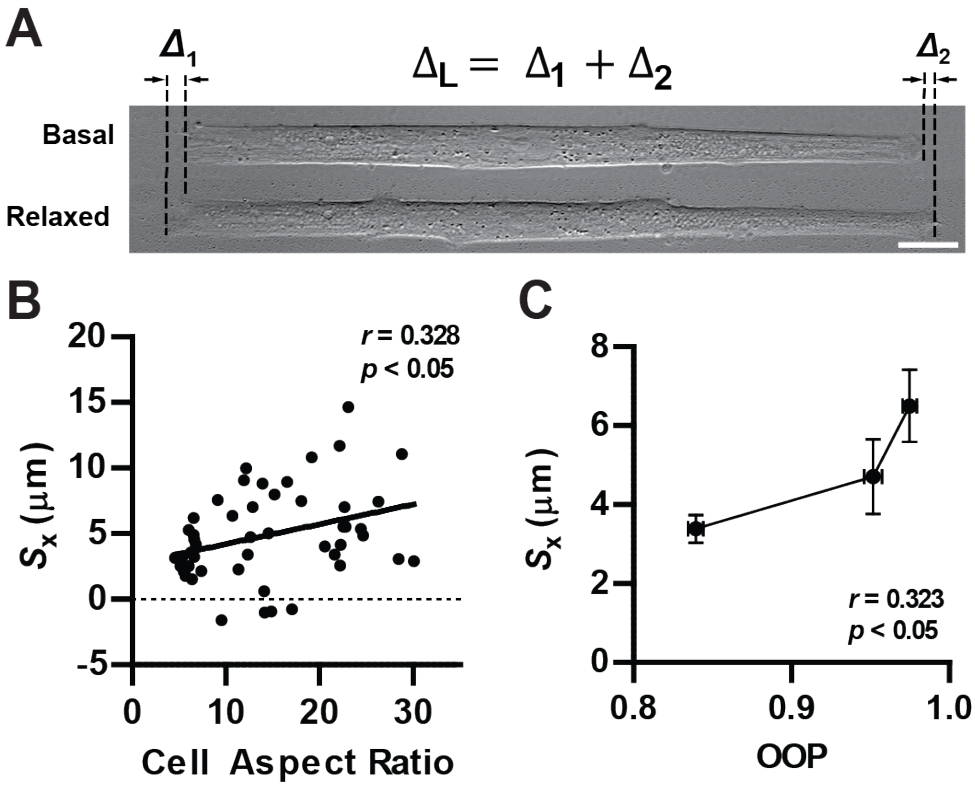


Supplementary Fig. 4 VSMC AR correlated with strain energy output. (A) Schematics illustrating calculations for strain energy from beads displacement and traction force of an isolated VSMC at basal (U_b) and after stimulation with ET-1 (U_c). (B) Representative temporal strain energy profiles of isolated VSMCs with AR 5:1 (lower bound) and 20:1 (upper bound) prior to and after stimulation. Relative contractile increase in strain energy (K_U) is defined as the per cent change in strain energy from basal to ET-1 stimulated. U_b (C), U_c (D) and K_U (E) plotted as a function of isolated VSMC ARs. (C-E) *n* = 14-17 cells from 4-6 experiment per AR. The correlation efficient, *r*, is determined by linear regression analysis. Reported *p* values for Pearson correlations are two-tailed, demonstrated that the correlation is significantly different from zero.



Supplementary Fig. 5 Longitudinal cell shortening correlated with cell AR and OOP. (A) DIC images showing longitudinal cell shortening (*ΔL*) of a 20:1 AR VSMC calculated from cell length difference on both ends of cell body between basal and relaxed conditions. Scale bar = 20 µm. *ΔL* as a function of cell AR (B) and OOP (C). The correlation coefficient, *r*, is determined by linear regression analysis. (B-C) Reported *p* value is two-tailed, demonstrating that the correlations are not significantly different from zero. (B): *n* = 14-17 cells from 4-6 experiment per AR. **(**C): *n* = 13-18 cells per condition. Data: mean ± SEM.