a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

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MECH 493 project: Intradermal injections through hollow microneedles

Background and research goal

Hollow microneedles provide a promising alternative to conventional drug delivery techniques, by precisely delivering drug-containing fluid into the skin. Delivery of drugs, especially vaccines, into the skin have been considered beneficial in the past, but have been limited in use mainly due to the challenges associated with targeting the upper skin layers with long hypodermic needles. Microneedles solve most of the challenges of conventional intradermal drug delivery, and have the potential of injecting drugs more reliably. In the past, researchers have studied the effects of injection parameters such as injection pressure, microneedle geometry, microneedle retraction and insertion depth on injected fluid volume. However, the effects of fluid viscosity on injections into the skin have not been studied previously. This study aims to explore the effect of fluid viscosity on flow into the skin through a hollow microneedle by recording fluid properties such as pressure and flow-rate using microfluidic sensors, and controlling different injection parameters such as input fluid pressure, microneedle penetration velocity, and microneedle retraction. Since different types of injectable drugs have different viscosities, understanding the relationship between fluid viscosity and flow-rate into the skin is important for optimizing intradermal injections through hollow microneedles.

Tasks to be performed by the student

- Prepare injection fluid, skin sample and experimental setup for injection experiments
- Conduct injection experiments on excised porcine skin tissue through hollow microneedles using existing experimental setup with microfluidic sensors/controllers
- Design and 3D print any required modifications to the experimental setup to test new samples
- Analyze and process sensor/actuator data acquired through LABVIEW
- Conduct literature review to relate experimental findings to theoretical models

Facilities and team:

The experiments will be conducted in PPC 121, Pulp and Paper Centre. The student will work closely with Prof. Boris Stoeber's graduate student, Pranav Shrestha (email: pranav.shrestha@alumni.ubc.ca; phone: 250-858-3404).