



Module 4: Suture Anchors

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Problem Identification and Needs Assessment

Identification of targeted learners

Targeted learners for this template include junior residents and surgeons who are at the early learning level of arthroscopy.

Identification of need or problem for targeted learners

Suture anchors are used commonly during open and arthroscopic surgery to attach soft tissue to bone. The holding capability of the suture anchor is affected in part by the angle of insertion into bone relative to the cortical surface. This particular variable can be controlled more easily with open surgery, due to the inherent limitations of portal creation during arthroscopic surgery (which significantly affects the angle of approach). Learners should develop sufficient technical skills to allow for reliable placement of suture anchors into bone at the appropriate angle and depth to achieve solid fixation.

Current educational approach to address need or problem

Most trainees currently learn to place suture anchors in the operating room under the mentorship of the attending surgeon, which includes a period of preliminary observation. Learners may be exposed for the first time to suture anchor placement during either open or arthroscopic surgery. In some educational centers, laboratory models are available but there is neither an established curriculum nor programmed approach to facilitate structured, progressive learning.

Ideal educational approach to address need or problem

The educational process should be structured and progressive. Prior to engaging the motor skills sub-modules, learners should read fundamental didactic material covering the basic principles of suture anchors. After acquiring the requisite cognitive skills (confirmed by a post-test of knowledge), learners will observe video demonstrations of proper suture anchor placement into bone. These videos will also demonstrate pitfalls of this motor skill.

The first motor skills task involves suture anchor placement under direct visual control. The second task involves suture anchor placement under arthroscopic visualization. These elements can be rehearsed easily using a block of foam bone.

Goals and Objectives

Specific educational goals

The broad purpose of this training module is to develop the basic motor skills that are required to place suture anchors into bone. Specific goals include:

- Familiarization of the learning surgeon with the various types of suture anchors currently available (including design and material considerations, and associated biomechanical principles).
- Understanding of the surgical techniques involved with the placement of suture anchors into bone.
- The development of psychomotor skills necessary to perform these tasks under arthroscopic conditions.

Specific cognitive, affective, psychomotor task objectives

The following anchor placement objectives were defined by task deconstruction:

- Ability to identify the appropriate angle of insertion of a suture anchor relative to the surface of the bone (for open and for arthroscopic surgery).
- Ability to prepare the bone as needed, per the specific technical requirements of the suture anchor that will be inserted (i.e., pre-drilling of the bone).
- Ability to insert a suture anchor to appropriate depth (per manufacturer recommendations) in order to avoid excessively proud or excessively deep suture anchors.
- Ability to pre-test the anchor, by a tensile load via the attached sutures, to confirm anchor security within bone.
- Ability to manage the associated sutures and avoid inadvertent off-loading from the anchor. These skills are needed to facilitate subsequent steps in the overall surgical procedure (i.e., suture passage and knot tying).

Syllabus Development

Assumptions

To engage in this module, the beginning surgeon must have acquired the basic skills of diagnostic arthroscopy, must be able to effectively triangulate and position equipment in space in a coordinated and controlled manner (*FAST* Program Modules 1-3).

Suggested readings

- Implant Choices: The Biomechanics of Anchors and Sutures (Chapter by Pedowitz, Weichel, Barber). In Ryu R, Angelo R, Esch J (Editors): *AANA Advanced Arthroscopy: The Shoulder*, Saunders Elsevier, Philadelphia, pp 34-43, 2010.

Description of laboratory module

A brief video presentation will be available on-line that describes the overall rationale for each individual sub-module. Introductory videos will also present important information about how to set up the skills sessions (i.e., the *FAST* workstation or equivalent platform). For these modules, the laboratory setting would include:

- A block of foam bone that is stabilized by the *FAST* workstation (or another suitable alternative).
- Lucent and opaque covers with various portals that allow for suture anchor delivery at various angles relative to the bone block.
- An arthroscope and camera for visualization (either a USB camera connected to a laptop computer or a bank of arthroscopy equipment).

Description of techniques and procedures

The learner will read the appropriate didactic material and watch the instructional videos. Although there are a wide variety of suture anchors, designs, and materials available for clinical application, the current module will involve placement of a metallic screw in suture anchor as a basic, representative example. These anchors have the inherent advantage of being retrievable and reusable, which will lower the costs associated with this educational module.

The first task will involve placement of a metallic screw-in suture anchor into foam bone under direct visual control. For this task, the lucent *FAST* workstation cover or equivalent lucent platform will be used. This will allow the learner to see the foam bone directly, but will force the learner to select an appropriate trajectory in order to achieve perpendicular placement of the anchor relative to the surface of the foam bone block. The suture anchor will then be tested using a tensile force applied by the learner via the attached suture limbs.

For the second task, the opaque *FAST* workstation cover or equivalent opaque platform will be used. Visualization will be via the arthroscope and monitor. The learner will place a metallic screw-in suture anchor into the foam bone block, and will test the anchor by pulling on the associated sutures.

The third task will involve placement of a suture anchor under arthroscopic control, with subsequent retrieval of each suture limb through different portals of the opaque workstation cover. This element will train techniques of suture management that avoid inadvertent offloading of the suture anchor.

Common errors and prevention strategies

The following errors are common:

- Improper direction of the suture anchor relative to the surface of the bone. This can result in damage to the adjacent articular cartilage (by undermining) or subsequent failure of the anchor (due to inadequate bone purchase). The ideal relationship is for the shaft of the anchor inserter to be perpendicular to the cortical surface.
- Improper depth of anchor penetration into bone. A proud anchor can cause direct damage to opposing articular surfaces and soft tissue structures. A deep anchor may be associated with suboptimal mechanical fixation (since cancellous bone is weaker than cortical bone).
- Offloading of the suture anchor during removal of the inserter device or during subsequent suture management in preparation for suture passage.

Demonstrate expert performance

At the beginning of this module, the learner will watch a narrated video presentation of motor skill performance by an expert arthroscopist using the *FAST* workstation. The expert will show narrated examples of suture anchor techniques using clinical cases.

Recommendations for motor skills practice

Sub-module 1: Anchor Placement (Lucent Cover): The learner will place anchors into foam bone under direct visual control.

Sub-module 2: Anchor Placement (Opaque Cover): The learner will place anchors into foam bone under arthroscopic control.

Sub-module 3: Suture Handling after Anchor Placement: The learner will move each suture

limb from the suture anchor through different portals, without offloading of the suture anchor.

Supplies and station setup

- The *FAST* workstation (or an appropriate alternative motor skills set up), stabilized on a flat working surface, with lucent and opaque covers with various portals.
- A stabilized block of foam bone of appropriate density to allow for suture anchor placement. If the bone is excessively hard, predrilling may be required to create a starting hole for the anchor.
- Metallic screw in suture anchors loaded with one or two sutures. These anchors should be retrievable and reusable.
- An arthroscope / light source
- An arthroscopic suture retrieval device (i.e., a loop grasper or crochet hook) , and a hemostat.

Suggested duration for completion of module

Background reading and video review should be accomplished in one hour.

Sub-module 1: Anchor Placement (Lucent Cover): The learner should complete this in approximately 30 minutes.

Sub-module 2: Anchor Placement (Opaque Cover): The learner should complete this in approximately 60 minutes.

Sub-module 3: Suture Handling after Anchor Placement: The learner should complete this in approximately 30 minutes.

Total estimated time for this module: Three hours.

Estimated budget

- The budget should include expenses associated with the *FAST* workstation (or another suitable alternative that meets the educational requirements).
- Costs associated with the foam bone blocks, reusable suture anchors, and arthroscopic visualization.
- These motor skills modules will require replacement of foam bone blocks as they

are consumed. Metal suture anchors will need to be replaced occasionally (threads get dull and the anchor / eyelet may eventually break after repeated use).

Periodic Curriculum Review, Evaluation, Validation, and Refinement

Learner Evaluation and Feedback

Methods of performance assessment

Assessment could be either by direct visualization by the mentor (with completion of a task oriented check list) or by submission of unedited video data for secondary grading. Given that there are three sub-modules, the learner should achieve sufficient proficiency at each level before moving on to the next phase in the learning process. For this particular module, it is likely that the learner could self-evaluate and then move along in sequence to the next sub-module. These specific motor tasks are relatively straightforward. Success and failure should be relatively easy to discern by the learner.

Suggested proficiency benchmarks

Proficiency is defined by the ability to place a suture anchor perpendicular to bone at the appropriate depth, followed by suture management without inadvertent offloading of the suture anchor. The learner should be able to do this sequentially at least three times with no observable technical errors.

Methods for learner debriefing and feedback

Immediate viewing of one's own work is a very powerful teaching vehicle. Video recording and intermediate viewing by the learner should be an integral part of this exercise. The mentor may also wish to observe the learner during performance of suture anchor placement under arthroscopic control with subsequent suture management, using a task-oriented checklist. Proximate feedback should be provided after observation by the mentor.

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

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.