Kinematic analysis of the hand during opening a yoghurt: Are there gender differences?

L. REISSNER, G. FISCHER, P. GIOVANOLI, M. CALCAGNI
Division of Plastic Surgery and Hand Surgery, University Hospital Zurich

Introduction
The human hand is used in a great range of activities of daily living. In recent years, researchers and clinicians increasingly focused attention towards the assessment of hand movements. However, there is still very little knowledge about hand and finger kinematics during ADL. The aim of the study was to analyze the motion patterns during opening a yoghurt in healthy volunteers.

Methods
Twenty healthy volunteers (10 male, 10 female) mean age 28 (SD 4.7) years were performing a set of basic motion tasks and the functional task ‘yoghurt-opening’. Each volunteer was assessed twice on two different measurement days. The active range of motion (AROM) and the mean angle during the opening phase were calculated for the wrist, the radioulnar joint and the joints of the small finger. Furthermore, the AROM of a joint during the functional task was expressed in percentage of its maximum range of motion calculated from the basic motion tasks. An optoelectronic motion capture system consisting of eleven fixated infrared cameras as well as the corresponding software VICON-Nexus were used for data collection (figure 1). Forty-six reflective markers were placed at specific positions on the finger, wrist and forearm (figure 2).

Results
There was a wide range of joints angels among different volunteers. The AROM ranged between 17°-85°/21°-58° and 17°-79° for flexion angle of the MCP of the small finger, the wrist and the pronation-supination of the radioulnar joint, respectively. Some individuals had the wrist, metacarpophalangeal (MCP) 5 or proximal interphalangeal (PIP) 5 joint in extended position, while others preferred in the same joints in flexed position with a mean angle up to 60°. The exploitation of the maximum range of motion was between 5-84%. A significant higher AROM in wrist flexion/extension of 44° was found for the female group compared to 32° of the male subjects (p<0.001). Furthermore, the female group had a mean flexion angle of 30° in the MCP of the small finger during the opening phase, while the male group had the corresponding joint in a more flexed position of 41° (p=0.05) (table 1, figure 3, figure 4).

Summary
Individuals seem to use different strategies to fulfill the analyzed task. In the group, that performed the functional task without contact of the small finger to the object (extended/abducted small finger), five out of six cases were women whereas mostly male subjects tended to ‘roll’ the hand over the small finger to open the yoghurt. This study reveals that gender differences might influence motion pattern during the analyzed ADL. The individual preference has to be considered for the determination of the required range of motion of this daily activity.