REPLY TO JACKSON ET AL.:
Precision on the squeeze film levitation of human fingertip

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We would like to thank the authors of the Letter for the interest they showed to the results we presented in ref. 1. The authors point out the significant role that tilt may have in reducing squeeze film thickness but also speculate that compliant finger–surface contact may be immune to tilt (2). Indeed, this would seem to be the case. As seen in figure 2D in ref. 1, levitation tends to occur within the contact patch, not at the edges. Thus, what we observe is closer to a conforming contact with deformation toward the center, as opposed to a tilted contact in which one side is elevated relative to the other. Nonetheless, the rough and grooved shape of the finger may play a role similar to tilt insofar as it provides a place for air to escape. This may be why we see levitation distances of ∼1 μm, in contrast to the ∼80 μm predicted by the authors' model.

We agree that the phase shift between the total area of contact and the plate displacement is intriguing. Contrary to what is postulated in the Letter, however, we do not believe that the shift is due to a viscous or inertial effect of the squeeze film levitation but rather that it is the consequence of the dynamics of the skin. The observed behavior is coherent with the skin bouncing off the plate. Indeed, similar phase lags are often observed in ball-bouncing problems (3).

1 Wiertlewski M, Fenton Friesen R, Colgate JE (2016) Partial squeeze film levitation modulates fingertip friction. *Proc Natl Acad Sci USA* 113(33):9210–9215.

2 Jackson RL, Xu Y, Mahajan M (2016) Fundamentals and previous experiments of the squeeze film levitation mechanism. *Proc Natl Acad Sci USA* 113:E6906.

3 Holmes PJ (1982) The dynamics of repeated impacts with a sinusoidally vibrating table. *J Sound Vibrat* 84(2):173–189.

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Conflict of interest statement: J.E.C. is a founder of Tanvas, Inc., which holds license to variable friction technology.

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