Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplemental Figures:

Figure S1: Device assembly

A) The larva is placed in the groove crossing the bar and frame, and rotated to the right position with a fine brush; B) A glass capillary filled with glue slides along the groove until it touches the larva. A second capillary is adhered in the same manner to the other end of the larva; C) A glass coverslip is inserted to the device base and secured with four rubber stoppers; D) The base with the glass is flipped and placed on top of the bar and frame so the rubber stoppers are facing down; E) The assembled device is flipped back, with the rubber stopped facing up; F) The bar is removed and the larva and capillaries is covered with polymerization solution; G) The assembled device from the lens perspective.

Figure S2: No dependency between myonuclear volume and average velocity and average force

(A) Plot of myonuclear volume against the average velocity values of each nucleus of control (upper panel) or Nesprin/klar mutant muscles (lower panel). Note the mixed tendencies in the graphs of control group. Each colour represents myonuclei of a single larva of either control or mutant groups (interaction $p = 0.06$).

(B) Plot of myonuclear volume against the AF values of each nucleus of control (upper panel) or *Nesprin/klar* mutant muscles (lower panel). Note the mixed tendencies in the graphs of control group. Each color represents myonuclei of a single larva of either control or mutant groups (interaction $p=0.112$).

Supplementary movies:

Movie 1: Representative movie of nuclei dynamics in control muscle.

Sarcomeres are labeled with sallimus-GFP (green), and the muscle nuclei with Cherry-NLS (red). Both constructs were driven into muscles by Mef2GAL4 driver.

Movie 2: Representative movie of nuclei dynamics in *Nesprin/klar* mutant muscle

Sarcomeres are labeled with sallimus-GFP (Sls-GFP, green), and the muscle nuclei with Cherry-NLS (red). Both constructs were driven into muscles by Mef2GAL4 driver.

Movie 3: Microtubules buckling during muscle contraction.

Microtubules are labeled with alpha-tubulin-GFP (green), and the muscle nuclei with Cherry-NLS (red). Both constructs were driven into muscles by Mef2GAL4 driver.

Movie 4: Muscle intracellular Ca^{++} entry during muscle contraction

GCaMP driven into muscles by Mef2GAL4 driver indicates the rise in Ca^{++} levels during muscle contraction (green). The muscle membrane is marked by a fluorescent protein with a myristoylation signal (red). Movie was obtained in collaboration with Karen Fridman.

Movie 5: Chromatin distribution during muscle contraction

Muscle expressing H2B-RFP, combined with Sls-GFP. Chromatin distribution is demonstrated during muscle contraction. Movie was obtained in collaboration with Daria Amiad-Pavlov.

Movie 6: Nuclear lamina deformation during muscle contraction

Muscle expressing Lamin C-GFP marks the nuclear membrane. Nuclear lamina deformation is observed during muscle contraction. Movie was obtained in collaboration with Daria Amiad-Pavlov.