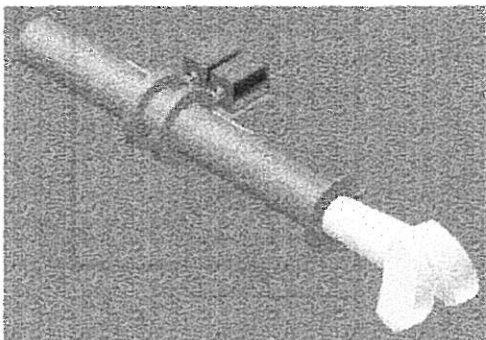


The use of simulators in medicine is an increasingly common practice to enhance the teaching of medical techniques and procedures.

The aim of this project was to design and develop a knee examination simulator, which could be used to train students in the techniques involved in performing a physical knee examination.

The final system should be capable of simulating partial or full ruptures to any of the four main stabilising ligaments of the knee and any combination of these.

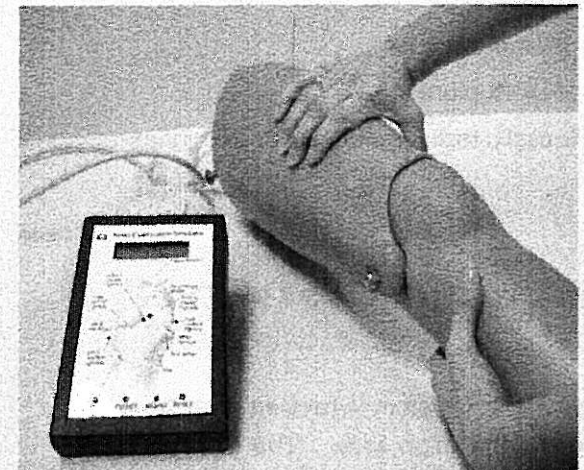


Scott Bond & Melissa Ryan  
School of Informatics & Engineering  
Flinders University of South Australia



FLINDERS UNIVERSITY  
OF SOUTH AUSTRALIA

## A KNEE EXAMINATION SIMULATOR



Scott Bond & Melissa Ryan  
School of Informatics & Engineering  
Flinders University of South Australia

## FEATURES OF THE COMPLETE SYSTEM:

- Life like in size appearance
- An easy to use interface
- 3 possible operating modes:
  - Training Mode
  - Exam Mode
  - Random Mode
- Ability to test the four main ligaments:
  - Medial Collateral
  - Anterior Cruciate
  - Posterior Cruciate
  - Lateral Collateral
- 3 Possible conditions for each ligament
  - Healthy
  - Partial Rupture
  - Full Rupture
- Realistic tactile feedback for all injuries

## MECHANICAL OPERATION

The mechanical system is housed away from the joint, up in the thigh area. The pins are controlled by solenoids, which can move them in or out of the mechanical system, either restricting or allowing greater movement of the wire in the following ways:

### Healthy Ligament:

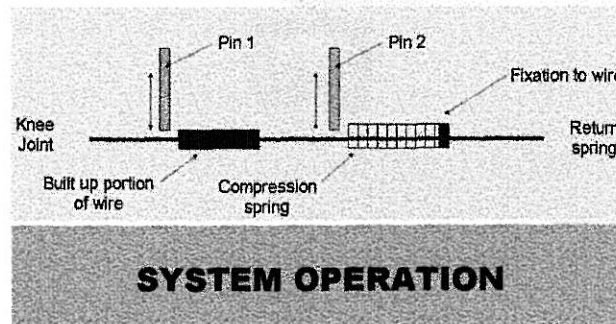
- Both pins in
- Built-up portion of wire hits pin 1
- Further movement of wire restricted
- Hard, abrupt end-point feel

### Partial Rupture:

- Pin 1 out, Pin 2 in
- Compression spring hits pin 2
- Wire can continue to move, but resistive tactile feedback until fixed end of compression spring hits pin 2
- More movement allowed at joint, with a softer end-point feel

### Full Rupture:

- Both pins out
- Total mechanical portion of wire free to move
- Total movement at joint possible
- Return spring offers soft, but no real end point



## SYSTEM OPERATION

### Training Mode:

- User selects specific injury
- Injury type displayed on LCD
- Corresponding LED's light up

### Exam Mode:

- Examiner selects specific injury
- LED's & LCD cleared
- Answer displayed on LCD & LED's light up when 'RESULT' pressed

### Random Mode:

- System randomly selects ligament injury
- Different ligaments have different probabilities of injury
- LED's & LCD cleared
- Answer displayed on LCD & LED's light up when 'RESULT' pressed

