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In vivo mechanical characterization of human facial skin combining curved surface imaging and indentation techniques

Shibin Wang, Huixin Wei, Linan Li, Wenjian Chen, Anan Dai, Zhiyong Wang and Chuanwei Li
Tianjin University, China

In vivo study mechanical properties of facial skin mainly composed of epidermal, dermis and hypodermis, especially the development of experimental devices and the optimization of experimental methods are very important. In this study, a set of facial skin and soft tissue mechanical properties measurement equipment is developed, which is composed of indentation and friction device and properly combined with three cameras CCD. One CCD connected transparent indenter is used to observe the contact area and the topography of the test area. The other two acquire the image around the test area during the experiment and then obtained the deformation field by using digital image correlation technology. This device can not only obtain the force-displacement curve, but also observe the morphology of the test area and the deformation of the surrounding test area. It can be obtained the mechanical properties of the facial soft tissue more accurately. Compared with the formulas in classical Hertz theory, the contact force calculated by the new formula is in better agreement with the experimental results. We performed the *in vivo* indentation tests on human facial skin to evaluate the Young's modulus. A better understanding of the adhesive behavior of human facial skin is important for dermatological or cosmetic applications. The real contact radii of human facial skin under different conditions were obtained by indentation experiments on the six volunteers and their adhesive behavior is studied. Except the adhesion forces under different conditions, we also compared the theoretical adhesion energy and theoretical debonded radius with the experimental results. Considering that hyperelastic model is usually more suitable for skin research, we revise the classical elastic adhesion theory (JKR theory) based on Neo-hookean model and the contact radii obtained by the modified hyperelastic adhesion theory model shows a better agreement with the experimental values.

Biography

Shibin Wang is currently working as a Professor of School of Mechanical Engineering, Tianjin University. He completed his Bachelor of Science in Optics from Nanjing University of Science and Technology in China and Master of Science in Mechanics from Tianjin University, China and also PhD degree in Mechanical Engineering from Poitiers University, France in 1987, 1990 and 1994 respectively. He joined the Tianjin University Faculty in 1995. He is the Member of CSTAM (China) and Editorial Board Member of journal of Research in Higher Education of Engineering. His honors and awards are Tianjin Outstanding Teacher Award (2009) and Baogang Outstanding Teacher Award (2015).

shbwang@tju.edu.cn

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