

**VirtaMed ArthroS™**  
Module descriptions

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## FAST module

Fundamentals of Arthroscopic Surgery Training

### Module description

9 motor skill training tasks on the FAST workstation guide the trainee through the first steps of arthroscopy. Basic camera navigation tasks include steadiness and image centering, horizon control and telescoping as well as the use of different optics - using both left and right hand for camera handling as well as frontal and posterior access to the FAST shell. This very basic arthroscopy skills training also teaches periscoping. Trainees learn how to detect and center an object, probe and grasp static objects, and develop triangulation skills.

### FAST – Fundamentals of Arthroscopic Surgery Training

The major American Orthopedic associations ABOS (American Board of Orthopedic Surgery), AAOS (American Academy of Orthopedic Surgeons) and AANA (Arthroscopy Association of North America) implemented a mandate in 2013 to further improve and standardize surgical education in the field of arthroscopy. They created a program called FAST (Fundamentals of Arthroscopic Surgery Training) which VirtaMed has now incorporated into the ArthroS™ surgical training simulator.

This virtual reality module is based on the Sawbones FAST workstation, which was developed with specifications and refinements from a team led by Robert Pedowitz, MD, PhD. The fusion of the Sawbones FAST dome with our virtual reality simulator offers exciting new training opportunities: surgeons can now practice the basic skills needed before they actually go on and perform complex knee or shoulder arthroscopies.

### Learning objectives

- To control camera movements and to center an image
- To control image orientation (i.e. camera horizon)
- To perform basic triangulation
- To acquire steadiness of the camera and arthroscope
- To minimize unnecessary movements of the scope
- To develop of ambidextrous motor skills
- To practice deliberate linear scope movements
- To track a moving target with the scope
- To correctly periscope, i.e. properly use the angled optics
- To find and grasp stationary targets
- To plan and perform deliberate object manipulation

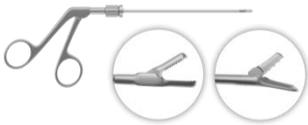
## Instruments



Arthroscope



Hook



Grasper/Punch

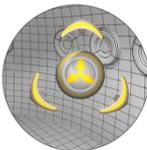
## Didactic module



### General concepts of arthroscopy

- Equipment overview
- Imaging principles
- Clinical issues

## Training cases



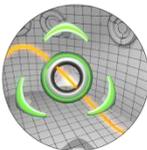
### Image centering

- 10 VirtaTeds
- Visualize each VirtaTed for 3 seconds



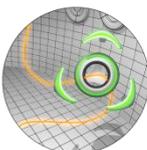
### Telescoping

- 10 VirtaTeds with different perspective depths
- Visualize each VirtaTed for 3 seconds



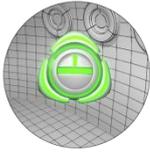
### Trace the lines

- 8 VirtaTeds moving on lines
- Center each VirtaTed and follow them on the lines



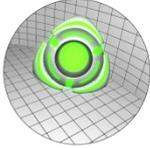
### Trace the curve

- 1 VirtaTed, 2 laps
- Center the VirtaTed and follow it on the path



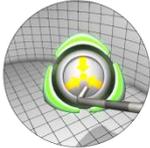
### Horizon control

- 10 VirtaTeds
- Control the horizon of the camera for 3 seconds on each VirtaTed



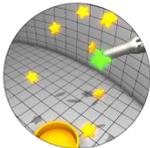
### Periscoping

- 10 VirtaTeds
- Visualize each VirtaTed for 3 seconds using the angled optics



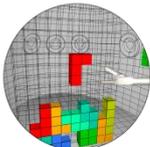
### Probe triangulation

- 10 VirtaTeds
- Visualize each VirtaTed for 3 seconds, while touching its center with the probe



### Gather the stars

- 10 stars
- Grasp the stars and let them fall into the dish.



### Tetris

- Align all the objects of different sizes and colors in the grid
- Maximum points: 40



## Knee module

Basic skills, diagnostic, and surgical cases for knee arthroscopy

### Module description

The module presents basic skills, diagnostic and surgical cases for knee arthroscopy, as well as didactic teaching slides. 9 guided basic skill training cases are fully integrated into a highly realistic simulation. Mastering these basic tasks enables trainees to perform a complete arthroscopy more easily and in an efficient, professional way. 8 patient cases with varying levels of difficulty offer the trainee the chance to perform complete diagnostic arthroscopic interventions. Patients include different meniscus lesions, unhappy triad and arthrosis grade I-III. 11 patients with various lesions in different locations provide training for the first steps in operative arthroscopy using the original operating equipment from the OR. Patients include different meniscus lesions, synovial membrane inflammations and loose body removal.

### Learning objectives

- To navigate the camera in the knee joint
- To manipulate the knee joint to optimally visualize the retropatellar pouch and the medial knee joint
- To avoid unnecessary tool movements and unwanted contact with the cartilage surfaces in the joint
- To control two tools at the same time and to triangulate whilst avoiding cartilage damage
- To correctly use the following instruments: grasper, hook, punch and shaver

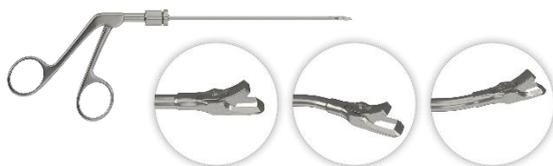
### Instruments



Arthroscope



Hook



Grasper/Punch



Shaver

## Didactic modules



### General concepts of arthroscopy

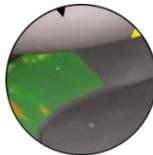
- Equipment overview
- Imaging principles
- Clinical issues



### Basic principles of knee arthroscopy

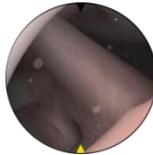
- Background and basics
- Diagnostic arthroscopy
- Therapeutic interventions

## Basic skill cases



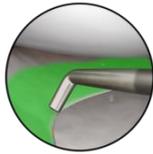
### Guided Diagnostics I: Menisci

- Healthy right knee
- Step by step guided inspection of lateral and medial meniscus



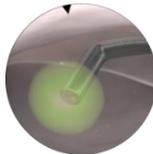
### Guided Diagnostics II: Knee

- Healthy right knee
- Step by step guided inspection of the entire knee



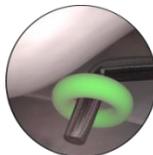
### Guided Diagnostics and Palpation

- Healthy right knee
- Step by step guided inspection of the entire knee
- Learn bringing the probe to all relevant anatomical structures



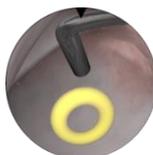
### Triangulation I

- Locate virtual spheres in the knee joint
- Touch all the spheres with the hook for two seconds



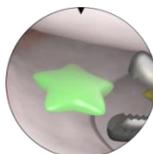
### Triangulation II

- Locate the virtual rings in the knee joint
- Place the hook inside the rings for two seconds



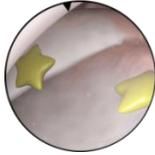
### Triangulation III

- Locate the virtual rings in the knee joint
- Place the hook inside the rings for two seconds



### Catch the stars I

- Locate the virtual stars in the knee joint
- Use the grasper to remove the stars



### Catch the stars II

- Locate the virtual stars in the knee joint
- Use the grasper to remove the stars



### Guided Meniscectomy I

- Guided resection of a meniscus tear with guidance for each step
- Radial tear lateral meniscus



### Guided Meniscectomy II

- Guided resection of a parrot beak meniscus tear supported by step by step instructions

## Diagnostic cases



### Diagnostic knee scope handling – teaching video

- Watch an expert performing a structured diagnostic knee arthroscopy
- Movie provided by Dr. R. Burks, University Salt Lake City, Utah



### Pathology Unknown case

- Perform a diagnostic tour of a knee. The case will randomly select a patient example
- Discover and remember all abnormalities you observe
- Report the abnormalities discovered at the end of the diagnostic tour



### Diagnostic I

- Healthy right knee
- Menisci can be palpated



### Diagnostic II

- Flap tear in the lateral meniscus
- Tear can be palpated with the hook



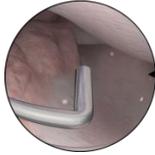
### Diagnostic III

- Bucket handle tear in the medial meniscus
- Tear can be palpated with the hook



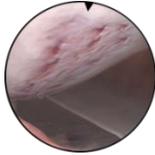
### Diagnostic IV

- Parrot beak tear in the medial meniscus
- Tear can be palpated with the hook



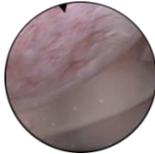
Diagnostic V

- Arthrosis Grade I
- Radial meniscus tear lateral meniscus and parrot beak tear medial meniscus



Diagnostic VI

- Arthrosis Grade III
- Radial meniscus tear lateral meniscus and parrot beak tear medial meniscus



Diagnostic VII

- Arthrosis Grade IV
- Radial meniscus tear lateral meniscus and parrot beak tear medial meniscus



Diagnostic VIII

- Unhappy triad
- Rupture of anterior cruciate and medial collateral ligaments
- Parrot beak tear medial meniscus



Diagnostic IX

- Medial side, Meniscus root tear



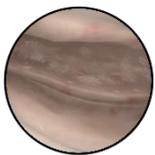
Diagnostic X

- Peripheral meniscus tear, medial compartment



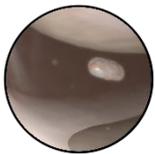
Diagnostic XI

- Synovitis in the lateral recess
- Partial cartilage damage femoral and tibial side



Diagnostic XII

- Synovitis in suprapatellar pouch
- Partial cartilage damage femoral and tibial side



Diagnostic XIII

- Loose bodies



Diagnostic XIV

- Chondromalacia, partial damage to the retro patellar cartilage

## Surgical cases



### Meniscectomy I

- Lateral meniscus radial tear
- Remove damaged parts of the meniscus and smooth the borders with the shaver



### Meniscectomy II

- Bucket handle tear in the medial meniscus
- Remove damaged parts of the meniscus and smooth the borders with the shaver



### Meniscectomy III

- Parrot beak tear in the medial meniscus
- Remove damaged parts of the meniscus and smooth the borders with the shaver



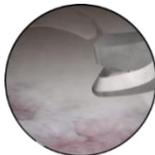
### Arthrosis Grade I

- Arthrosis grade I
- Radial tear lateral meniscus, parrot beak tear medial meniscus



### Arthrosis Grade III

- Arthrosis grade III
- Radial tear lateral meniscus, parrot beak tear medial meniscus



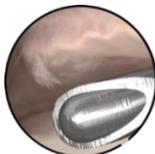
### Arthrosis Grade IV

- Arthrosis grade IV
- Radial tear lateral meniscus, parrot beak tear medial meniscus



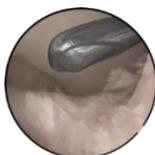
### Unhappy Triad

- Rupture of the anterior cruciate ligament and medial collateral ligament
- Parrot beak tear medial meniscus



### Synovitis I

- Inflammations on the inner skin of the joint capsula
- Use the shaver to remove the synovitis



### Synovitis II

- Inflammations on the inner skin of the joint capsula
- Use the shaver to remove the synovitis



### Loose body removal I

- Find and remove two loose bodies floating in the joint with the grasper



### Loose body removal II

- Find and remove the four loose bodies floating in the joint with the grasper
-



# ACL reconstruction (knee) module

Understanding mechanisms of ACL injury, reconstruction, and correct graft placement

## Module description

This module is for specialization in ACL reconstruction. Trainees learn how to navigate the 3D anatomy of the knee joint in relation to the relevant landmarks for ACL reconstruction and learn about the consequences and effects of graft malpositioning. Mastering correct graft positioning is paramount for safe and effective ACL reconstruction. There are 6 different learning cases for the ACL reconstruction module. The first 2 cases cover the main principles of ACL reconstruction and anatomical concepts, and the other 4 cases present therapeutic patient cases based on the different features and complications of ACL reconstruction surgery. The cases vary from complete ACL tear to partial rupture of the ACL.

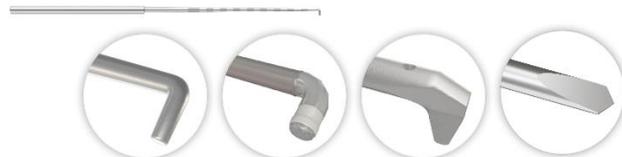
## Learning objectives

- To understand the mechanisms of ACL injury
- To identify and visualize anatomical landmarks using the scope and angled optics
- To locate correct grafting points for ACL reconstruction
- To manipulate the knee to access the femoral attachment site of the ACL
- To know how to place the tunnels for an anatomical ACL reconstruction
- To understand the consequences of typical graft malpositioning
- To correctly use the following instruments: grasper, hook, punch, tibia targeting tool, and shaver

## Instruments



Arthroscope



Hook



Grasper/Punch

Shaver

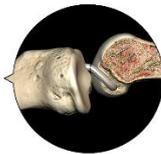
Guidewire

## Didactic modules



### Principles of ACL reconstruction

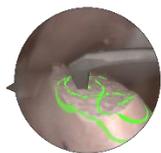
- Learn basic ACL biomechanics
- Understand principles of ACL reconstruction
- Understand the mechanism of injury



### Anatomical concepts

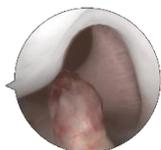
- Identify anatomical landmarks using scope and angled optics
- Understand the anatomical concepts and kinematics of the ACL
- Understand graft malpositioning consequences

## Surgical cases



### Guided ACL reconstruction I

- Complete ACL tear
- Patient in chronic state
- Step by step guided ACL reconstruction



### ACL reconstruction I

- Complete ACL tear
- Patient in chronic state
- Trainee is free to choose sequence of procedure



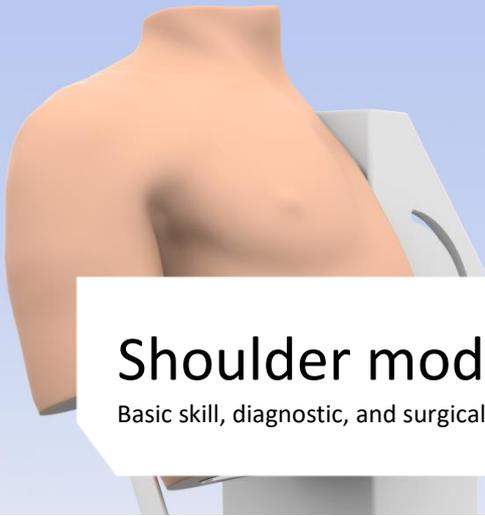
### ACL reconstruction II

- Complete ACL rupture
- Patient in subacute state
- Trainee is free to choose sequence of procedure



### ACL reconstruction III

- Partial rupture of the ACL
- ACL is present, but knee is unstable
- Trainee is free to choose sequence of procedure



## Shoulder module

Basic skill, diagnostic, and surgical cases for shoulder arthroscopy

### Module description

10 guided basic skill training cases fully integrated into a realistic simulation, as well as didactic teaching slides. Mastering these basic tasks enables trainees to perform a complete shoulder arthroscopy more easily and in an efficient, professional way. 10 different patients with varying level of difficulty offer the trainee the chance to perform complete diagnostic arthroscopic interventions. Patients include different lesions in rotator cuff and impingement syndrome. 7 patients with various lesions in different locations provide training for first steps in operative arthroscopy using original OR equipment. Patients include loose body removal, subacromial debridement and decompression.

### Learning objectives

- To navigate the camera and the instruments in the glenohumeral joint and in the subacromial space
- To visualize the most important anatomical structures and to identify pathological conditions
- To get used to triangulation either in beach chair or in lateral decubitus position
- To control two tools at the same time and to triangulate whilst avoiding unnecessary tool movements and unwanted contact with the cartilage surfaces in the shoulder joint
- To perform different procedures

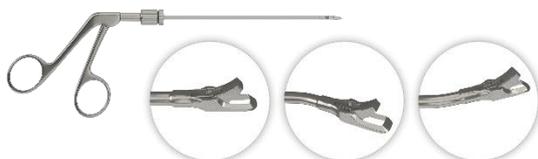
### Instruments



Arthroscope



Hook



Grasper/Punch



Shaver

## Didactic modules



### General concepts of arthroscopy

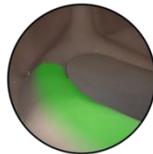
- Equipment overview
- Imaging principles
- Clinical issues



### Basic principles of shoulder arthroscopy

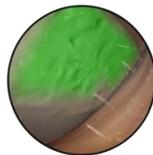
- Background and basics
- Diagnostic arthroscopy
- Therapeutic interventions

## Basic skills cases



### Guided diagnostics glenohumeral

- Healthy right shoulder
- Guided inspection of glenohumeral joint



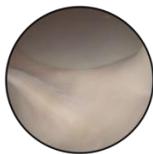
### Guided diagnostics subacromial

- Healthy right shoulder
- Guided inspection of the subacromial space



### Guided diagnostics and palpation

- Healthy right shoulder
- Guided inspection of the shoulder joint
- Learn how to bring the probe to all relevant structures



### Guided 15 point shoulder examination

- Guided inspection of the healthy right shoulder joint
- Switch the scope from the posterior to the anterior portal to visualize the dorsal labrum and the subscapularis recess



### Triangulation I glenohumeral

- Locate virtual spheres in the glenohumeral joint
- Touch all the spheres with the hook for two seconds



### Triangulation II Subacromial

- Locate virtual spheres in the subacromial space
- Touch all the spheres with the hook for two seconds



### Triangulation III glenohumeral

- Locate the virtual rings in the subacromial space
- Place the hook inside the rings for two seconds



### Triangulation IV Subacromial

- Locate the virtual rings in the subacromial space
- Place the hook inside the rings for two seconds



### Catch the stars glenohumeral

- Locate the virtual stars in the glenohumeral joint
- Use the grasper to remove the stars



### Catch the stars subacromial

- Locate the virtual stars in the glenohumeral joint
- Use the grasper to remove the stars

## Diagnostic cases



### Pathology Unknown case

- Perform a diagnostic tour of a shoulder. The case will randomly select a patient example
- Discover and remember all abnormalities you observe
- Report the abnormalities discovered at the end of the diagnostic tour



### Diagnostic I

- Healthy right glenohumeral joint



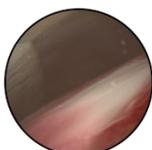
### Diagnostic II

- Healthy right subacromial space



### Diagnostic III

- Acromion with bony hook
- Superficial rotator cuff tear



### Diagnostic IV

- Superficial calcification of the rotator cuff
- Acromion with bony hook



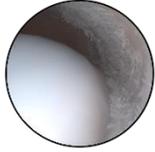
### Diagnostic V

- SLAP II lesion; detachment of the biceps tendon anchor system from the glenoid



#### Diagnostic VI

- Bankart lesion; detachment of the anterior inferior labrum from the glenoid



#### Diagnostic VII

- Complete rotator cuff tear
- Rupture of the supraspinatus tendon



#### 15 Point shoulder examination

- Healthy right shoulder
- Switch scope to from the posterior to the anterior portal to visualize the dorsal labrum and the subscapularis recess

## Surgical cases



#### Subacromial debridement

- Use shaver to debride soft tissue/ bursitis from the subacromial space



#### Subacromial decompression I

- Locate the hook on the acromion
- Use acromionizer burr to resect the part of the acromion causing impingement



#### Loose body removal

- Locate the loose bodies in the glenohumeral joint
- Use the grasper to remove the loose bodies

## Hip module

Basic skill, diagnostic, and surgical cases for hip arthroscopy

### Module description

The ArthroS Hip module contains 8 basic guided skill training cases fully integrated into realistic simulation. By mastering these tasks, trainees are more equip to perform a complete hip arthroscopy. There are 4 different patients with varying levels of difficulty, which offer the trainee the chance to perform complete diagnostic arthroscopic interventions. The module features zero radiation fluoroscopy simulation for the trainee to practice how to access the hip joint and to learn to establish proper and safe portals. Patient cases include different lesions in the labrum and cartilage as well as a CAM impingement. 2 patient cases offer various lesions in different locations to provide training for first steps in operative arthroscopy using original OR equipment. Patient cases also include loose body removal, synovial debridement, and CAM decompression.

### Learning objectives

- To navigate the camera and the instruments in the central and peripheral aspects of the hip joint
- To visualize the most important anatomical structures and to identify pathological conditions
- To get used to triangulation either in supine or lateral position
- To control two tools at the same time and to triangulate whilst avoiding unnecessary tool movements and unwanted contact with the cartilage surfaces in the hip joint
- To learn how to establish a save access to the hip joint using zero radiation fluoroscopy simulation

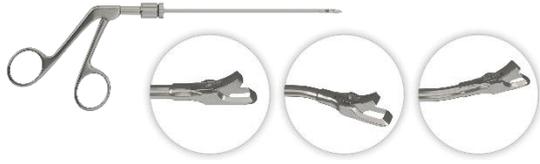
### Instruments



Arthroscope



Hook



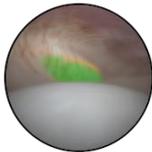
Grasper/Punch



Shaver

Guidewire

## Basic skills cases



### Guided diagnostics central

- Healthy left hip joint
- Guided inspection of the central compartment of the hip joint



### Guided diagnostics peripheral

- Healthy left hip joint
- Guided inspection of the peripheral compartment of the hip joint



### Triangulation I central

- Locate virtual spheres in the central compartment
- Carefully select the appropriate instrument portal to access the spheres
- Touch all the spheres with the hook for two seconds



### Triangulation I peripheral

- Locate virtual spheres in the peripheral compartment of the hip joint
- Carefully select the appropriate instrument portal to access the spheres
- Touch all the spheres with the hook for 2 seconds



### Triangulation II central

- Locate virtual rings in the central compartment
- Carefully select the appropriate instrument portal to access the rings
- Hook the rings with the probe and hold still for 2 seconds



### Triangulation II peripheral

- Locate virtual rings in the peripheral compartment of the hip joint
- Carefully select the appropriate instrument portal to access the rings
- Hook the rings with the probe and hold still for 2 seconds



### Catch the stars central

- Locate the virtual stars in the central compartment
- Carefully select the appropriate instrument portal to access the stars
- Use the grasper to remove the stars from the hip joint



### Catch the stars peripheral

- Locate the virtual stars in the peripheral compartment
- Carefully select the appropriate instrument portal to access the stars
- Use the grasper to remove the stars from the hip joint

## Diagnostic cases



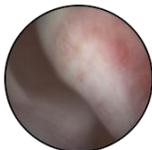
### Diagnostic I

- Healthy left hip joint



### Diagnostic II

- Labrum rupture



### Diagnostic III

- CAM deformity of femoral neck



### Diagnostic IV

- Cartilage flap on the acetabulum caused by CAM impingement

## Surgical cases



### Loose body removal

- Locate the loose bodies in the hip joint
  - Carefully select the appropriate portals for the grasper to access the loose bodies
  - Use the grasper to remove the loose bodies
  - Use shaver to debride soft tissue/ bursitis from the subacromial space
- 



### CAM decompression

- Locate the CAM deformity on the femoral neck
- Use the burr to resect bone from the femoral neck until impingement is removed.
- Bring the hip into flexion to control for success of the decompression