Visual Feedback for skill acquisition in Cataract Surgery

Computer Integrated Surgery II
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Figure showing overlayed force vectors. The length of the vector is proportional to the magnitude of the force applied.
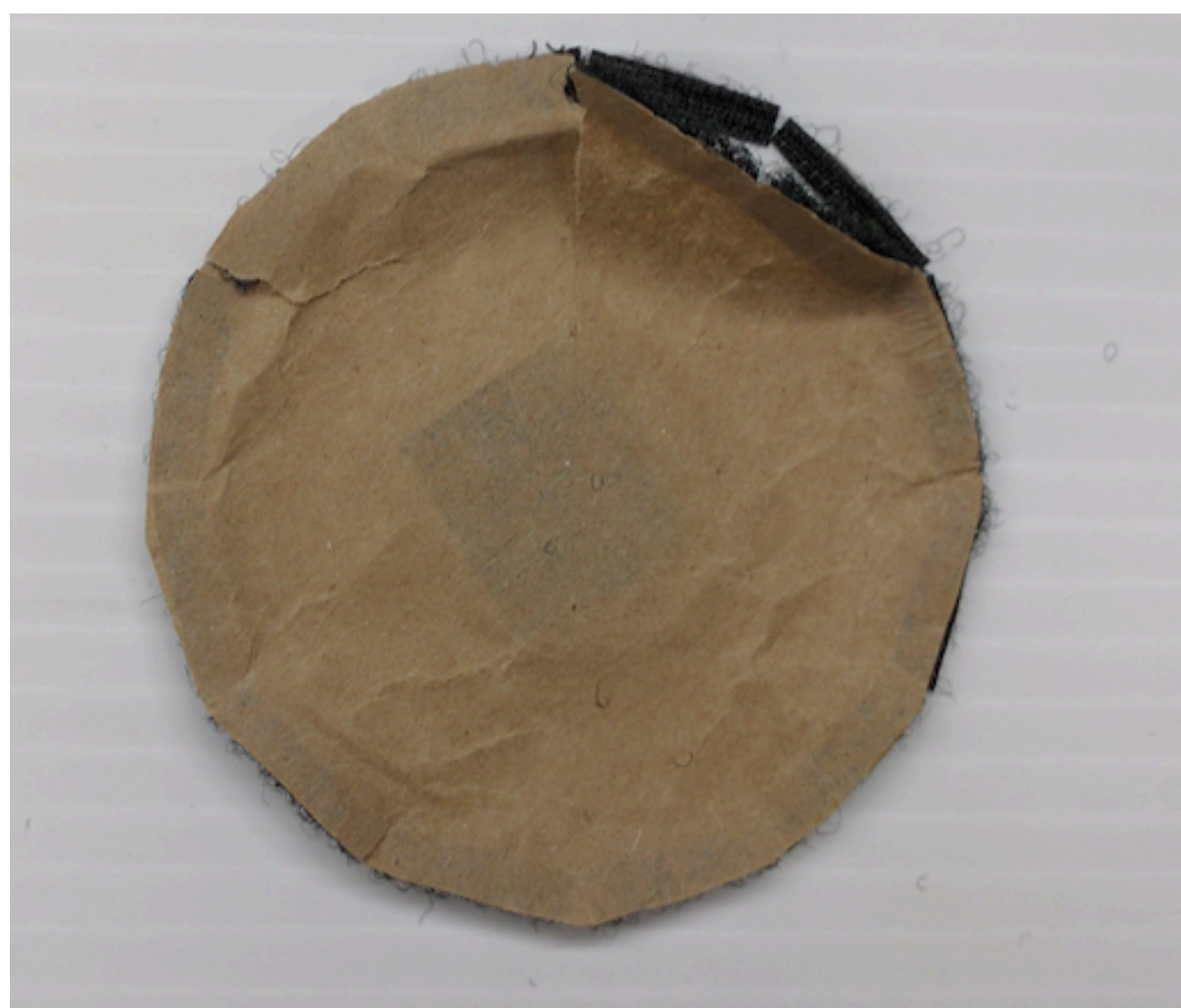
Introduction

- Capsulorhexis is a part of the cataract surgery procedure. The technique does not require special skill, but occasionally, run away tears occur which require high skill to fix.
- We aim to use visual feedback to facilitate skill development among novice surgeons for capsulorhexis procedure.
- We visually overlay force data on the tool motion video.

The Problem

- Currently, feedback to support technical skill acquisition among trainees in ophthalmology is through qualitative verbal instruction and demonstration.
- Most of the simulations used are either software or do not provide proper visual cues to evaluate the procedure.
- Directed feedback can facilitate deliberate practice and effective skill acquisition.

The Solution

- We propose using visual overlays for assisting surgeons to perform and evaluate tasks.
- We perform the procedure on a phantom using the Da Vinci Research Kit and record tool motion data and force sensor data.
- We overlay the force sensor data with the tool video to provide visual cues to the person operating on the phantom.
- The phantom used was : wax paper attached with Velcro. This was opted after considering several factors namely, repeatability, sensitivity to force sensor readings, realisticness towards the operation.
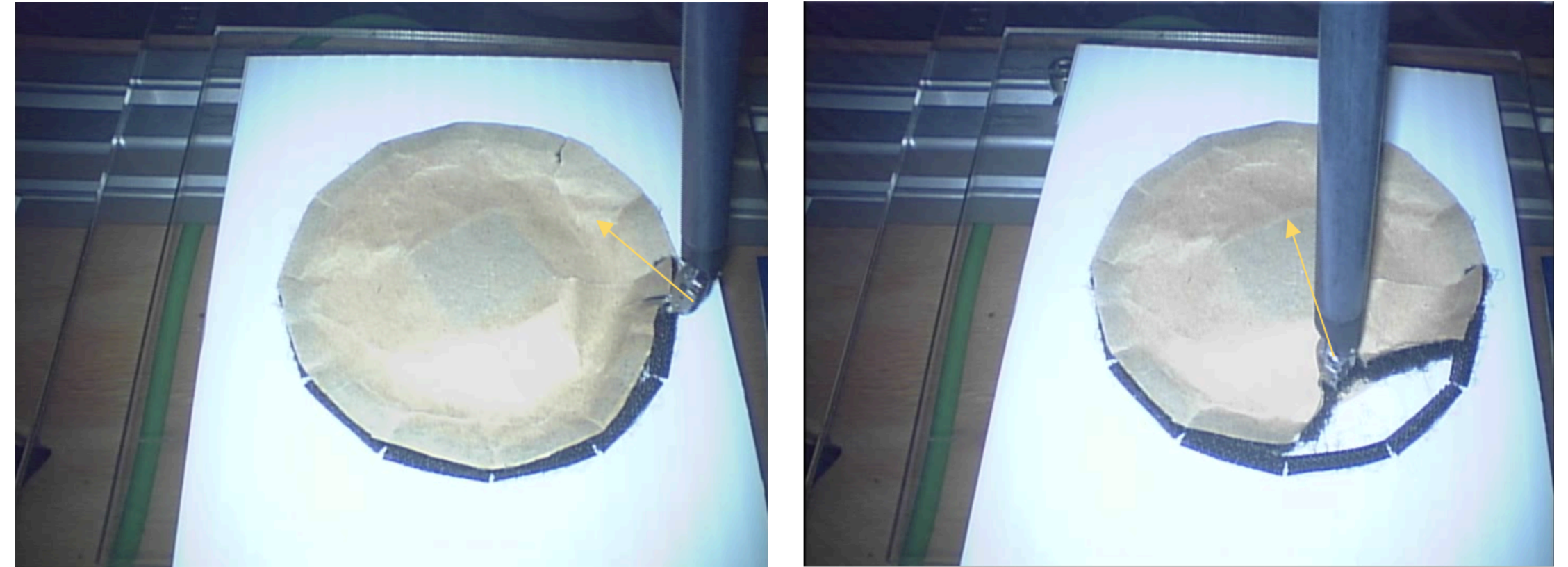

Chosen Phantom made using velcro and wax paper

Outcomes and Results

- Developed phantom to simulate capsulorhexis task.
- Overlayed force sensor data in the tool video to provide visual cues to the surgeon.
- Developed code and setup to collect tool motion data and force sensor data.

Future Work

- Collect tool motion data and force sensor data for many procedures.
- Estimate forces during any point of the procedure and overlay this force to guide the novice surgeon to perform the task.
- Compare tool force data between experts and novices.

Lessons Learned

- Any mechanical system developed has to be repeatable and realistic with good results.
- Synchronization of sensor data is vital during data collection.

References

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- Gauba V, Saleh GM, Goel S. Ophthalmic plastic surgical skills assessment tool. Ophthal Plast Reconstr Surg. 2008;24(1):43-46.

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