

S RTP - Project Description Form #216

PART I:

Name of Schulich faculty member who will supervise the project Caitlin Symonette

Supervisor's Schulich, Western, Hospital or Lawson Email caitlin.symonette@lhsc.on.ca

Schulich Department Surgery

Name of Division Chair Andreanna Butter

Division Chair Email andreanna.butter@lhsc.on.ca

PART II - Project Description

Title of Project DIGITS: a novel remote small joint range of motion validation for upper extremity patients

Background

One of the major challenges in providing remote musculoskeletal care has been how do we measure joint mobility - which is often a primary outcome of interest. This is especially hard in the hand, where there are many small joints moving in complex motions in multiple planes. A further challenge is how do we make this simple and cost-effective for clinicians to use in routine practice. We have been working on an innovative solution called DIGITS which will be a comprehensive telerehabilitation platform. DIGITS leverages open access augmented reality frameworks to remotely measure small joint range of motion (ROM) in the upper extremity. The current model uses pose-estimation algorithms to obtain the position coordinates of the joints. Our team has shown good reliability compared with in-person measurements of finger flexion-extension. We plan on developing an option for a manual override for joint range of motion using widely available angle calculation tools. Our next steps in our research are to validate our remote range of motion assessment in patient populations.

Hypothesis

Our hypothesis is that DIGITS will have strong validity and accuracy in recording remote small joint range of motion in pathologic hand conditions.

Proposed Methodology

With a prospective design, we aim to validate our software in patients with hand trauma and acquired conditions (such as Dupuytren's/arthritis). Basic demographic (e.g., age, sex, gender identification, hand dominance, occupation, ethnicity), medical history (e.g., arthritis, neuromuscular conditions, congenital anomalies, physical disability, etc.), surgical, and injury descriptions will be recorded for each patient. We will aim to collect finger joint range of motion data on 100 patients (ages 18-80) with hand pathologies recruited from the practices of our local hand surgeons. A single surgeon sees approximately 10-15 new hand trauma patients a week in clinic, so we anticipate total patient recruitment to take approximately 3-6 months. During each assessment, participants will be instructed to make a composite fist using our software and the maximum active range of individual small joint measurements will be tabulated. These results will be compared directly to in-person measurements taken by a hand therapist who works in the clinic. During this part of the study, the "virtual" assessment will not replace an in-person visit but the evaluation will be completed either before or following the in-person assessment (random order). All data will be stored securely using our REDCap database.

The data from the baseline visits (n=100) will be analyzed for inter-method reliability/consistency using Bland and Altman Plots, intraclass correlation coefficients, and minimal detectable change (MDC). The agreement in change

scores will be assessed using similar statistics, adding responsiveness analysis (effect size, SRM).

Expected Outcomes

We expect to demonstrate excellent agreement of our data with the gold-standard of in patient goniometry. We also hope to gain a subjective impression of the user friendliness of our platform for patients with hand pathologies.

Research Environment - Description of the number of research personnel, primary location of research, size of lab, etc

The DIGITS project is well equipped with both grant funding, personal, and access to patients for this study. The data collection itself will take place at Victoria Hospital and at the Hand and Upper Limb Center. De-identified data analysis and manuscript preparation can be performed remotely.

Names and titles of other individuals who will be involved with the research project?

Dr. Joy MacDermid PT, PhD (Faculty of Health Sciences)- collaborator

Dr. Nayran Apurva PhD (Computer Science)- collaborator

Jacob Davidson (MSc)- research associate

Claire Parent (PhD)- research associate

Dr. Jamey Fraser- post-doctoral associate

Can this project be done remotely? No

Duration of Project Two Summers

Expected Objectives/Accomplishments for Student for Year 1?

1. Background research and familiarization with technology/methodology
2. Obtain appropriate clearance for researching within the hospital
2. Data collection (in-person)
3. Begin Data analysis.

Expected Objectives/Accomplishments for Student for Year 2?

1. Data analysis and additional data collection (if required)
2. Manuscript preparation and submission

PART III - Certifications

If the project will require any certification - Human Ethics approvals from one or more of the following offices, please check the appropriate box below.

Human Ethics: If you have the protocol information, please enter it below (or enter the status of the approval). 119808

Note: certification approval should be obtained prior to the start of the summer. Projects without this approval will not be a priority for funding.