Aufgabenbeschreibung

Studienarbeit/Masterarbeit

Improving Blood Draw Methods – MISTI Collaboration

Overall project description:
The collection of blood samples for diagnostic testing is a frequent procedure in both in- and out-patient. Although this is one of the most common invasive procedures performed in healthcare, complications, particularly around Hematoma and vein collapse, still arise. There is an ongoing need to improve blood collection, particularly by providing clinicians with information about the degree of blood vessel puncture and the state of a patient's venous walls.

This proposed collaboration will use the knowledge, resources and clinical experience of MIT's Medical Device Design Course and IMT's Masters of Medical Engineering Course to resolve: the degree of blood vessel puncture with the needle tip and state of the venous walls (Normal, Partially collapsed or Completely collapsed). In the beginning, the Primary Investigators (PI) of MIT and IMT will supervise students from both institutes to develop a prototype solution.

This collaboration is designed to initiate research relations between groups at MIT and IMT around a pressing clinical need. The proof-of-concept work originating from this collaboration is expected to stimulate further research together around improving blood draw methods, with the goal to reduce complications and improve the blood drawing procedure.

MISTI MIT INTERNATIONAL SCIENCE AND TECHNOLOGY INITIATIVES

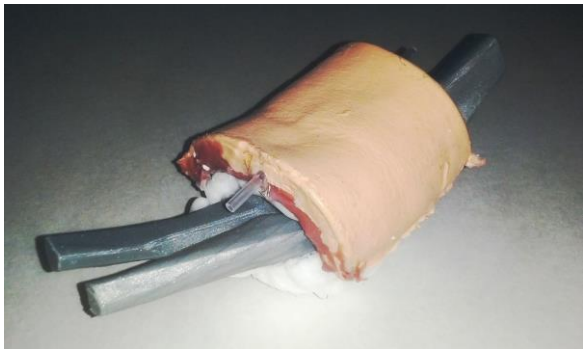
Student project 1: Realistic venipuncture phantom
(Starting ASAP)

Before clinical validation of any of the developed measurement devices, evaluation in a lab setting needs to be performed. Moreover, to enable us to validate the functionality of these developed devices a realistic lab setup needs to be created. Therefore, this project is focused on creating a realistic venipuncture phantom, simulating different tissue layers, vein types and venous wall collapsing. The phantom will be designed to allow multiple punctures and vein properties easily changed. The final prototype will be evaluated by its ability to replicate a range of clinical situations and the assessment of clinicians.

The main points to be addressed are:

- Review and identification of physiological phenomena needed to realistically replicate venous blood draw.
- Review of commercial venipuncture phantoms and research developed phantoms, identifying of strengths and weaknesses.
- Development/adaption of a venipuncture phantom, integrating into existing venous blood flow equipment developed by IMT.
- Assessment of phantom's performance in regard to physiological phenome identified.
- Clinician assessment of phantoms performance.

Supervision will be provided in English by a native English speaker (From New Zealand). As a result, the thesis should also be written in English.



http://www.tessonics.com

www.mentone-educational.com.au

Student project 2: Restricted blood flow detection
(Starting July 2019)

Currently, during blood draw or with catheter insertion a patient's venous walls can collapse resulting in effective blood draw being no longer possible. As a result, clinicians are required to draw blood at another location, requiring more time and increasing patient discomfort. Therefore, this project is focused on creating a blood flow indicator to indicate to the clinicians the blood flow at the extraction site, and in turn indicating if the state of the venous walls. The device will be designed to be integrated into existing blood draw needles and able to be disposed of after use. The final prototype will be evaluated by restricting flow in a venous blood sampling phantom.

The main points to be addressed are:

- Development of a mathematical model describing restricted blood flow dynamics.
- Creation of FEA model to validate model results and confirm device operating specifications.
- Review and evaluation of flow measurement methods most suitable for the application.
- Concept design and build of flow measurement device.
- Evaluation of the device on venous blood sampling phantom or similar.

Supervision will be provided in English by a native English speaker (From New Zealand). As a result, the thesis should also be written in English.

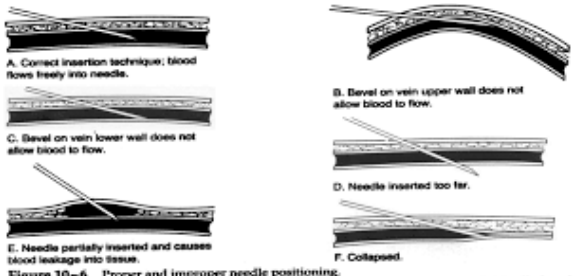


Figure 10–6 Proper and improper needle positioning. *A.* Proper needle position. *B.* Needle bevel against the upper wall of a vein. *C.* Needle bevel against or embedded in opposite wall of vein. *D.* Needle inserted all the way through a vein. *E.* Needle partially inserted into vein. *F.* Needle in collapsed vein.

Venepuncture exercises 2018

Student project 3: Optimal clinicial integration of an extension to existing blood draw methods (Starting July 2019)

There is an ongoing need to improve blood collection, particularly by providing clinicians with information about the degree of blood vessel puncture and the state of a patient's venous walls. However, technology has not been improved in this area for many decades. This is likely due to lack of clinician acceptance and the added hindrance new devices may bring. Therefore, this project is focused on reviewing the current blood draw methods and determining the specifications required for minimal integration effort into the clinical practice (device geometry, placement, interaction etc.). This project will work alongside the first student project and MIT collaborators to help in designing a clinically integrable device. The final prototype will be assessed by clinicians' review.

The main points to be addressed are:

- Review all commonly used methods of blood draw and identify use cases.
- Determine range of geometries and potential areas of placement suitable for the device.
- Create mock up (non-functional) ergonomic designs (3D printed) and assess via clinical feedback.
- Integrate ergonomic design into functional designs provided by first student project and MIT.
- Create final design integrated into various blood draw equipment setups and assess via clinical feed.

Supervision will be provided in English by a native English speaker (From New Zealand). As a result, the thesis should also be written in English.

https://spinoff.com/veebot

https://www.alamy.com/stock-photo/phlebotomy-equipment.html

What is involved:

- Collaboration with a group of students at MIT as part of their Medical Device Design Course 2.75 (2019 Fall Semester)
- A potential trip to MIT Boston.

Who I am looking for:

- Master/Studienarbeit students
- Proficient in English (Thesis also written in English)
- Experience with working with clinicians and/or medical device construction ideal
- Enthusiastic and motivated individuals

Please send your CV and a cover letter of why you are suited for the project (Both in English) to:

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