ABSTRACT:
During leukocyte rolling on the endothelium, membrane tethers (nanotubes) are extracted simultaneously from both leukocytes and endothelial cells because of the force imposed by the blood flow. Tether extraction has been shown to stabilize leukocyte rolling by increasing the lifetime of the adhesive selectin-ligand bonds that mediate leukocyte rolling. Over the past two decades, tether extraction has been studied extensively, both experimentally and theoretically. In contrast, much less is known about tether retraction. Tether retraction may occur in several occasions. For example, upon the breakage of the selectin-ligand bonds during leukocyte rolling, extracted tethers may retract back to the cells. In addition, during simultaneous tether extraction (two tethers, one from a leukocyte and the other from an endothelial cell, linked in series by receptor-ligand bonds), one tether will retract when the pulling force falls below the larger threshold force. In this work, with the micro-cantilever technique where latex beads affixed on silicon cantilevers were used as the force transducer, we extracted tethers either perpendicular or tangential to the neutrophil surface. Little movement of the tether-cell junction was observed during tangential tether extraction and no coalescence was observed during multiple tether extraction. Following adhesion rupture, spontaneous tether retraction was visualized by membrane staining, which revealed two phases: one was fast and exponential, whereas the other was slow and linear. Both phases can be reproduced with a mechanical model, showing that the first phase was dominated by elastic deformation recovery and the latter slow phase was driven by the far-field membrane tension on the cell body and the membrane-cytoskeleton adhesion. These results show for the first time how neutrophil tethers shorten upon instantaneous force removal and illustrate further how membrane tethers contribute to neutrophil rolling stability during the inflammatory response.

BIOGRAPHICAL:
Dr. Shao received his BS (1988) and MS (1991) degrees from Peking University. He received his Ph.D in 1997 from Duke University, Durham, North Carolina. His laboratory has been studying cellular and molecular biomechanics for more than a decade. Past research activities have allowed him to gain both experimental and theoretical experiences. Consequently, his research has produced both experimental and theoretical publications supported by NIH, the Whitaker Foundation, and the Barnes-Jewish Foundation. While managing all the funded research projects, he gained tremendous experience in budgeting, staffing, collaboration, research protection, and research planning. Therefore, he has a demonstrated record of successful and productive research projects in cellular and molecular biomechanics.

DATE • TIME • LOCATION:
Tuesday February 12, 2013, 4:00 PM, 105 Agricultural Engineering Building