



Module 3:

Basic Interventional Arthroscopy

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Problem Identification and Needs Assessment

Identification of targeted learners

This module is intended for junior orthopaedic residents and beginning arthroscopists.

Identification of need or problem for targeted learners

Fundamental training is inconsistent during residency, more commonly stressing the historical see one, do one, teach one philosophy without sound understanding of foundational motor skills in arthroscopy.

Current educational approach to address need or problem

Our current approach is a classic see one, do one, teach one philosophy in most training programs with little foundational motor skills development

Ideal educational approach to address need or problem

The ideal educational approach would involve sequential skills advancement based on a foundational understanding of anatomy and core skills, followed by a progressive advancement of skills. The learner should not advance to more advanced skills until they have mastered the prior level. This mastery should be measured by a validated assessment tool or direct supervision.

Goals and Objectives

Specific educational goals

- This module targets basic interventional arthroscopic skills including resection of tissue and removal of loose bodies.

Specific cognitive, affective, psychomotor task objectives

- The learner will be able to use an arthroscope in one hand, maintain a stable, properly-oriented view of a targeted area, while using an instrument in the opposite hand to resect or remove material from a closed space.
- The learner will be able to avoid undue contact on the walls of the closed space.

Syllabus Development

Assumptions

This module is dependent on prior skill and knowledge development including:

- Principles of arthroscopy and introduction tools and equipment, scope optics, fluid management, blood pressure, anesthesia safety, room set up, draping, and optimizing visualization with a scope
- Arthroscopic motor skills of triangulation, camera control

(rotation, telescoping, and sweeping), and ambidextrous skills

- Must have anatomic knowledge of joint including neurovascular structures and principles of proper portal placement

Suggested readings

- Utilize the same readings described in FAST Modules 1 and 2

Description of laboratory module

This module is divided into three sub-modules that will progressively develop basic interventional skills. The first sub-module will utilize a “box trainer”. The second sub-module will utilize an anatomic knee model. After mastery of skills using the models, the learner will then practice motor skills using a cadaver specimen.

Each of the modules will require an imaging device. Alternatives for imaging will include a rigid arthroscope and light source connected to an arthroscopy monitor (or a similar surrogate). The other alternative will be a USB chip camera connected to a laptop computer, with either a built in or external light source.

Triangulation skills will involve an arthroscopic probe, and arthroscopic grasping tool, and an arthroscopic basket or duck bill forceps. An arthroscopic shaver will not be used due to the associated requirement for fluid irrigation (not needed for the other exercises).

Each of the exercises will be demonstrated by a video which will be viewed by the learner prior to each submodule.

Description of techniques and procedures

Sub-Module 1: Box Trainer: This module will utilize the *FAST* workstation, or an appropriate substitute that has access portals at appropriate positions to mimic clinical portal relationships. The learner will initially practice skills through a lucent cover (which

will allow the learner to look directly at the tips of the scope and the instruments in space). Once sufficient proficiency is achieved, the learner will then practice skills through an opaque cover, which will force visualization only via the video screen.

Within box trainer, there will be colored plastic cylinders that will be transferred between pegs of various orientations and positions.

The exercises will involve picking up and transferring cylinders from one location to another within the box trainer and then transferring them back to the original position. Then the learner will use basket forceps to resect marked portions of paper attached within the box trainer. All of the exercises will be performed with both hands in order to train ambidextrous motor skills.

Sub-Module 2: Anatomic Knee Model: The arthroscope will be used to visualize the patellofemoral joint, medial compartment, lateral compartment, intra-articular notch, posterior medial compartment, and posterior lateral compartment of the knee.

With the opposite hand, the learner will use an arthroscopy probe to touch anatomic landmarks within each visualized area of the knee. This exercise will be repeated with the instruments in opposite hands.

The learner (or a mentor) will then place simulated loose bodies (for example, corn kernels) at various locations within the joint. The learner will then use a grasping forceps to retrieve the loose bodies. This exercise will be repeated with the instruments in opposite hands.

The learner will use a basket forceps or duck bill forceps to resect approximately 50% of the posterior horn of the medial meniscus and lateral meniscus. This exercise will be repeated with the instruments and opposite hands, with resection of the residual 50% of each meniscus.

For all of these exercises, the learner will avoid forcing instruments and will avoid contact with articular surfaces.

Sub-Module 3: Cadaver Specimen: Each of the steps described in Sub-module 2 will be repeated on cadaveric specimen. The cadaver specimens will require fluid flow through the joint. An option will be to add practice opportunities using a motorized shaver, if one is available. All skills will be practiced with both hands to facilitate development of ambidextrous motor skills.

Common errors and prevention strategies

- Poor camera orientation and visualization should be avoided by not progressing to this module until successful passing previous models and motor skills
- Failure to respect perspective created by viewing from different portals. This skill will be improved practicing from varying portal positions while using various rotations of the 30° arthroscope.
- Poor use of dynamic instruments will be avoided by practicing simple procedures such as probing pathology, removal of loose bodies, and resecting tissue in progressive order.
- Over-resection of tissue will be assessed by marking on the simulated meniscus (or paper surrogate) the target zone that shall be resected. An observer can then assess successful performance based on residual tissue remaining or irregularity of resection surface.
- Iatrogenic cartilage damage will be reduced by progressively challenging the learner to go from open (the box) to tighter spaces (the knee model). In the cadaver model, iatrogenic cartilage injury can be monitored by direct visualization, either by the learner or by the mentor.

Demonstrate expert performance

Each of these skills and sub-modules will be demonstrated by an expert, who will describe the learning objectives and clinical pitfalls for each motor skill.

Recommendations for motor skills practice

Learners should begin by practicing on the box trainer with the lucent lid. They should advance to the opaque lid as skills improve. Learners should be able to pick up colored cylinders and transfer them onto the pins, without dropping, before proceeding to the anatomic knee model.

Learners should be able to retrieve loose bodies from all compartments and probe all facets of the knee joint before proceeding with meniscal resection. In addition, removal of loose bodies and use of the arthroscopy probe should involve minimal contact with the articular surfaces of the model. The student should be able to perform each procedure with no articular cartilage damage before proceeding to a cadaveric specimen. The learner should address the cadaveric specimen in the same sequence as the anatomic model.

It is very important that the learner practice all elements of these modules with both hands to facilitate development of ambidextrous arthroscopy motor skills.

Supplies and station setup

- Arthroscope and tower, with light source or a USB connected video camera with light source.
- The *FAST* workstation, or appropriate motor skills substitute
- An anatomic knee model
- A cadaver knee joint

- An arthroscopy probe, and arthroscopic grasper , and basket forceps or duck bill forceps,

Suggested duration for completion of module

Background reading and video review should be accomplished in one hour. The learner should be able to complete Sub-Module 1 in one to two hours. The learner should be able to complete Sub-Module 2 in two to four hours. The learner should be able to complete Sub-Module 3 in one to two hours. Total time to module completion: 5 to 9 hours.

Estimated budget

- High quality videos will be available online for implementation of this module. Additional expenditure would be associated with on-site customized video production.
- Completion of these modules will require purchase of either a dedicated arthroscopy tower, or purchase of a USB connected camera and a laptop computer.
- Additional costs will be associated with utilization of the *FAST* workstation or other equivalent platforms (including the disposable elements that will need to be replenished), the anatomic knee model (including the disposable elements that will need to be replenished), and cadaveric knee specimens (single use).

Learner Evaluation and Feedback

Methods of performance assessment

Assessment can be performed by a trained observer using a checklist. For exercises on the box trainer, time to task completion without errors (for example, dropping loose bodies during transfer) will serve as a self-monitored performance metric.

Suggested proficiency benchmarks

Assessment of the quality of tissue resection can be made by measuring the amount of resection achieved in relation to a pre-marked line on the meniscus surrogate (plastic or paper). Secondary quality assessment can be made of the smoothness of the edge of resection.

Learners will receive a failing score if repeated contact with the articular surface is visualized or if iatrogenic full thickness cartilage damage is created.

Methods for learner debriefing and feedback

Learners will provide curriculum feedback using a web-based, anonymous tool assessing module didactic content, expert video quality and usefulness of skills training.

Periodic Curriculum Review, Evaluation, Validation, and Refinement

During the development phase, the module should be assessed on an annual basis to identify elements that are not concordant with our teaching goals. Some of the sub-module elements may be too easy or too difficult, and these should be modified to match the typical skills of our target learners.

Curriculum faculty will annually review learner comments and assess potential improvements in the didactic and manual skills portion of the module. Educational validation will occur when the learner is observed and graded in the clinical setting, noting the specific steps of arthroscopic equipment set up and portal placement.