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Extended Abstract

Advanced Materials & Nanotechnology: 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

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Abstract

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.

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