in-vitro and *in-vivo* self-healing dynamics after fs-laser perforation of live cells

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The dynamics of hole growth and closure of live-cell plasma membrane was investigated with an optical perforation by single-shot femtosecond laser ablation. Self-healing process of plasma membrane was optically observed within several minutes after the perforation. An irregular feature in the topographical images of the injured plasma membrane was found to maintain relatively long after fading out of the holes in optical photography. The dynamics for the growth and closure of the transient hole could be well explained in terms of the viscoelasticity of plasma membrane of cells as well as the relaxation of surface tension associated with extrusion of cellular contents. Based on the proposed model for the dynamics, we have estimated a much slower closure process with a typical speed of 0.007 um/sec in addition to a growth time constant of several tens of seconds The slow closing speed could be explained in terms of high surface viscosity due to the presence of filament actin network, which is bound to the plasma membrane and restricts the movement of the plasma membrane. We will also discuss about the recent results on the fs-laser surgery of blood vessels of mutated zebra fish in early developmental stage.