

Fundamentals of Arthroscopy Surgery Training (FAST) Program - Validity and Feasibility

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Disclosure

- I and my co-authors have no financial conflicts of interest related to this work
- I served on and led the AANA FAST committee that worked on the development of the FAST curriculum and workstation.
- I have received funding from the ABOS/OREF and AANA to perform research related to the FAST Program.



FAST

FUNDAMENTALS OF ARTHROSCOPIC SURGERY TRAINING

A collaborative project of the
Arthroscopy Association of North America (AANA)
American Academy of Orthopaedic Surgeons (AAOS)
American Board of Orthopaedic Surgery (ABOS)

What is the FAST Program?

FAST Curriculum

Core Content	Fundamental Concepts	
Preamble to Arthroscopy	Knot Tying	Complex Skill
FAST Program 1 - Basic Principles of Arthroscopy	Grasping/Passing	Fine Motor
FAST Program 2 - Basic Triangulation Skills	Probing	Visual Memory
FAST Program 3 - Basic Interventional Arthroscopy	Triangulation	Bimanual Dexterity
FAST Program 4 - Suture Anchors	Deliberate Linear Motion	Tracking
FAST Program 5 - Passing Suture Through Tissue	Image Centering	Visualization
FAST Program 6 - Arthroscopic Knot Tying	Periscoping	
	Telescoping	
	Horizon Control	

Skills Build from Foundational to More Complex



Web-Based and Self-Directed

FAST Workstation and Training Modules



Proficiency-Based Progression

Module	Benchmark Time	Benchmark Errors
Probe	<90 seconds	No Errors
Ring Transfer	<140 seconds	<2 dropped rings
Maze	<103 seconds	No balls off platform
Resection	<88 seconds	<2 areas of over or under-resection
Suture Passing	0.46	0.06
Knot Tying	<195 seconds	<1mm from target area (per target), no suture unloads

FAST Testing



Identifies Skills Gaps and Allows Demonstration of Proficiency



Training Curricula

- Content Validity
- Feasibility

Core Content

Preamble to Arthroscopy

FAST Program 1

- Basic Principles of Arthroscopy

FAST Program 2

- Basic Triangulation Skills

FAST Program 3

- Basic Interventional Arthroscopy

FAST Program 4

- Suture Anchors

FAST Program 5

- Passing Suture Through Tissue

FAST Program 6

- Arthroscopic Knot Tying

Fundamental Concepts

Knot Tying

Grasping/Passing

Probing

Triangulation

Deliberate Linear Motion

Image Centering

Periscoping

Telescoping

Horizon Control

Complex Skill

Fine Motor

Gross Motor

Bimanual Dexterity

Tracking

Visualization



Module 1: Basic Principles of Arthroscopy

Keith Nord, MD

Problem Identification and Needs Assessment

Identification of targeted learners

Targeted learners will include PGY 1 Orthopaedic Surgery residents with potential inclusion of PGY 2 residents.

Identification of need or problem for targeted learners

Arthroscopy is one of the most common orthopaedic procedures. In order to perform arthroscopy safely and efficiently, surgeons must become familiar with basic arthroscopy tools and equipment. Learners must also understand relevant periarticular anatomy and the associated portals for safe access to joints.

Current educational approach to address need or problem

Our current approach is to bring the resident into the operating room environment, demonstrate the use of the arthroscope, and then allow the trainee to utilize the instruments in a patient. A cadaveric lab may have been performed beforehand, but typically residents have very limited training about the surgical equipment to be used. Risk of patient injury is higher and risk of equipment damage is higher with this see one, do one, teach one approach. Relevant neurovascular and portal anatomy is generally taught with lectures and cadaver dissections, followed by making portals on patients. A stepwise progressive approach is likely to be both safer and more efficient.

Ideal educational approach to address need or problem

The ideal educational approach would be structured and progressive, allowing the resident

to acquire basic cognitive information, followed by training and practice setting up arthroscopy equipment, leading to practice with a model or arthroscopy simulator (to an acceptable level of proficiency), before implementation of these skills on patients.

Goals and Objectives

Specific educational goals

- The learner will become familiar with the basic set up and function of the arthroscopy "tower", including the angled arthroscope (30 and 70 degree lens), light source, shaver and pump, tissue ablation / coagulation tools (radiofrequency devices), foot pedals, and control boxes.
- The learner will become familiar with basic hand tools that are used during arthroscopy, including probes, graspers, baskets, scissors, and motorized shavers.
- The learner will become familiar with operating room set-up and draping techniques for the most common arthroscopic procedures.
- The learner will understand the relationships between surface anatomy, superficial and deep neurovascular anatomy, and basic arthroscopy portals.

Specific cognitive, affective, psychomotor task objectives

- The learner will demonstrate ability to set up and connect the various elements of the arthroscopy tower.
- The learner will demonstrate familiarity and application of various hand instruments used during basic arthroscopic procedures.

Content Validity

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- Mark Hutchinson MD – University of Illinois
- Robert Hunter MD – HRRMC: Salida Colorado
- Howard Sweeney MD – Northwestern Illinois

Reviewed and adopted by the Surgical Skills Task Force of the American Board of Orthopaedic Surgery (ABOS) in collaboration with the American Academy of Orthopaedic Surgeons (AAOS), and the American Orthopaedic Association (AOA)/Council of Orthopaedic Residency Directors (CORD)

Published:

<https://www.abos.org/wp-content/uploads/2019/07/Module-14-Basic-Arthroscopy-Skills-edit.pdf>

OLC FAST Course

40 PGY 1-3 Residents

- 8 Institutions

Baseline Surgical Assessment

(Live Patients)

- Diagnostic Knee Arthroscopy
- Diagnostic Shoulder Arthroscopy
- Subacromial Decompression
- Arthroscopic Partial Meniscectomy

OLC FAST Course

- Pre-Course FAST Assessment
- FAST Training
- Post-Course FAST Assessment
- Assessment of Concurrent Validity
 - Diagnostic Knee (Cadaver/Simulator)
 - Diagnostic Shoulder, Partial Meniscectomy, SAD (Simulator)
 - Bankart Model (Copernicus)

Repeat Surgical Assessment

(Live Patients)

- Diagnostic Knee Arthroscopy
- Diagnostic Shoulder Arthroscopy
- Subacromial Decompression
- Arthroscopic Partial Meniscectomy

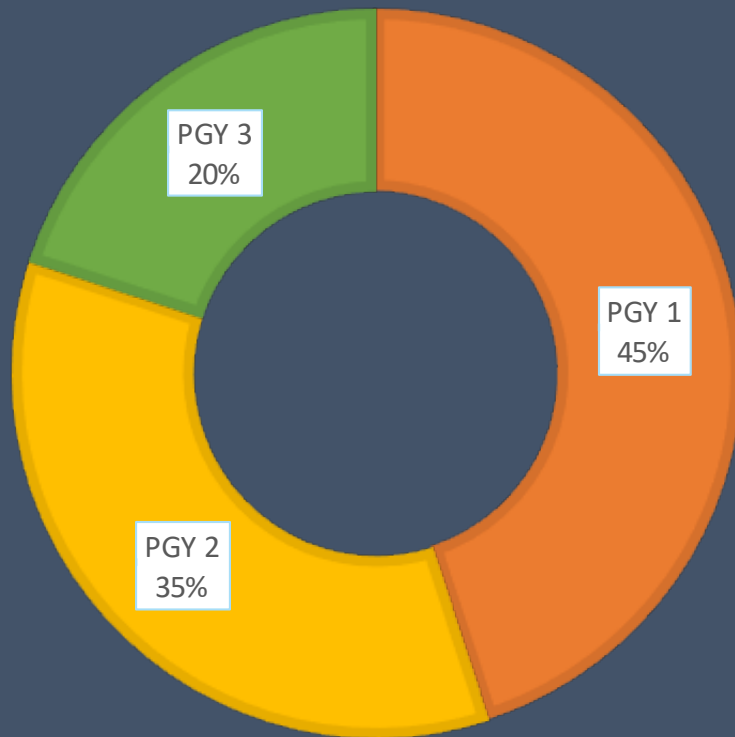
Designed to assess feasibility, content, construct, concurrent, and transfer validity of the FAST training program

Feasibility

Demographics:

34 Resident Cohort

- Seven Programs
- Median Age = 28
- 23% Female
- 87% Right Hand Dominant

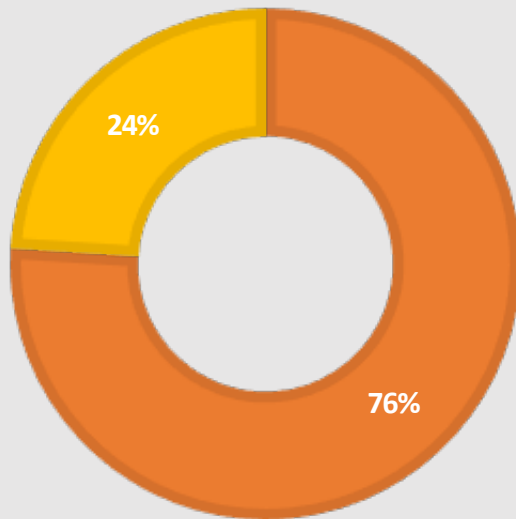


- 5 hours to Complete 14 Training Modules
 - Dominant and Non-Dominant Hand
 - 100% Completion

Training Content Validity (Students N=40)

FAST TRAINING EFFECTIVELY IMPROVED MY FUNDAMENTAL ARTHROSCOPIC SKILLS

Strongly Agree Agree Neutral Disagree Strongly Disagree



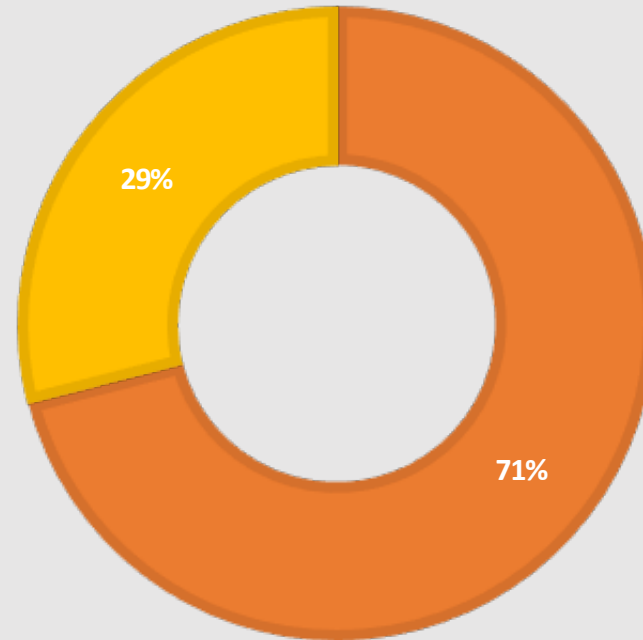
What do you think is the most effective way to learn fundamental arthroscopic skills?

1. Cadaver (2.03)
2. Performing Surgery in the OR (2.10)
3. FAST Simulation (2.54)
4. VirtaMed VR Simulator (3.07)
5. Observing Surgery in the OR (5.00)
6. Online Media (5.76)
7. Published Literature (6.92)

Training Content Validity (Faculty N=7)

FAST TRAINING EFFECTIVELY IMPROVED RESIDENT FUNDAMENTAL ARTHROSCOPIC SKILLS

Strongly Agree Agree Neutral Disagree Strongly Disagree



Training on the Simulator Improved Efficiency

FAST Testing Module	Pre-Test Mean Time (seconds)	Post-Test Mean Time (seconds)	P-Value
Probe Left	117.66	61.09	P<.001
Probe Right	100.45	58.85	P<.001
Ring Transfer Left	174.30	118.55	P<.001
Ring Transfer Right	213.31	136.78	P<.001
Maze Left	83.61	68.39	P=.035
Maze Right	100.82	87.41	P=.148
Resection Left	107.91	60.09	P<.001
Resection Right	96.79	63.03	P<.001
Suture Passing Left	476.34	263.69	P<.001
Suture Passing Right	383.43	211.79	P<.001

Training on the Simulator Decreased Errors

Module	Pre-Test Mean Errors	Post-Test Mean Errors	P-Value
Probe Left	0.00	0.00	P=1.000
Probe Right	0.06	0.00	P=.160
Ring Transfer Left	1.76	0.82	P=.007
Ring Transfer Right	1.81	1.31	P=.092
Maze Left	0.06	0.09	P=.662
Maze Right	0.18	0.03	P=.134
Resection Left	1.30	0.39	P=.005
Resection Right	0.76	0.21	P=.010
Suture Passing Left	0.59	0.06	P=.015
Suture Passing Right	0.57	0.11	P=.025



Testing Battery

- Benchmarks
- Content Validity
- Construct Validity

Benchmarks For Testing Modules Established

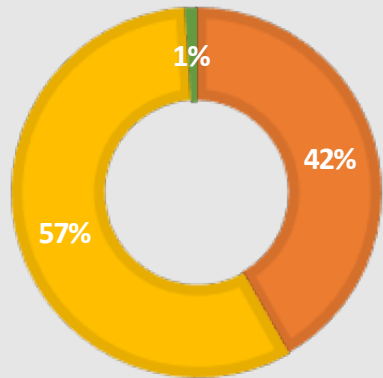
Module	Benchmark Time	Benchmark Errors
Probe	<96 seconds	No Errors
Ring Transfer	<140 seconds	<2 dropped rings
Maze	<103 seconds	No balls off platform
Resection	<68 seconds	<2 areas of over or under-resection
Suture Passing	0.46	0.06
Knot Tying	<195 seconds	<1mm from target area (per target), no suture unloads

*Based upon mean performance of 40 total AANA faculty at two OLC arthroscopy courses

Testing Content Validity (Students)

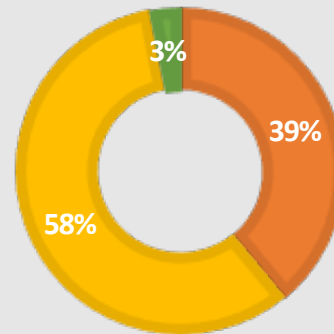
I FEEL THIS TESTING STRATEGY FULLY EXAMINED MY ARTHROSCOPIC SKILLS

Strongly Agree Agree
Neutral Disagree
Strongly Disagree



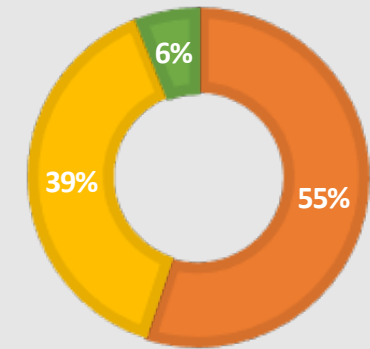
I FEEL THIS TESTING EFFORT WOULD DIFFERENTIATE SOMEONE WITH NO OR POOR SKILLS FROM SOMEONE WITH ACCEPTABLE ARTHROSCOPIC SKILLS

Strongly Agree Agree
Neutral Disagree
Strongly Disagree



THIS EXERCISE WAS HELPFUL TO ME IN HIGHLIGHTING ASPECTS OF ARTHROSCOPIC SURGERY I MIGHT WISH TO WORK ON

Strongly Agree Agree
Neutral Disagree
Strongly Disagree



94% "I feel that Orthopedic residents should demonstrate some required level of surgical skill prior to sitting for their board exam"

FAST Testing Construct Validity

Module	Novice* Mean Time (Seconds)	Experienced** Mean Time (Seconds)	Novice Mean Errors	Experienced Mean Errors	P-Values Time	P-Values Errors
Probe Left	119.21	96.15	0.00	0.00	P=.041	N/A
Probe Right	101.21	96.35	0.06	0.00	P=.489	N/A
Ring Transfer Left	174.21	143.25	1.76	1.00	P=.021	P=.066
Ring Transfer Right	215.15	170.05	1.94	0.85	P=.015	P=.003
Maze Left	85.50	96.40	0.06	0.00	P=.211	N/A
Maze Right	100.82	108.75	0.18	0.00	P=.423	N/A
Resection Left	109.21	76.80	1.29	0.20	P=.002	P=<.001
Resection Right	100.09	68.00	0.76	0.30	P=.001	P=.045
Suture Passing Left	476.34	221.5	1.03	0.9	P=<.001	P=.754
Suture Passing Right	383.43	185.7	1.36	0.8	P=<.001	P=.171

* Resident OLCohort

**2 Separate Faculty Groups at 2 AANA Courses

PASS Rate Increases with Training

Module	Pre-Test Pass Rate	Post-Test Pass Rate	P-Value
Probe Left	14/34 (41.2%)	32/34 (94.1%)	P=<.001
Probe Right	17/34 (50.0%)	31/34 (91.2%)	P=<.001
Ring Transfer Left	4/34 (11.8%)	24/33 (73.5%)	P=<.001
Ring Transfer Right	3/34 (8.8%)	15/34 (44.1%)	P=<.001
Maze Left	24/34 (70.6%)	28/34 (82.4%)	P=.206
Maze Right	20/34 (58.8%)	26/34 (76.5%)	P=.058
Resection Left	1/34 (2.9%)	23/34 (67.6%)	P=<.001
Resection Right	5/34 (14.7%)	26/33 (76.5%)	P=<.001
Suture Passing Left	2/34 (5.9%)	12/34 (35.3%)	P=<.001
Suture Passing Right	6/34 (17.6%)	17/34 (50.0%)	P=.002



FAST Program

- Concurrent Validity
- Transfer Validity

FAST Testing Concurrent Validity

FAST Training Improves Diagnostic Knee Arthroscopy Performance

- Each FAST Module* passed correlated with a 1.24 point improvement in ASSET
- $P=.002$

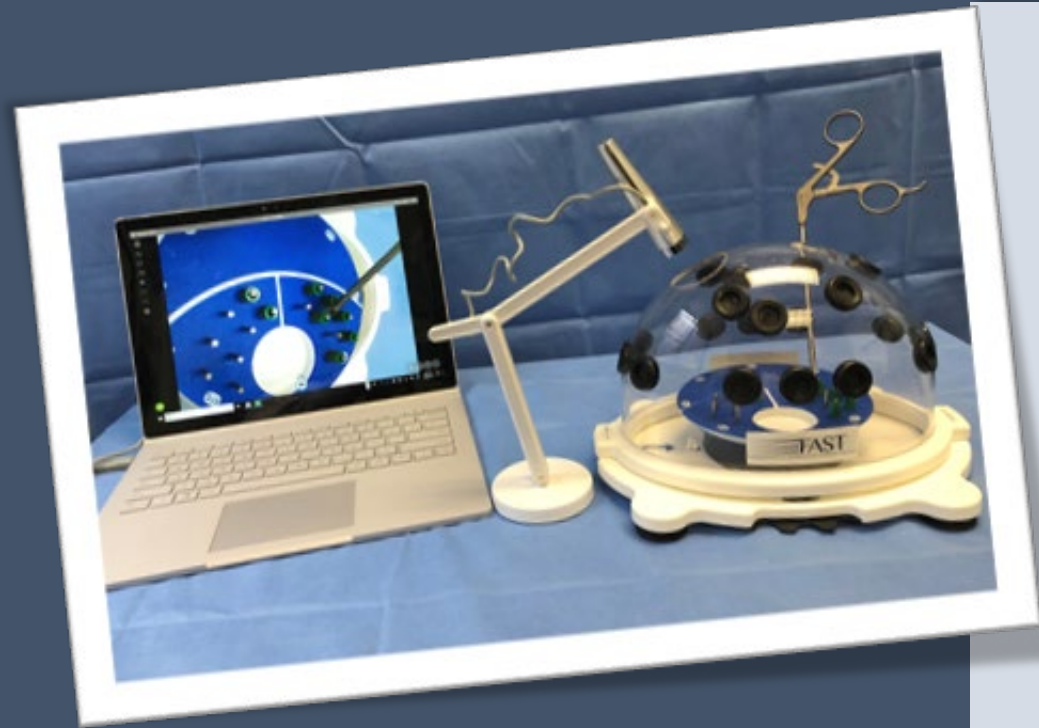
FAST Training Improves Knee Simulator Performance

- Increased Efficiency $p=.032$
- Increased Time on Horizon $p=<.001$
- Decreased Camera Path Length $p=.005$
- Decreased Grasper Path Length $p=<.001$

FAST Training Improves Shoulder Simulator Performance

- Increased Total Score $p=.05$
- Decreased Camera Path Length $p=.01$

*Total of 11 Testing Modules



ASSET Mean Improvement 3.8586 $p < 0.0001$

ASSET Self Rated Mean Improvement 6.0613 $p < 0.0001$

O-Score Mean Improvement 4.5150 $p < 0.0001$

O-Score Self Rated Mean Improvement 6.1199 $p < 0.0001$

P-Tool Mean Improvement 1.2911 $p = 0.002$

P-Tool Self Rated Mean Improvement 1.8796 $p = 0.1270$

Score	Total Pre-Course	Total Post-Course
Asset	130	44
Asset Self	154	21
O-Score	125	44
O-Score Self	174	21
P-Tool	130	45
P-Tool Self	151	50

Evaluation Tool	Total Possible Score
Asset	38
O-Score	40
P-Tool	5

Conclusions

- The FAST Program has undergone rigorous validation testing
 - Feasibility
 - Content Validity
 - Construct Validity
 - Concurrent Validity
 - Transfer Validity
- Higher performance on FAST testing results in improved operative performance for basic shoulder and knee arthroscopic procedures
- Future work is necessary to determine whether FAST can be delivered within individual programs and whether results are generalizable.

Thank You

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