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# Estimation of physical quantities on human organ surface during oral and swallowing process using novel measurement system “F-bology® analyzer”

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### Background

Due to the oral process is the complex action with fast movement and configuration changes, it is difficult to visualize the accurate bolus behavior and hard to evaluate numerically using physical quantities (such as force, shear rate, velocity, energy and work) during oral and swallowing process by conventional medical images and measurements. Physical quantities on human organ during oral and swallowing process are considered as important information for the development of the appropriate food product for elderly persons and swallowing difficulties.

### Purpose

The purpose of this work is to estimate physical quantities of bolus dynamically on the organ surface received from the food bolus during oral and swallowing process.

**Methods** In order to simplified measurement, we have developed “F-bology® analyzer” (FBA) which contained inclined plate with customized wet PVA sheet (pseudo organ sheet). This pseudo organ sheet has similar specific wetting properties of human organ surface. The food sample was supplied on the sheet of FBA by the piston pump, and it became bolus. The bolus flow down and the velocity on the sheet was measured by the disruption signal of laser sensors located on the upper and lower position of side wall of FBA. The changes of the diffusion area of food bolus were calculated from movies recorded by the high speed micro scope set on the vertical direction from the sheet. Physical quantities which include tribology properties on the sheet were calculated from these measured values.

### Result and conclusion

Differences of physical quantities such as shear stress, energy density and diffusion area have been observed under the different viscosity, density and drying condition of pseudo organ sheet. The behavior of the bolus flowing down on FBA was considered as similar to human oral and swallowing process qualitatively.