Translational Training Tools™

The 3 Ts Serving the 3 Rs

VOLUME 2

Recipes for Crafting Your Own Purpose-Specific Training Tools for Surgery Practice

Wendy O. Williams, DVM, DACLAM
David E. Mooneyhan, BS, RLATG
Christine M. Peterson, BS, RLATG

https://ras.research.cornell.edu/care/3T.html

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The 3 Ts Serving the 3 Rs

Center for Animal Resources and Education (CARE)

Cornell University, Ithaca, New York, 14853

The CARE Training Team has put a significant amount of time and effort into the creation of the 3 Ts methods and tools. We are pleased to be able to share the information in this manual with you. We welcome your comments and feedback and trust that you will respect that the information in this manual is the intellectual property of Wendy O. Williams, David E. Mooneyhan and Christine M. Peterson of the Cornell Center for Animal Resources and Education (CARE).
We ask that you please not copy, reproduce or present the material in this manual without permission from the authors.
Thank you from Wendy, Dave and Christine.

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The Cornell University Center for Animal Resources and Education (CARE)

Training Team Mission:

Be role models for responsible use of animals.

Emphasize the importance of minimizing pain and distress in the animals used for teaching and research; make animal comfort a priority during training classes.

Accommodate the needs of our trainees and guide them towards competency on the procedures required to accomplish their research goals.

Promote the 3 Rs (Replace, Reduce and Refine) through the use of inanimate models for hands-on training.

Recipes for Crafting Your Own Purpose-Specific Training Tools for Surgery Practice

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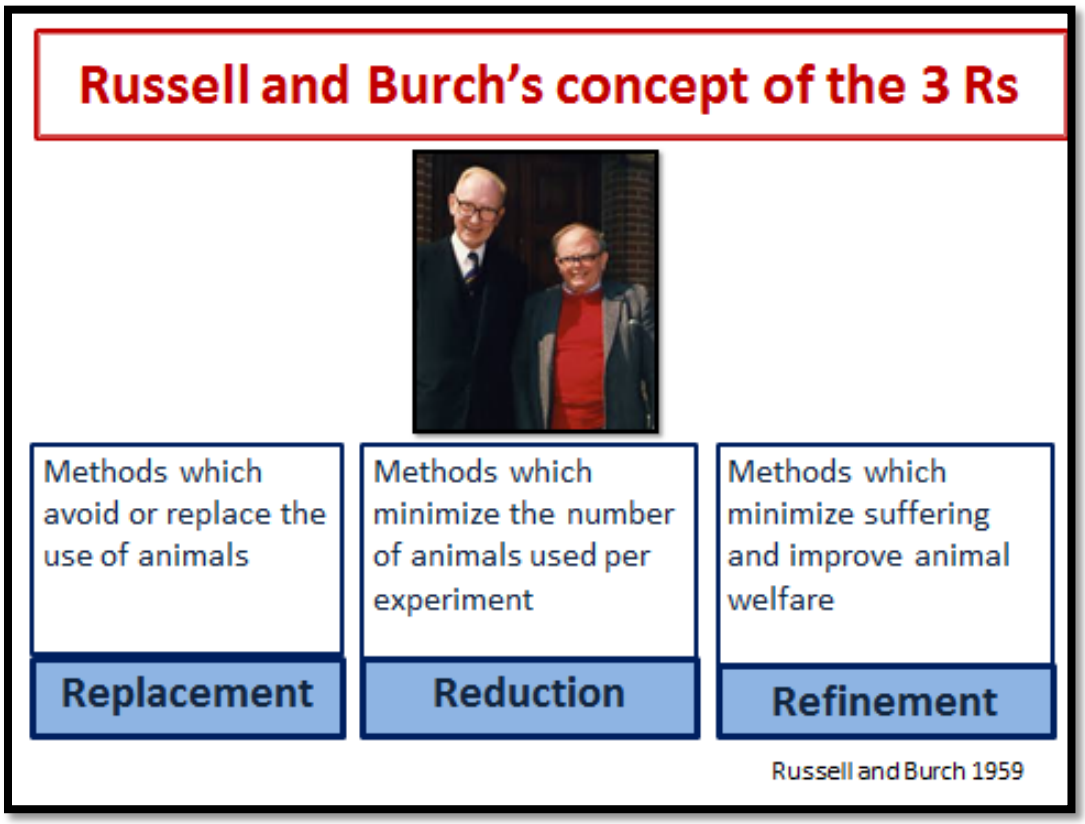
PART 1

1. Introduction to the concept of using the Translational Training Tools™ (3Ts) method and curriculum for Aseptic Rodent Surgery Training and Practice

Russel and Burch's the 3 Rs is an important concept in the creation of the 3 Ts surgical curriculum. While many institutions place an adequate focus on applying the 3 Rs to animals used in research and testing, we believe a stronger emphasis should also be placed on implementation of the 3 Rs into teaching and training exercises.



The 8th Edition of the Guide for the Care and Use of Laboratory Animals p. 115 states "Researchers conducing surgical procedures must have appropriate training to ensure that good surgical technique is practiced—that is, asepsis, gentle tissue handling, minimal dissection of tissue, appropriate use of instruments, effective hemostasis, and correct use of suture materials and patterns". We recognize that many trainers face a challenge in meeting these standards and equipping individuals with the appropriate skills to perform live animal surgery; particularly given that many trainees have no knowledge of basic surgical instrument handling and manipulation. In addition, training often must be conducted in a short amount of time and with limited budgets.

Our overall goal was to create a curriculum that addresses the early stages of surgical training, using exercises that encourage practice of surgical instrument selection and handling, while also focusing on developing the dexterity essential to good surgical technique. In keeping with Russell and Burch's concept of the 3 Rs, we developed a series of surgical classes that implement various in-house inanimate tools which we call the "**3 Ts Dexterity Tools™**". We created a series of **3 Ts Dexterity Exercises™** using these tools. These exercises are designed to address many of the common repetitive hand motions and skills required to perform surgery. During the training process, we do our best to alleviate some of the stress associated with the learning process and we provide take-home practice tools and exercises to our trainees.

In creating this curriculum, we considered several more specific goals to address. These goals are listed below:

- Provide a curriculum to teach basic surgical principles and facilitate practice of surgical skills at a very basic and introductory level.
- Demonstrate that implementation of the 3 Rs is an essential and feasible step for ensuring responsible use of animals for teaching and practice of surgical principles and exercises.
- Create several exercises that utilize inanimate tools, on which trainees could learn the proper hand positions and motions required for developing one's surgical skills.
- Emphasize trainee accountability and responsible animal use, by encouraging practice and refinement of surgical skills using inanimate tools, prior to manipulating animal tissues, cadavers or live animals.
- Create a means to assess the trainee's ability to handle and select surgical instruments and equip trainees with an understanding of the manual dexterity required for gentle tissue handling.
- Create a means to assess the trainee's understanding and application of aseptic procedures and practices.
- Provide tools for the trainees to conduct take-home practice.
- Create fun and effective exercises for surgical practice in a low stress environment.
- Provide an effective means to demonstrate surgical manipulations, hand positions and motions; and correct errors, without risking unnecessary discomfort to animals.

We accomplish these goals using **Translational Training Tools™** (**The 3 Ts**). The **3 Ts™** is a training method designed to provide hands-on training and practice for individuals working with animals in research, testing and educational settings. The **3 Ts** incorporates simple, inexpensive, and effective tools to teach and encourage practice of non-surgical and surgical procedures, prior to conducting similar training and practice on live animals.

We believe that when hands-on training is performed on a live animal too early in the trainee's learning process; the teaching exercise is potentially compromised in multiple ways. The **3 Ts** tools and training methods were developed to address several of the gaps that exist in the current methods of hands-on training for individuals learning to perform techniques on live animals. Using the **3 Ts** teaching methods, trainees will learn to translate the skills they have developed on the **3 Ts** inanimate training tools, to successful practice on a live animal.

In addition to offering practice options and exercises, using the **3 Ts** inanimate training tools allows for demonstration of both proper technique and incorrect manipulations. The tools are can also be used for demonstration of proficiency of basic instrument selection and handling without needing to demonstrate using live animals.

Remember:

A training tool does not have to look real to be effective at teaching a skill.

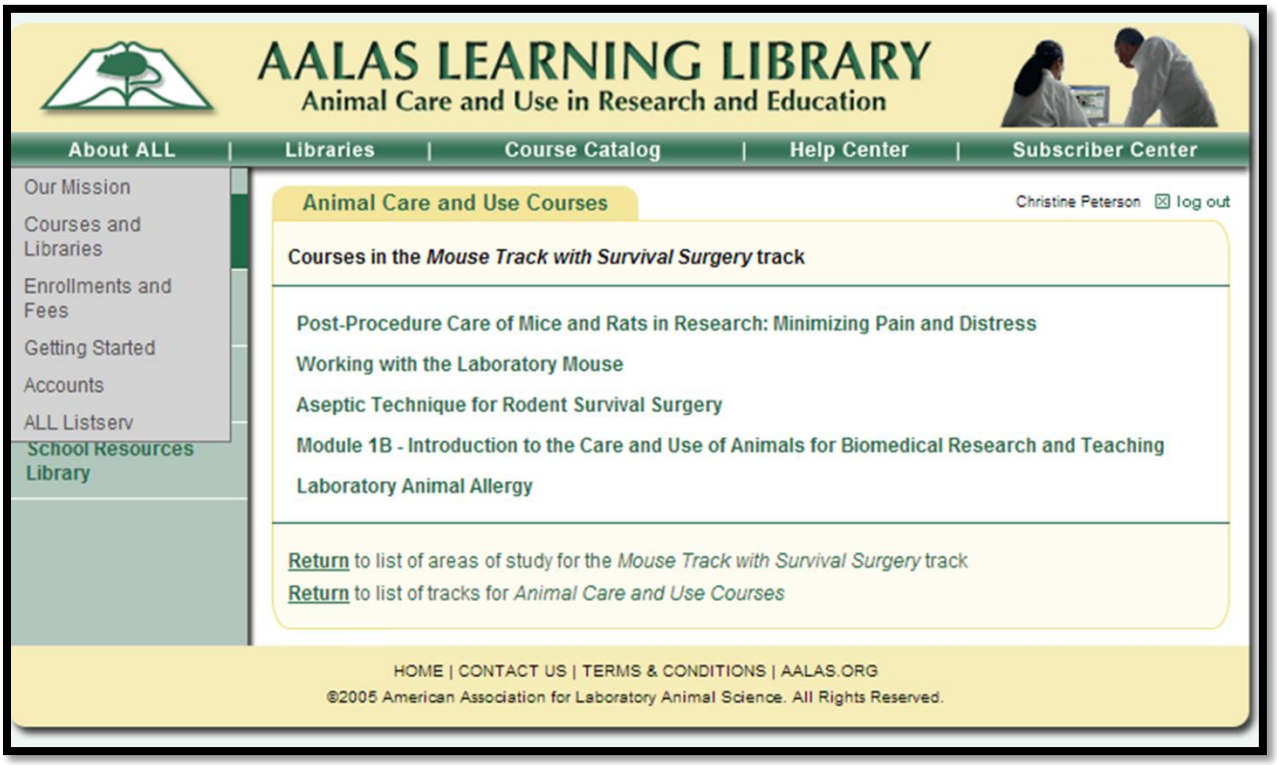
Translational Training Tools™

The 3 Ts Serving the 3 Rs

2. Overview of the 3 Ts™ Surgical Curriculum class series:

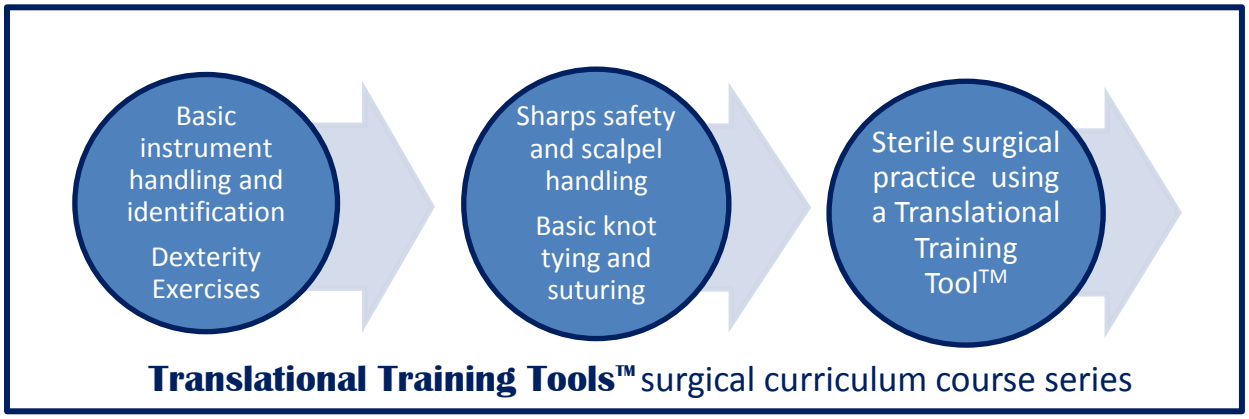
Currently the surgical curriculum consists of a series of three hands-on sessions. Any trainee listed as performing survival surgery on an approved-IACUC protocol is expected to complete the series of classes before scheduling surgery practice on animal tissues, cadavers or live animals. Individuals that are listed as performing non-survival procedures are assigned the first class in the series only; with the option to attend the whole series should the trainee desire to do so. Prior to attending the first sessions, trainees are assigned online training modules that address Aseptic Rodent Surgery and Post Procedural Care. Also, basic species-specific online-modules and hands-on classes such as Basic Rodent Handling Class are completed, prior to the trainees attending the surgical sessions.

Our online training modules are hosted by the American Association for Laboratory Animal Science (AALAS) Learning Library (ALL). We have created training tracks which are specific to various species and procedures. Individuals performing survival surgery on rats and mice are assigned the rat or mouse species-specific tracks with" Survival Surgery". The Mouse Track with Survival Surgery is shown in the image below.



https://www.aalaslearninglibrary.org/

Once the online training modules are completed, trainees attend the series of hand-on classes of the **3 Ts**™ Surgical Curriculum. The classes taught in this series are shown in the following schematic diagram:

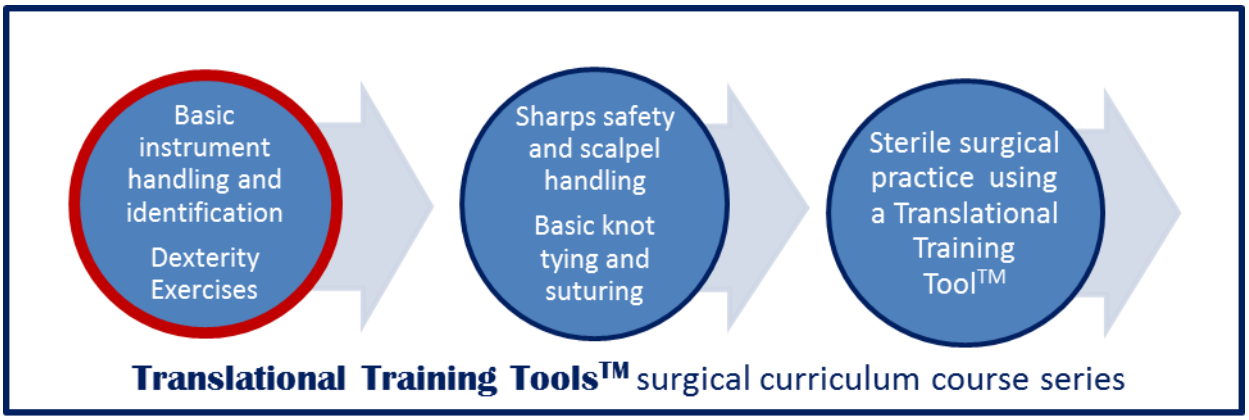


The exercises taught in each class in this series are geared towards building and practicing particular skills, which we break down into smaller steps or parts. Several exercises may be used to help the trainees gain proficiency at the same skill, and guide them to master steps of skills that will be applied more complex exercises that are introduced later in the curriculum. We gradually challenge the trainee to piece the skills together, for the more advance practice exercises that more closely relate to those skills required to conduct proper aseptic surgical procedures.

3. Introduction to the tools used for the 3 Ts™ surgical curriculum for Aseptic Rodent Surgery Training and Practice

Many of the tools used to conduct the **3 Ts** surgical series have been created by the **3 Ts** training team. For other tools, we make use of simple and inexpensive items that have been purchased at local craft stores. Each tool is designed and chosen to address specific **Key Learning Issues** that the trainee must master in order to properly perform surgery. Using the **3 Ts**, we strive to enhance the learning experience while minimizing distress for the animals, trainees and trainers.

a. 3 Ts Dexterity Tools™ and Exercises



Key Learning Issues addressed by the 3 Ts Dexterity Tools™ and Exercises:

- Learning proper instrument selection/handling for a given procedure
- Learning to manipulate objects with the appropriate surgical instruments
- Understanding and performing surgical hand motions in the most ergonomic and efficient manner.
- Developing the skills needed to use multiple instruments at once
- Developing non-dominant hand coordination and the use of both hands during surgical procedures
- Learning to keep the hands steady
- Developing fine motor coordination required for microsurgery
- Learning to manage the physical and mental challenges that can arise when performing surgical procedures.

The following steps are typical of how we train using the **3 Ts Dexterity Tools™**:

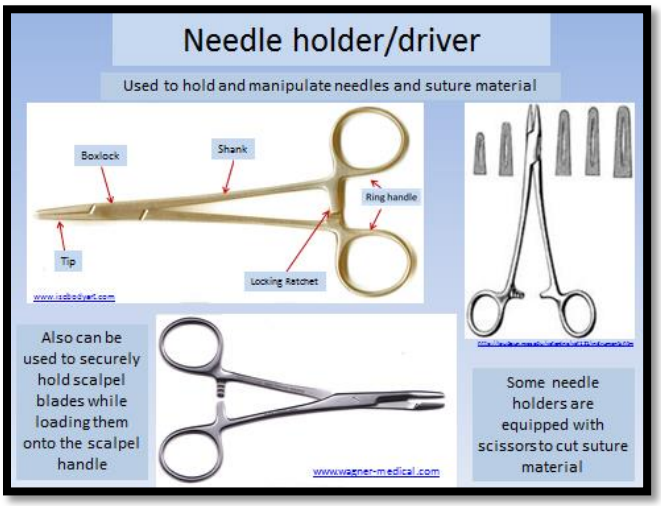
1. The trainer describes the goals of the exercise and the **Key Learning Issues** for which the **3 Ts Dexterity Tool™** is designed to address.

2. The trainer explains the biomechanics required to perform the exercise. Descriptions may include analogies and images to convey the **Key Learning Issues** and concepts applied by each of **3 Ts Dexterity Tools™**.
3. The trainer demonstrates the procedure on the appropriate **3 Ts Dexterity Tool™**, while verbally reemphasizing the proper hand positions and motions required to properly perform the exercise.
4. The trainee performs **supervised practice** of the exercise on each **3 Ts Dexterity Tools™**, while the trainer offers guidance and support to help the trainee refine the skills. Trainers will identify learning issues and offer constructive feedback to correct any errors, before advancing the trainee to the next step of training.
5. The trainer confirms competency of the trainee's performance on each of the **Translational Training Tools™**; prior to moving to the next steps of training.

The **3 Ts Dexterity Tools™** have the following basic properties:

1. They are not necessarily realistic; rather, they are designed to help address the **Key Learning Issues** that arise when teaching proper handling and manipulation of specific surgical instruments.
2. They effectively translate the necessary movements required to perform the movements or procedures being taught and practiced.
3. The exercises are versatile i.e. easily modified to accommodate different learning paces and address different steps or **Key Learning Issues**.
4. They are simple to create from inexpensive and readily available materials.

Prior to practicing with the **3 Ts Dexterity Tools™**, we introduce the trainees to each of the common surgical instruments. We accomplish this part of the training using a series of images and interactive discussions on the intended use for the instrument. An example of the visual material we use is shown in the image below.



Next, the instruments are handed to the trainee and we address the proper grip to apply when using each instrument. During this section of the class, guidance is provided with emphasis placed on the following points:

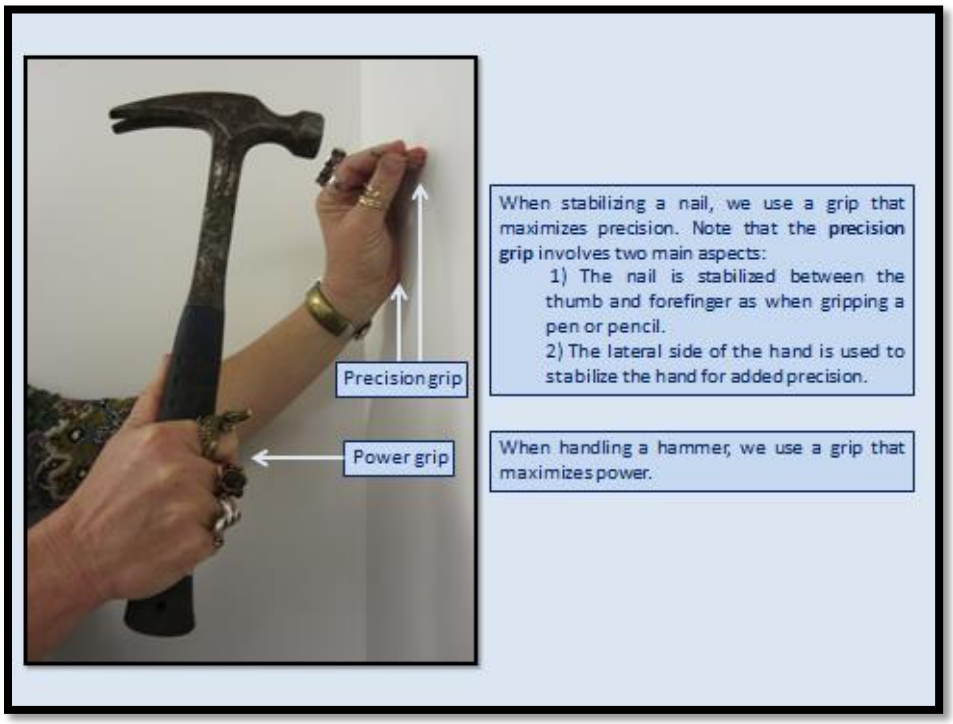
1. Preventing ergonomic injuries.
2. Performing precise, fine hand-movements with the instrument, to avoid tissue trauma.
3. Performing efficient hand movements that require the least amount of effort; thus, facilitating smooth and gentle motions.

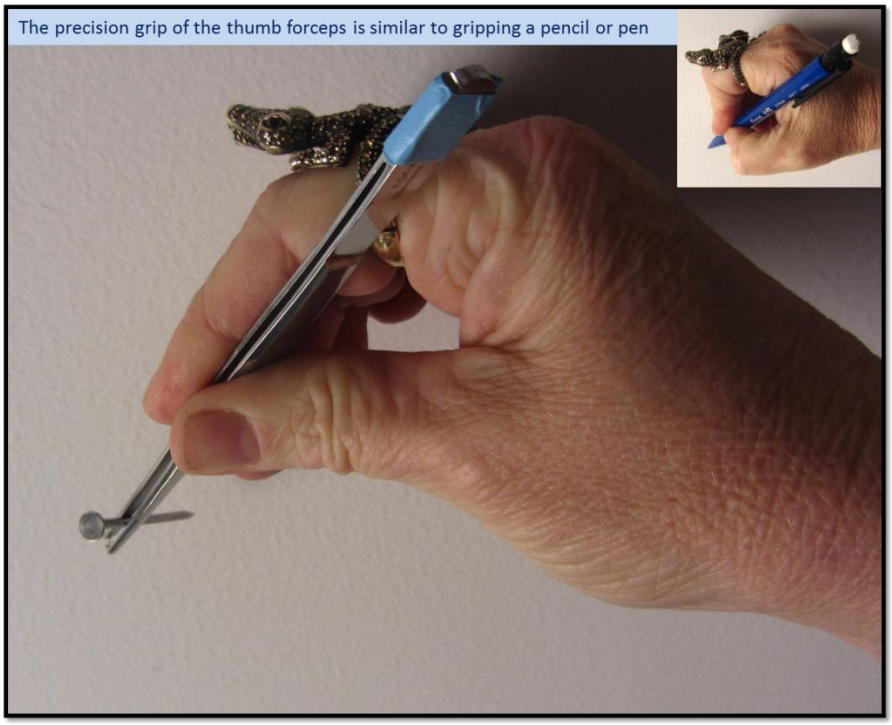
Once trainees demonstrate that they have mastered the proper grip on each instrument, we proceed to introduce the Dexterity Exercises.

The Dexterity Exercises begin with a discussion and demonstration of the precision hand grip in comparison to a power grip as described by Dr. M. Patkin (https://mpatkin.org/index.htm). These common grips of the hand provide a key concept that is applied throughout the dexterity training exercises.

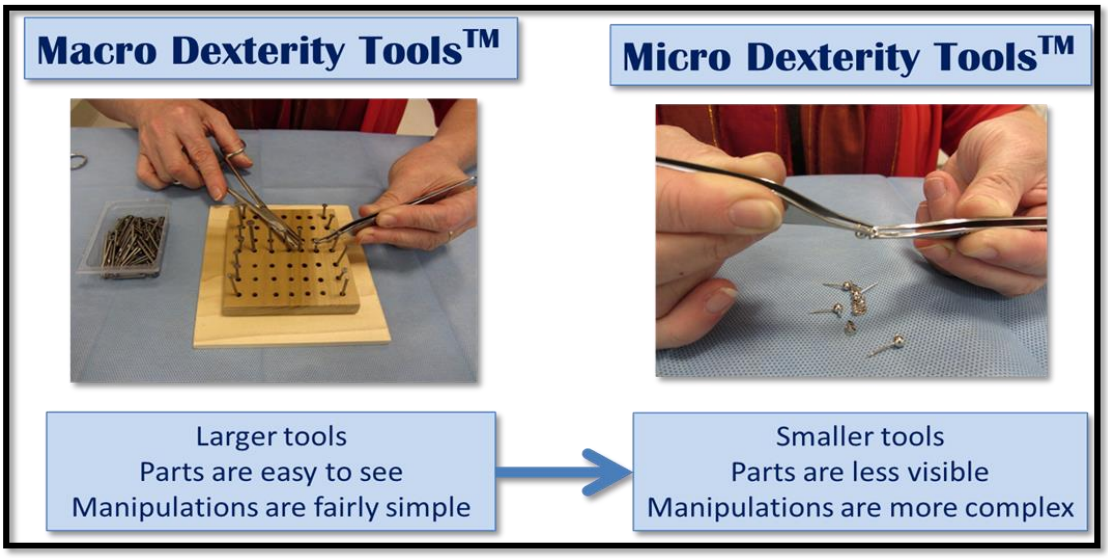
The **power grip** is used to power a larger object like a hammer. It requires mobility of the wrist and forearm to power a movement. This grip is not suitable for fine motor movements.

The **precision grip** is used to handle smaller objects like a nail or a pen. This grip uses the finger tips which provide the control necessary for fine motor movements. Additional stabilization is provided to the precision grip by bracing the lateral aspect of the hand against a surface while manipulating objects.





The **3 Ts Dexterity Exercises** begin with demonstration and practice of exercises using larger tools, with parts that are fairly simple to see and manipulate. We call these the **3 Ts Macro Dexterity Tools™**. Once the trainee can demonstrate proficiency with the exercises using these tools, we advance to exercises using the **3 Ts Micro Dexterity Tools™**, which are smaller tools, with parts that are less easily visible and require more difficult manipulations. Though each exercise is different, many of the hand motions performed during each exercise are similar. By giving the trainees different exercises, we minimize the opportunity for trainees to lose interest in the class, while encouraging multiple means to accomplish the goal of proper instrument handling.



When using any of the **3 Ts Dexterity Tools™,** trainers should carefully observe the trainees and offer guidance and constructive feedback to help the trainee improve instrument handling and manipulation. Specifically address the following aspects in for each dexterity exercise:

- Ensure trainees use the proper precision grip on the given instrument(s) designated for a given dexterity exercise
- For exercises involving practice using tissue forceps:
    - Ensure the forceps are held in the grip used when holding a pencil or pen, for precision movements.
    - Ensure that the trainee is using the lateral portion of the hand to stabilize the hands for further precision.
- Remind the trainees that they will build speed by developing precise, two-handed dexterity.
    - Remind them not to rush through the exercise
    - Emphasize pick up and place objects carefully rather than quickly tossing objects from one place to another
- Remind trainees of the learning issues and goals of the exercise

Note that many of the **3 Ts Dexterity Tools™** used for the **3 Ts** surgical curriculum are made of metal, wood and plastic, all of which can be hard on the surgical instruments, particularly when in the hands of inexperienced surgeons. We encourage trainees to use quality surgical instruments during live animal surgery; however, when using these tools, we advise against using expensive, top quality surgical instruments.

i. Introduction to the Macro Dexterity Tools™:

These tools and the exercises performed with each tool are introduced to trainees in the order listed below.

1. **Bead Board™**
2. **Neuter Board™**
3. **Tissue Board™**
4. **Nail Board™**
5. **Cutting Ring™**

The order is intended to gradually emphasize a different aspect of surgical instrument handling. Tools 1 through 4 are intended for demonstration and practice of handling tissue forceps, needle holders, and hemostats. As the trainees progress through the exercises, we place an increasing emphasis on precise hand movements, non-dominant hand coordination, and encourage practice controlling two instruments at once, using both hands. The cutting ring is used to address the proper use of surgical scissors.

Note that our instructions refer to handling instruments in the dominant and non-dominant hands. If left-handed surgical instruments are not available, the trainer may need to modify the description of the exercises for left handed trainees. We find that often left handed individuals will adapt to using needle holders in their non-dominant right hand.

1. Bead Board™

Description of the Bead Board™:

- Consists of four shallow wells about 1 cm deep within a metal, or sealed wooden base
- Beads of various colors are randomly arranged in each of the wells
- The trainee is provided a minimum of two thumb forceps for the exercise. It is useful to provide thumb forceps with various different tips e.g. rat tooth, smooth tip, serrated tip.

Key Learning Issues to address using the Bead Board™ Macro Dexterity tool:

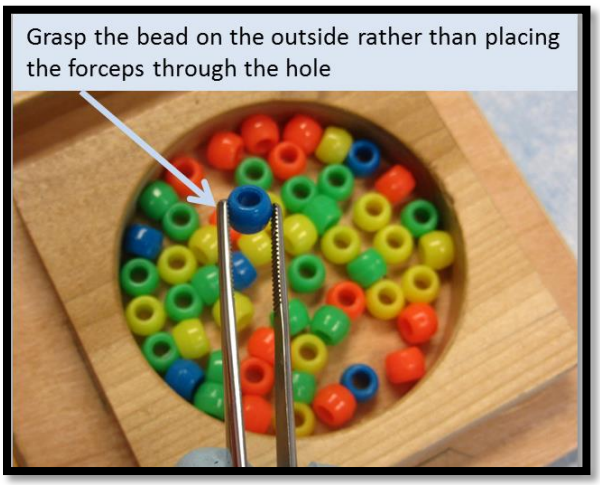
1. Stabilizing hands for precise, tasks
2. Practicing proper grasp of **thumb forceps**
3. Choosing the appropriate instruments for the exercise
4. Positioning instrument properly to ensure secure yet gentle manipulation of objects

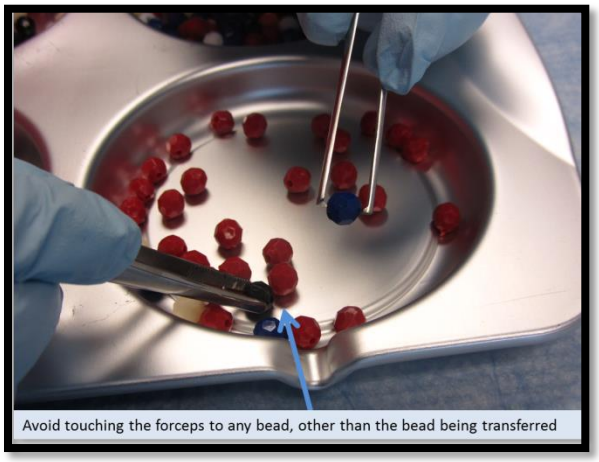
Description of the Bead Board™ exercise:

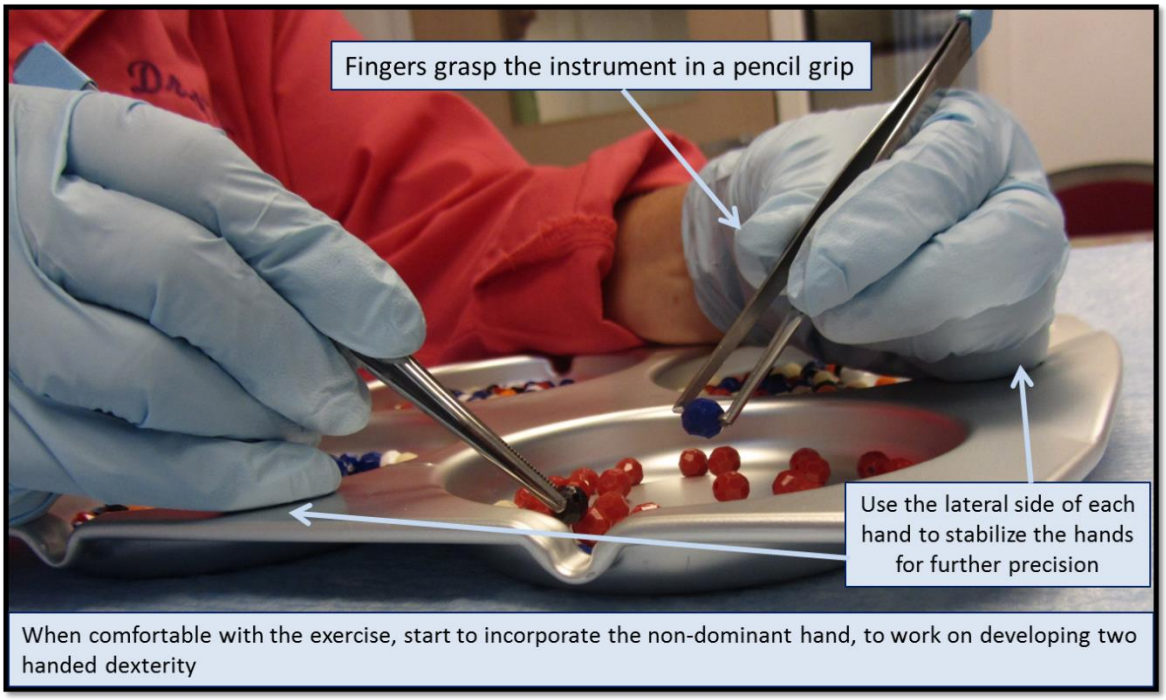
Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Sort the different colored beads so that each well eventually contains only 1 color of bead.
2. Start the exercise by practicing with the dominant hand.
3. When comfortable with the exercise, start to incorporate the non-dominant hand to work on developing two handed dexterity with thumb forceps.
4. Use thumb forceps in the precision grip to pick up one bead at a time.
5. When handling the beads, place the forceps on the outside of the bead rather than placing the forceps into the hole on the bead.
6. Avoid touching the forceps to any bead, other than the bead being transferred.

7. Note that beads should be placed into the wells slowly and carefully. Do not toss the beads or drop the beads into the wells.







Sort the different colored beads so that each well eventually contains only 1 color of bead

2. Neuter Board™

Description of the Neuter Board™

- Bolts are secured into a sealed wooden platform
- Nuts are attached to the bolts
- The trainee is provided with at least one pair of needle holders. Different types of needle holders will provide the trainee with an opportunity to explore personal preferences for instrument selection.
-

Key Learning Issues to address with the Neuter Board™:

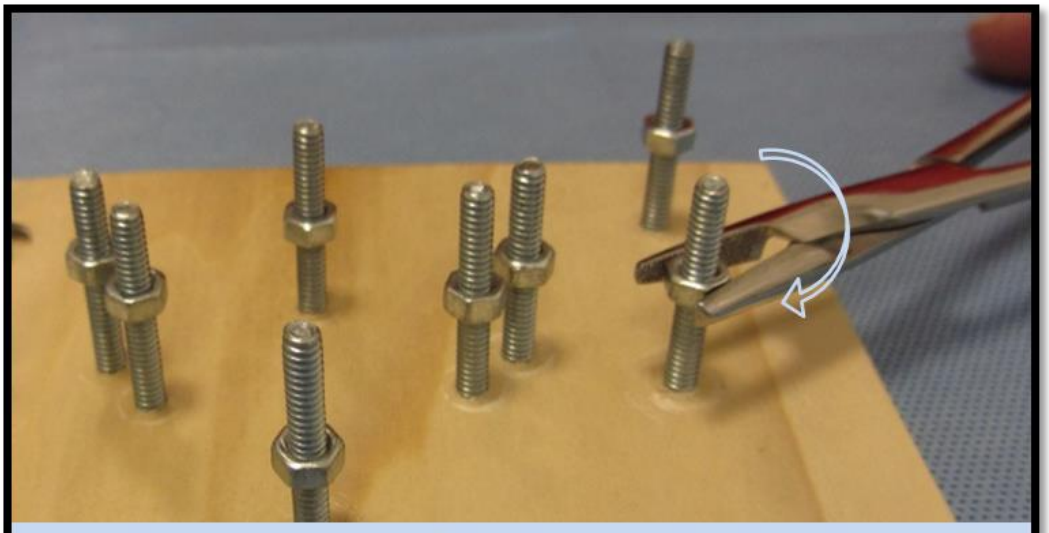
- Practice the proper grasp of a needle holder during repetitive motions
- Practice of pronating and supinating motions of the wrist required for using a needle holder for suturing
- Appreciation of how the proper hand position assists in powering the instrument, during the supination motion that is required to remove the nuts
- Determine how to maneuver the needle holder to access structures in different orientations and in tight spaces

Description of the Neuter Board™ exercises:

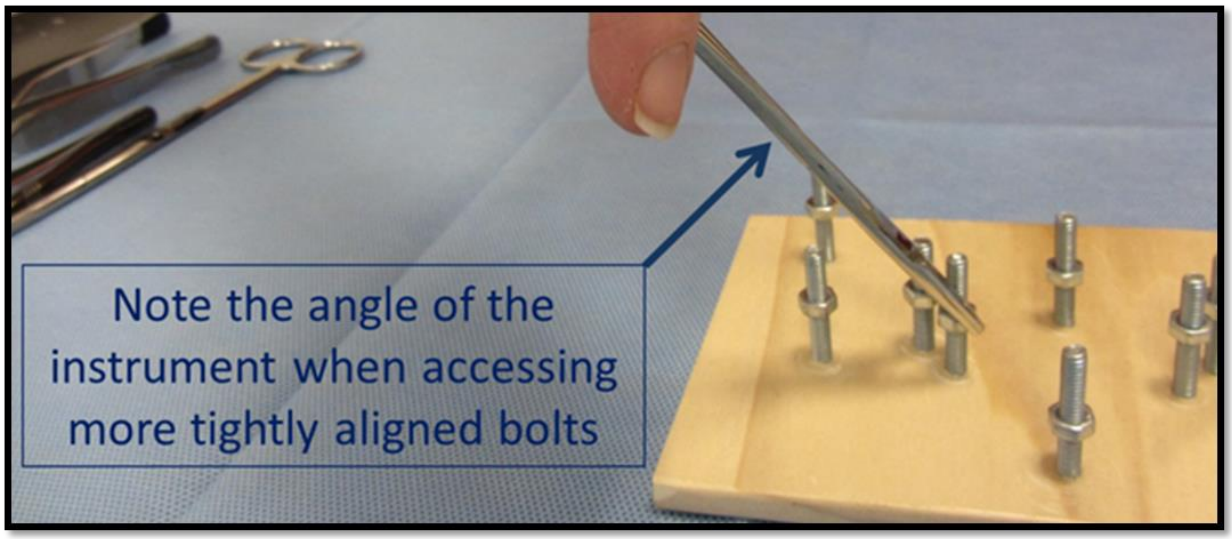
Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Stabilize the board in place with the non-dominant hand (If left-handed instruments are not available, then left-handed individuals may choose to use their left hand to stabilize the base of the **Neuter Board™**).
2. Using the proper grasp of the dominant hand on the needle holder, grasp one of the nuts.
3. Remove the nut from the bolt, using a supinating motion of the wrist.
4. Start with the nuts that are attached to bolts more widely spaced from others. The orientation of these bolts will provide more access to the nuts and facilitate a less obstructed rotation of the needle holder.
5. Once the comfortable with the first stage of the exercise, proceed to remove the nuts that are more closely aligned to one another; thus creating a challenge to properly alter the needle driver position accordingly to remove the nuts in a more confined space.
6. Remind the trainee to accomplish the goal is to accomplish the task while using proper surgical skills rather than simply to remove the nuts as quickly as possible.

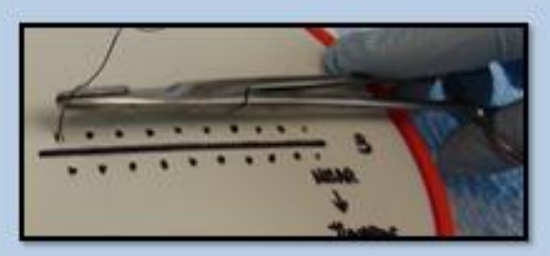
Note that if the nuts are too easy to unscrew, we have noticed that some students attempt to tap at the nuts off using the tip of the needle holder. We have combatted this issue by using a product called Loctite® to make the nuts more difficult to remove.



Using the proper grasp of the dominant hand on the needle holder, grasp one of the nuts.
Remove the nut from the bolt, using a supinating motion of the wrist.



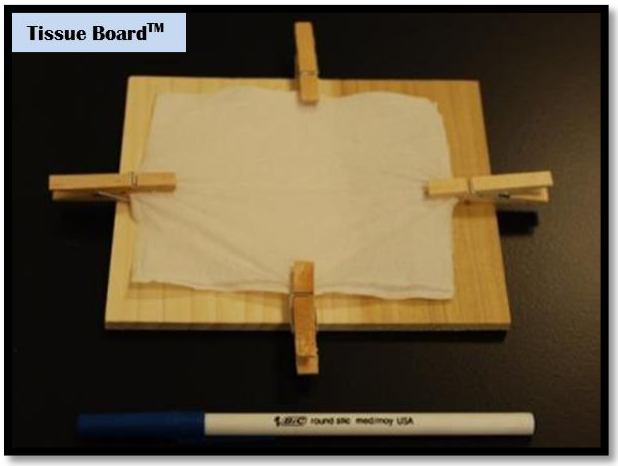
When the **Neuter Board™** is in the upright position, the hand motions required to remove the nuts are similar to the motion used when driving a needle through tissue with a needle holder.

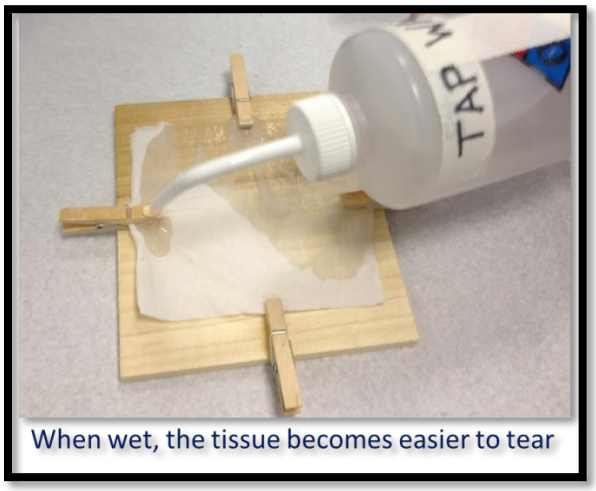


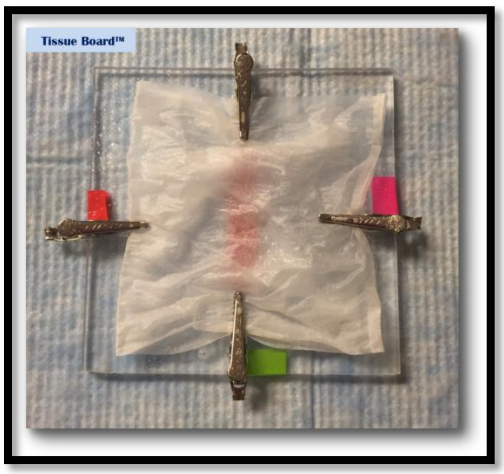
3. Tissue Board™

Description of the Tissue Board™:

- Four clips hold a piece of tissue flat on a sealed hardwood or Plexiglas board.







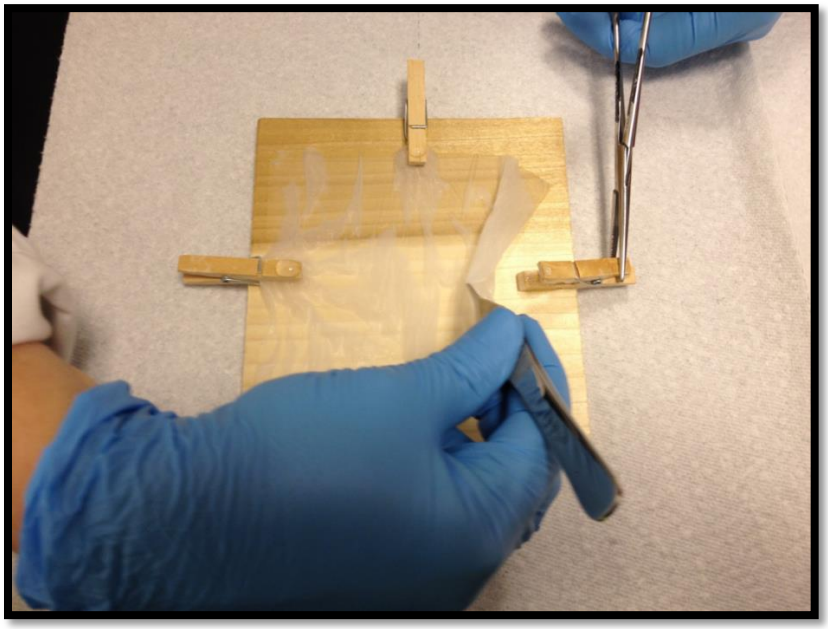
Key Learning Issues to address with the Tissue Board™ dexterity tool:

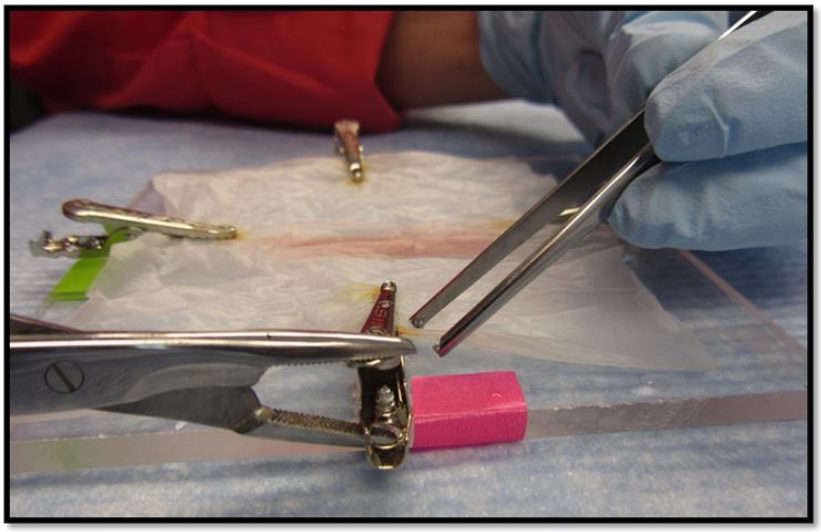
- Understanding how to handle tissues delicately, to minimize tissue trauma
- Practice the proper grip of needle drivers and tissue forceps.
- Appreciating the pros and cons of using forceps with various tip types.
- Non-dominant hand coordination.
- Stabilizing the hands to avoid rough movements that might tear the tissue.

Description of the Tissue Board™ exercise:

Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Hold the clips open with needle drivers in the dominant hand.
2. Experiment with different forceps to gently remove the tissue from the clips.
3. Replace tissue into the clips with forceps, attempting to lay the tissue as flat as possible.
4. Try not to tear the tissue.
5. The board must remain in the same orientation for the duration of the exercise i.e. the trainee must appropriately adjust the hand position rather than adjusting the position of the board, to access the clips with the needle driver and remove the tissue.

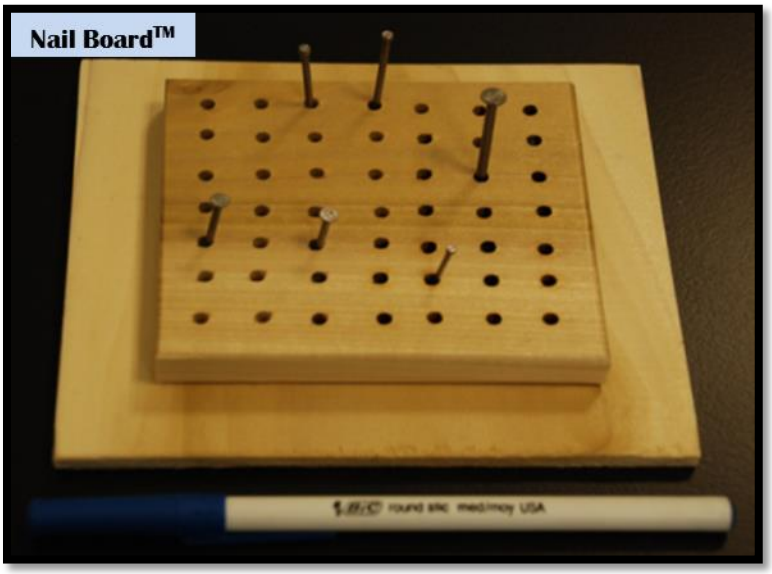




4. Nail Board™

Description of the Nail Board™

- Holes are drilled into a sealed wooden platform
- Holes slightly misaligned
- A container of nails is placed beside the **Nail Board™**



Key Learning Issues to address with the Nail Board™:

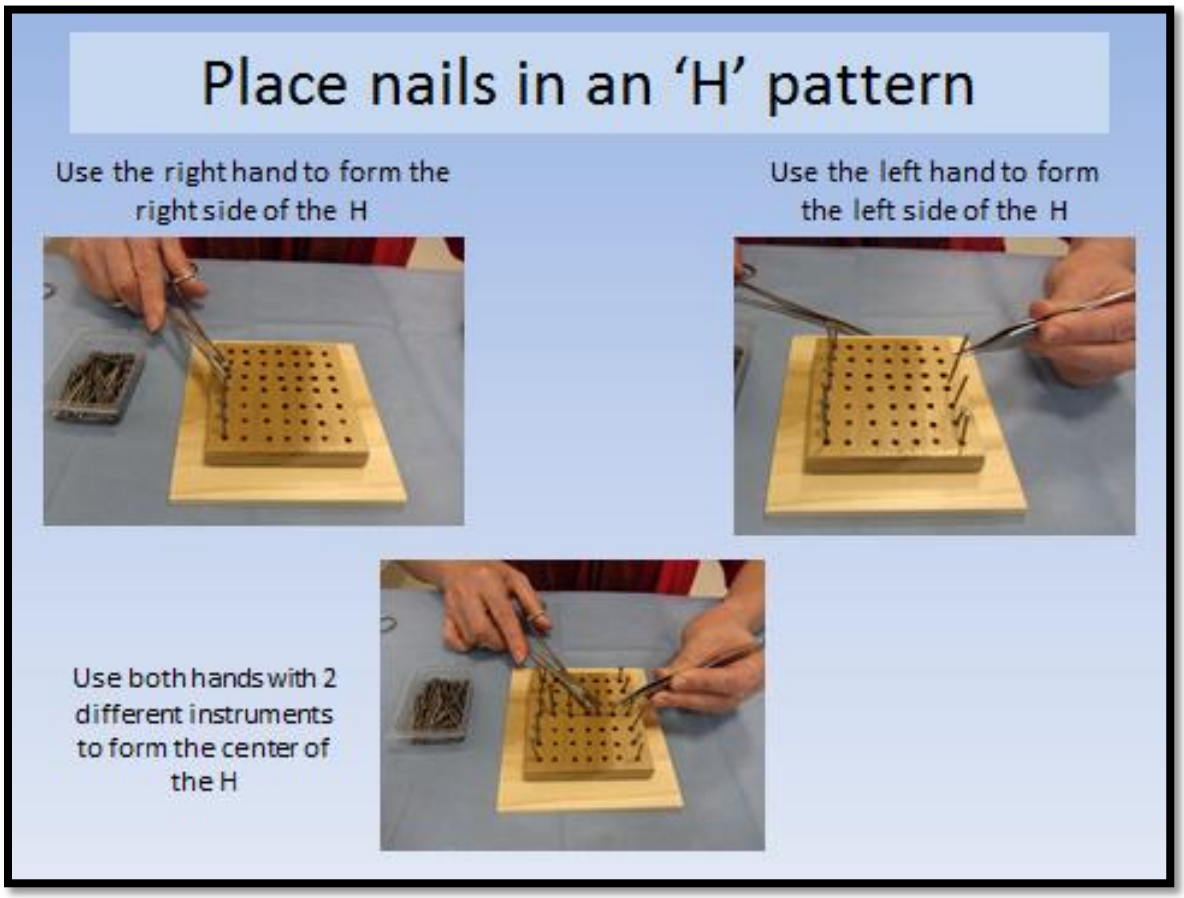
- Learn to apply skills of precision and efficiency to assist in developing speed in surgical technique.
- Practice placing manipulation of objects with hemostats, needle holders and forceps.
- Ensure proper grip and handling of hemostats, needle holders and forceps
- Demonstrates the skills of:
    - Instrument placement
    - Effects of repetitive motion

Description of the Nail Board™ exercises:

Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Practice placing different sized nails in holes using tissue forceps in the non-dominant hand and needle holders or hemostats in the dominant hand.

2. Once comfortable with manipulating the nails in the holes, trainees will be timed while performing a specified pattern in a specified manner. Note that time will be added to the clock each time a nail is dropped. We do this to help ensure that speed is achieved by being precise and efficient rather than being fast and sloppy with the technique.

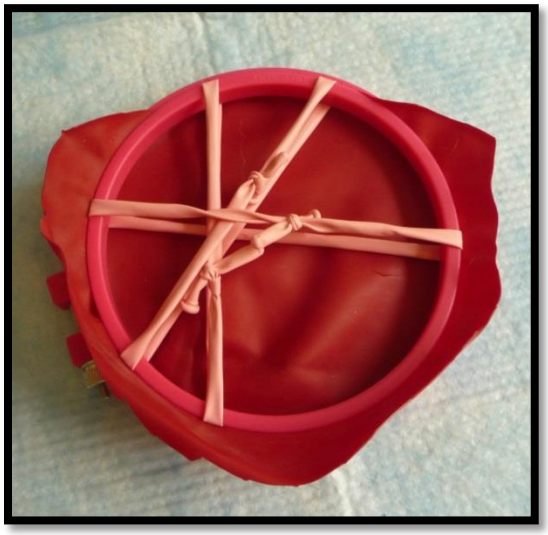


5. Cutting Ring™

Description of the Cutting Ring™:

- One layer of piece of rubber materials such as a large balloon, is gently stretched and secured into an oval or round set of rings i.e. the kind of rings that are used for embroidery or stitchery work.
- Three small holes are made at one end of the rubber material, each hole about 5 mm long and space about 5 cm (2”) apart.

- For a more challenging version of the tool, we secure pieces of thread, string or balloons into the rings, under the rubber. These objects represent blood vessels and other delicate structures to avoid when cutting animal tissues.



Key Learning Issues to address with the Cutting Ring™:

- Practice scissor handling and cutting
- Learn proper grip of surgical scissor while making a shallow cut through tissue
- Learn the proper hand movements and position required to extend an incision with surgical scissors
- Practice gently elevation scissors and tissue to avoiding inadvertently cutting the underlying tissues and blood vessels when extending an incision

Description of the Cutting Ring™ exercises:

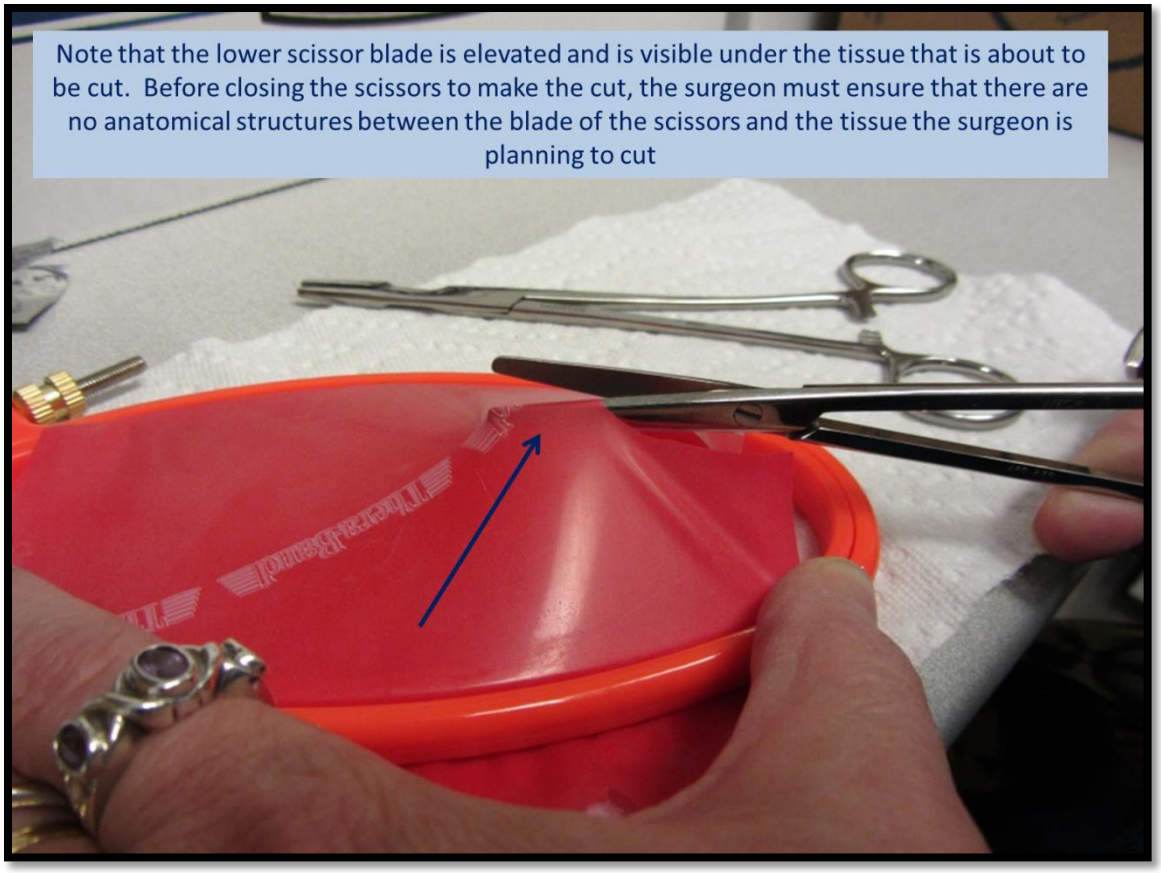
For this exercise, we are focusing on the practice of extending an existing incision rather than making the initial incision.

> Note that during the next class of the surgical series. we will address scalpel handling and safety, as well as creating a stab-incision with a scalpel. During the same session, we revisit the practice of extending the incision with scissors before addressing incision extension with a scalpel. Recall that the **3 Ts Dexterity Exercises™** are geared towards building and practicing particular skills that are broken down into parts; before challenging the trainee to put all the parts together in a more complex exercise later in the training.

Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Using the proper grasp of the Metzenbaum scissors inserts the lower blade of the scissors into one of the precut holes in the band
2. Keeping the lower blade of the scissor elevated and visible form the surface of the rubber material and also keeping the scissor tips up and away from potential organs below the surface being cut, the trainee uses a smooth continuous motion, to extend the incision, to approximately 10 cm (4“) in length, without creating jagged edges to the incision, nor cutting any of the underlying objects.

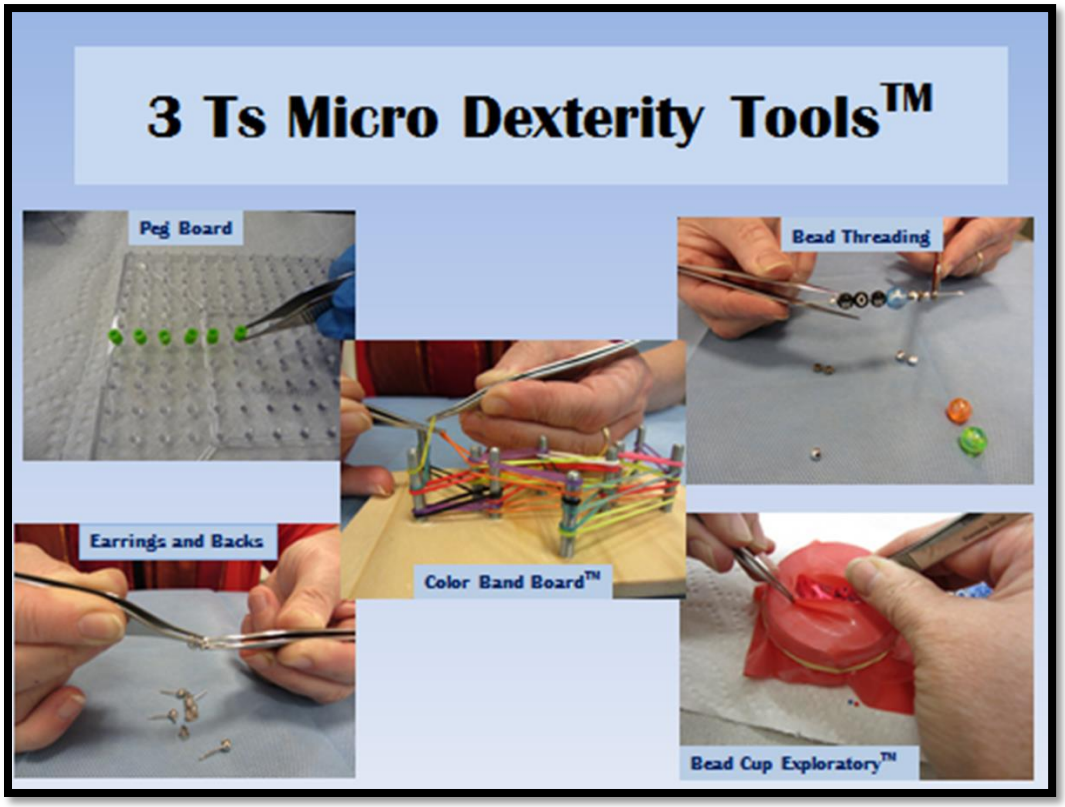
Note that there are 3 holes on each **Cutting Ring™** which the trainee can use to practice extending incisions.


Note that the lower scissor blade is elevated and is visible under the tissue that is about to be cut. Before closing the scissors to make the cut, the surgeon must ensure that there are no anatomical structures between the blade of the scissors and the tissue the surgeon is planning to cut

i. Micro Dexterity Tools™

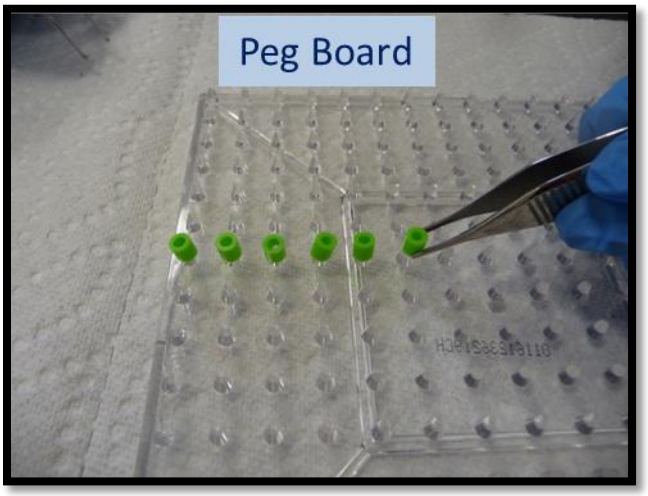
1. **Peg Board**
2. **Bead Threading**
3. **Earrings and Backs**
4. **Color Band Board™**
5. **Bead Cup Exploratory™**

The goal of training with the Micro Dexterity Tools™ is to further refine the trainees' skills using smaller and finer training tools while adding some variety and making the exercises fun. Most of the 3 Ts Micro Dexterity Exercises™ focus on practicing the precision grip of the thumb forceps and encourage the use of two instruments at a time; one in each hand.



i. **Peg Board**:

Description of the Peg Board:



Key Learning Issues addressed with the Peg Board exercise:

- Stabilizing hands for precision movements during finer manipulations.
- Two handed dexterity.

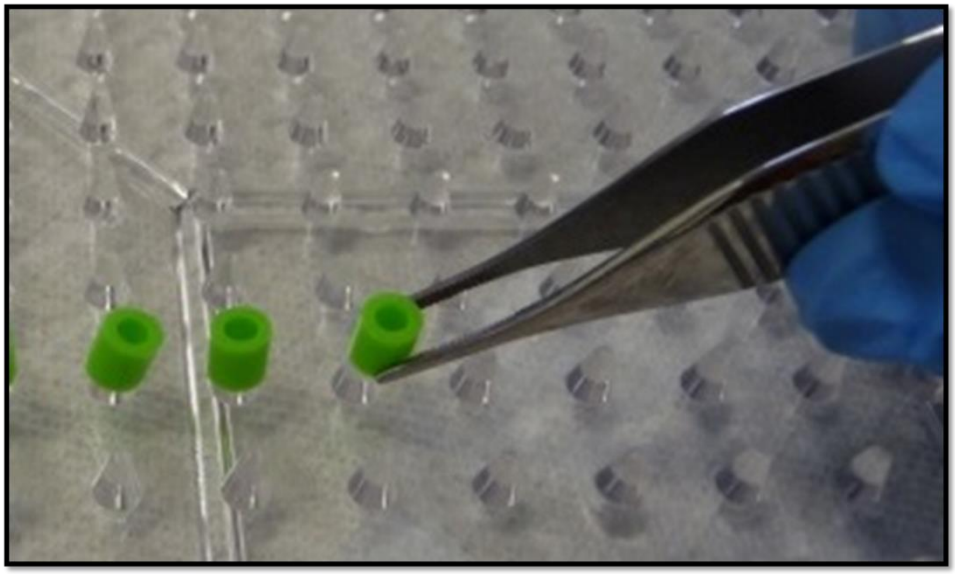
Description of exercise using the Peg Board Micro Dexterity tool:

Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Use forceps to handle beads.
2. Place beads onto pegs in a pattern designated by the trainer.
3. Note that the beads do not firmly seat onto the pegs.
4. Practice stabilizing hands during the process of bead placement.
5. Try not to drop beads in the process.
6. Try not to knock off any of the beads already placed.
7. Try dominant hand then non-dominant hand.
8. Attempt to improve speed through proper precision grip of the tissue forceps, stabilization of the hands and by using a pair of forceps in each hand.

Note that you may need to remind students to avoid rushing through this exercise. If done in a rushed manner, it is likely that more beads will drop. We consider beads dropping to be similar to causing tissue trauma and torn blood vessels. When trainees drop beads, we sometimes call out “bleeder” to remind them that they are compromising form for speed.

Offer consistent guidance and reminders on the proper precision grip and the further precision gained by resting the lateral portion of the hand and knuckles on the surface to stabilize them.



ii. Bead Threading:

Description of the Bead Threading tool:

Because many experimental surgeries require surgeons to manipulate metal objects such as screws, wires, nuts and bolts; we wanted to create an exercise that required students to manipulate various small metal objects. The Bead Threading, and Earrings and Backs exercises were designed to help build microsurgery skills and the skills of working with smaller pieces of hardware.

- There are various shapes and sizes of beads.
- A blunt-ended beading needle - found at local craft stores.

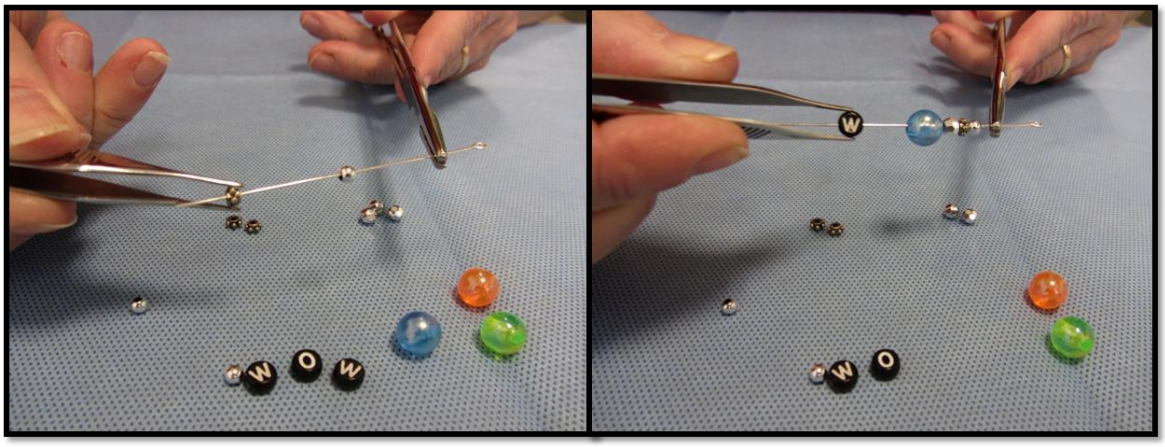
Key Learning Issues addressed with the Bead Threading exercise:

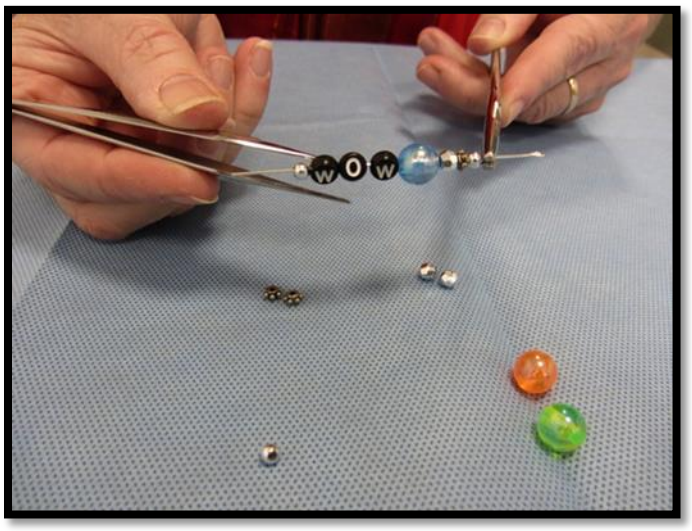
- Reinforcing the use of needle holders and thumb forceps.
- Reinforcing the proper grip on the instruments to maximize precision and efficiency of the manipulations.
- Using surgical instruments for the manipulation of small pieces of hardware.
- Steadying the hands during finer manipulations.

Description of the exercise using the Bead Treading tool:
Provide the trainee with the following instructions (please also refer to the images below the instructions):

1. Practice picking up beads with thumb forceps.
2. Hold the long narrow beading needles with a hemostat or needle driver.

3. Using the forceps, place the bead onto the needle.
4. Avoid rushing.
5. Attempt to build speed by performing the exercise by using the precision grip on the thumb forceps, stabilizing the hands and using smooth steady motions.





iii. Earrings and Backs

Description of the Earrings and Back tool:

Similar to the Bead Threading exercise, the trainees are required to manipulate metal objects with the surgical instruments. The earring backs have a tendency to require a bit of force to place onto the earring. This motion sometimes causes the hands to jerk. We find this exercise helps trainees to really focus on stabilizing the hands.

- Consist of a small stud earring and a simple butterfly earring back.

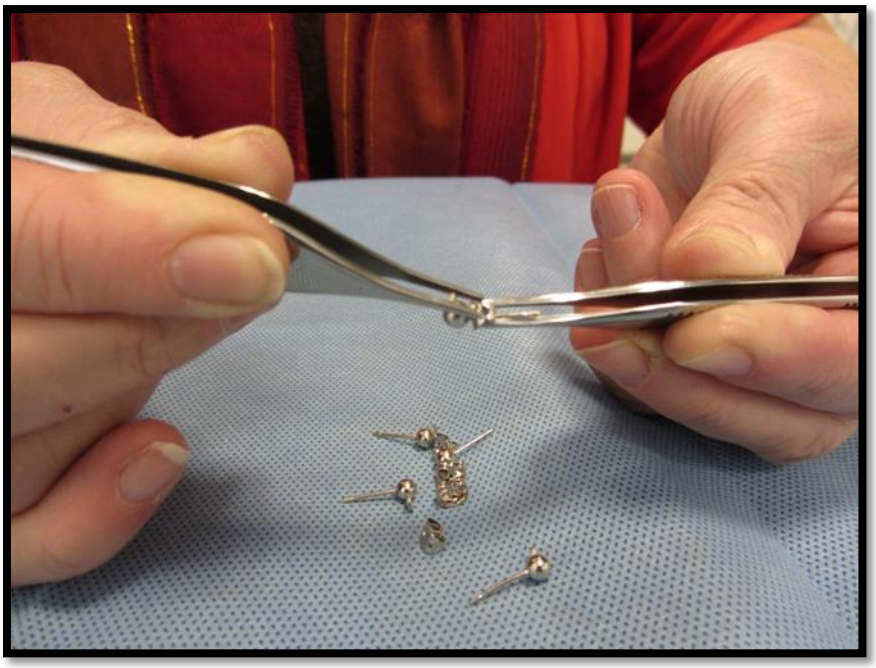
Key Learning Issues addressed with the Earrings and Back exercise:

- Reinforces the Key Learning Issues from the Bead Threading Exercise
- Stabilizing the hands during fine motor movements
- Stabilizing the hands during potentially jerky motions

Description of exercise using the Earrings and Back tool:

The instructions for this exercise are similar to needle beading exercise. Provide the trainee with the following information and instructions:

1. Earring backs are a bit tougher to place.
2. Maintain a stable hand position.
3. Try not to jerk or jolt your hands.
4. Try not to grip the instrument too firmly causing the hands to cramp or fatigue.



iv. Color Band Board™:

Description of the Color Band Board™ tool:

- Sealed wood or Plexiglas board.
- Bolts drilled up through the bottom of the board.
- Small colored rubber bands arranged between the bolts in an overlapping and underlapping intertwining pattern.

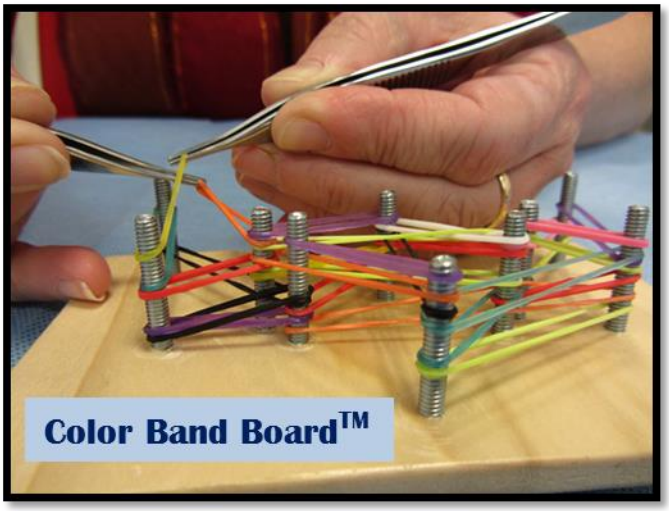
Key Learning Issues addressed with the Color Band Board™ exercise:

- Managing complex manipulations.
- Two handed dexterity.
- Use of two forceps, one in each hand.

Description of exercise using the Color Band Board™ tool:

Provide the trainee with the following information and instructions:

1. Use two forceps i.e. one in each hand.
2. Carefully remove bands from the bolts on the board.
3. Do not let the rubber bands drop or fling, and do not leave any bands dangling on the bolts.
4. Bands may be intertwined and will require the use of both forceps to untangle them during removal.
5. Remember to stabilize the hands.



Bead Cup Exploratory™:

Description of the Bead Cup Exploratory™ tool:

- A shallow container about 8 cm (3”) in diameter is filled with various objects including several small beads in 4 different colors.
- The container is covered with thin rubber material and has a premade cut of about 5 cm (2”), down the center.

Key Learning Issues addressed with the Bead Cup Exploratory™ exercise:

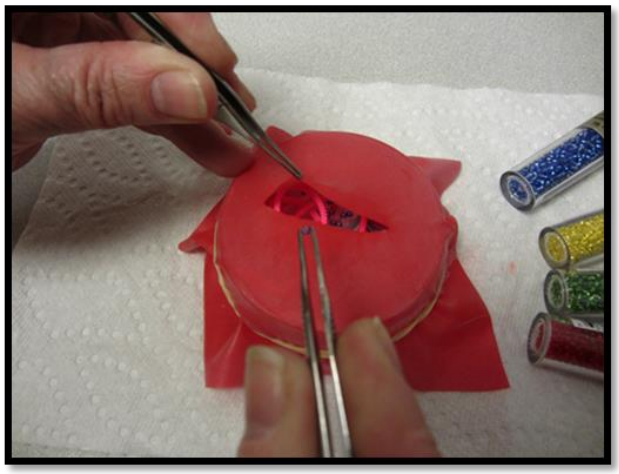
This tool begins to work on some of the hand positions and motions that are incorporated in the next class on suture training and practice.

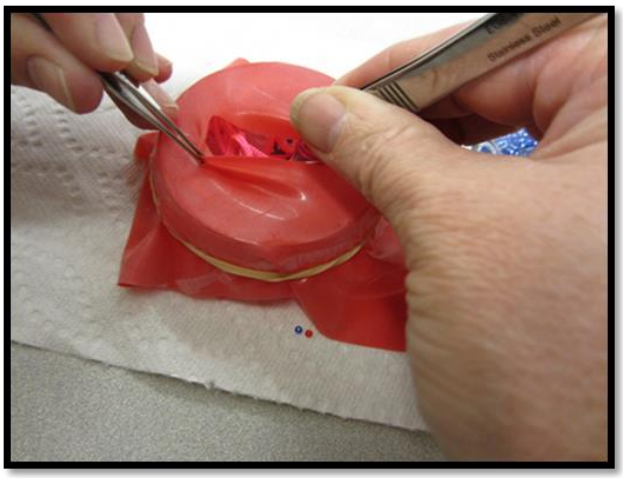
- Continuing to build fine motor movements and encourage further practice of precision handling of thumb forceps in both hands.
- Eversion of incision edge with tissue forceps.
- Maneuvering structures that obstruct the surgical site and anatomical feature of interest (i.e. colored beads)
- Gentle tissue handling.
- Manipulating the skin edges and other tissue/objects without damaging them.

Description of the exercise using the Bead Cup Exploratory™ tool:

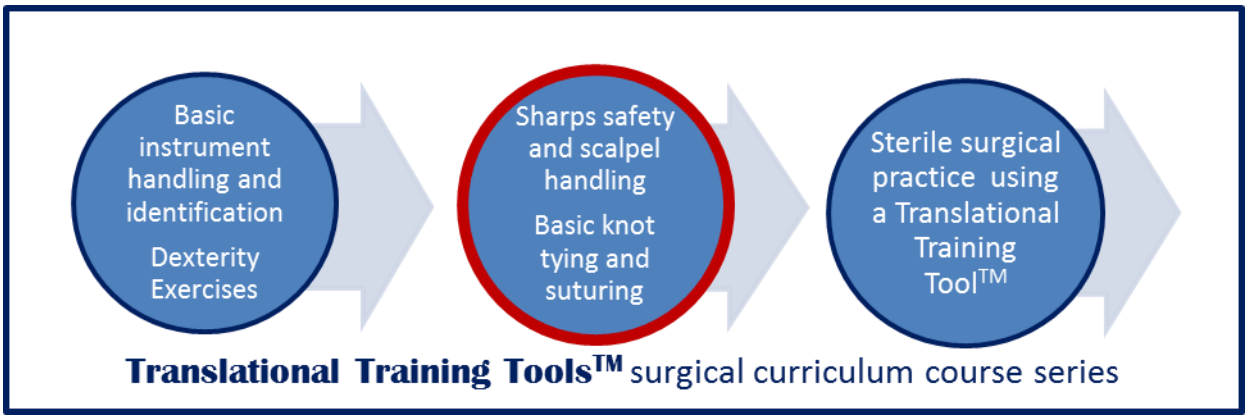
Provide the trainee with the following information and instructions:

1. Using the thumb forceps provide, reach into the opening in the rubber material covering
2. Explore the contents of the cup by everting the edges of the material.
3. Retrieve **one** of each of the 4 different colored beads from the cup without:
    - Tearing the exercise band.
    - Picking the cup off the table.
    - Removing more than 4 beads or any other objects.
    - Dropping beads on the table or floor.

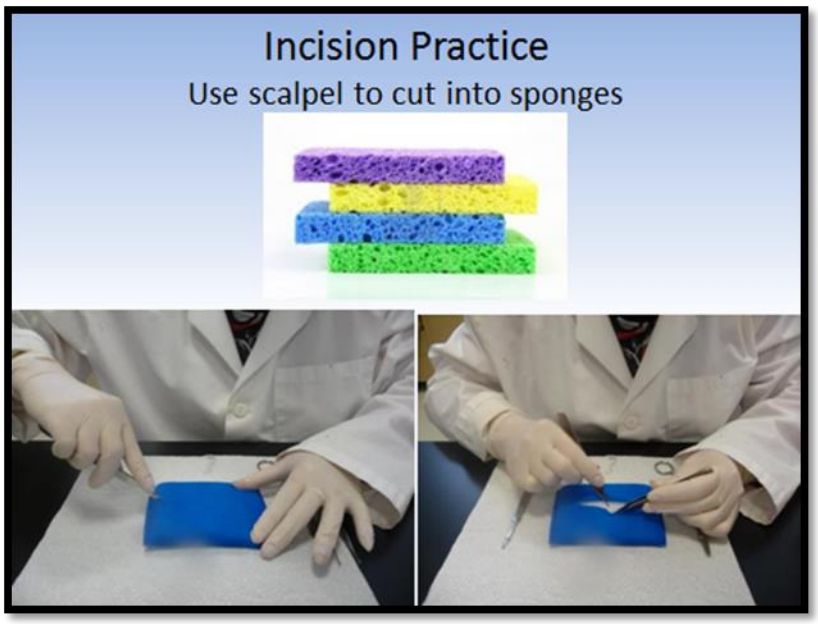




b. Scalpel Safety and Suture Training and Practice:



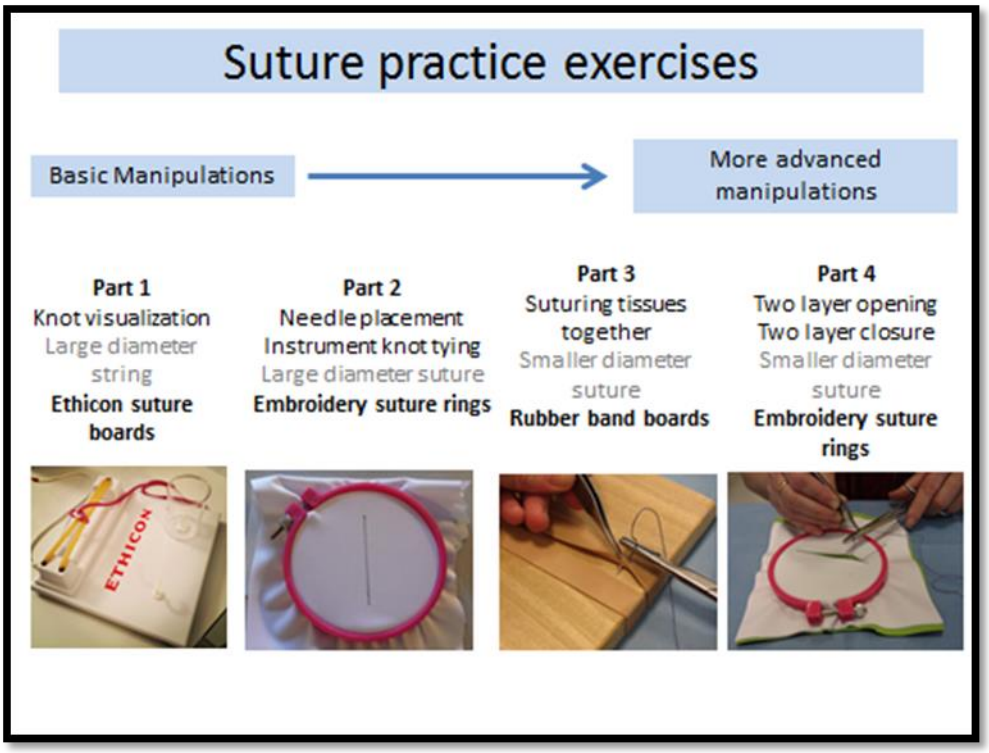
We spend the first part of the class addressing sharps safety, parts of the scalpel and scalpel handling. We then practice loading and unloading scalpel blades from scalpel handles. We familiarize trainees with safety scalpel systems and disposable scalpels. Then we perform some basic practice cutting into sponges.



We progress to the suture practice portion of the class, first by discussing different suture and needle types and sizes. The trainees are introduced to terms used when suturing e.g. taking a bite, single throw, double throw. We review the instruments that are used for suturing, and ensure that all trainees are able to consistently handle the instrument, with the proper grip they practiced during the dexterity exercises in the first class.

We use the following tools for suturing practice in a specified order, designated to gradually build and reinforce the skills required to perform proper suture placement and knot tying.

i. **Ethicon Suture Board**
ii. **Embroidery Suture Rings™**
iii. **Rubber band board**
iv. **Embroidery Suture Ring™ – 2 layer cut**

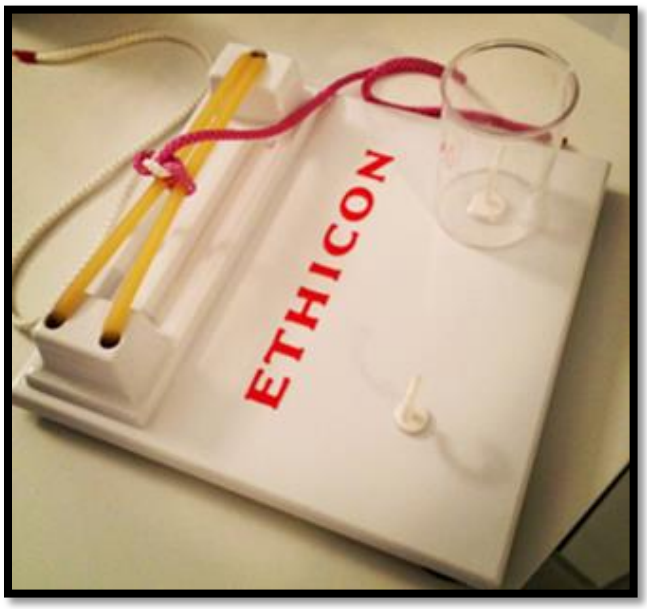


In the early stages of training, we use larger suture materials that are also easier to see. Gradually, we challenge the trainees to practice using smaller diameter suture materials. We also encourage practice with different types of suture material to provide trainees with exposure to the unique properties of these materials. Throughout each stage of practice, we provide visual cues and verbal reminders to encourage the proper grasp of the instruments and help the trainee to self-correct any errors in the grip.

i. Ethicon Suture Board

We begin our suture practice with demonstration of proper knot-tying, using an Ethicon suture board. This tool is a commercially made tool. Please refer to the following link for more information on how to obtain one of the Ethicon Suture Boards:

http://www.ethicon.com/healthcare-professionals/education/student-knot-tying-kit



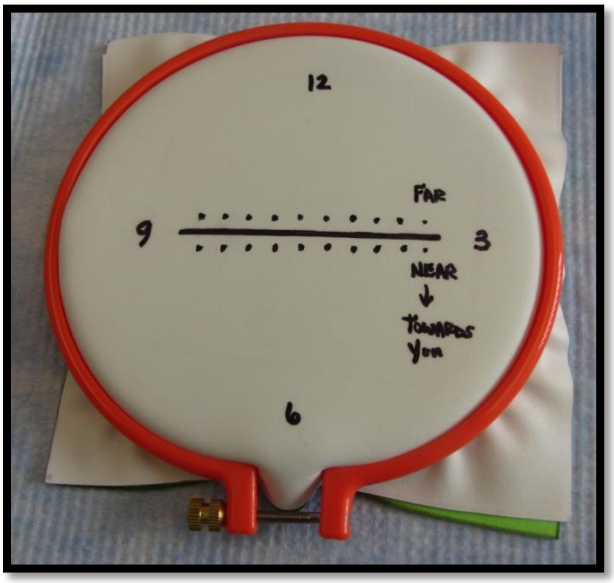
The large size of the string makes it easy to see the steps for tying a knot. The tool is helpful for the demonstration of square knots versus slip knots with this tool. The two different colored ends of string are helpful to observe the ends of the string alternating from one side to the other as each knot is tied.

Once the trainees are comfortable with the knot tying with the Ethicon suture boards, we advance to the next tool in the series.

ii. Embroidery Suture Rings™

Description:

This tool consists of two layers of fabric stretched across and clamped into two rings. Various markings are placed on the ring to indicate the incision line, suture placement and to help guide hand movements in particular directions.



Key Learning Issues:

- Reinforcing the proper grip of the needle holder in the dominant hand. Note that if left-handed needle holders are not available, the left-handed trainee may need to use the non-dominant hand to do this exercise)
- Reinforcing the grip of the thumb forceps with the non-dominant hand.
- Safely loading the needle into the needle holder.
- Mastering the hand movements with the needle holder, when taking a suture bite.
- Pronation of the wrist and forearm to achieve the angle required to facilitate needle placement into the tissue.
- Accomplishment of the proper needle angle when taking a bite.
- Supinating of the wrist and forearm to power the motion when taking of a suture bite.
- Grasping the needle as it emerges from the tissue.
- Practicing instrument ties.

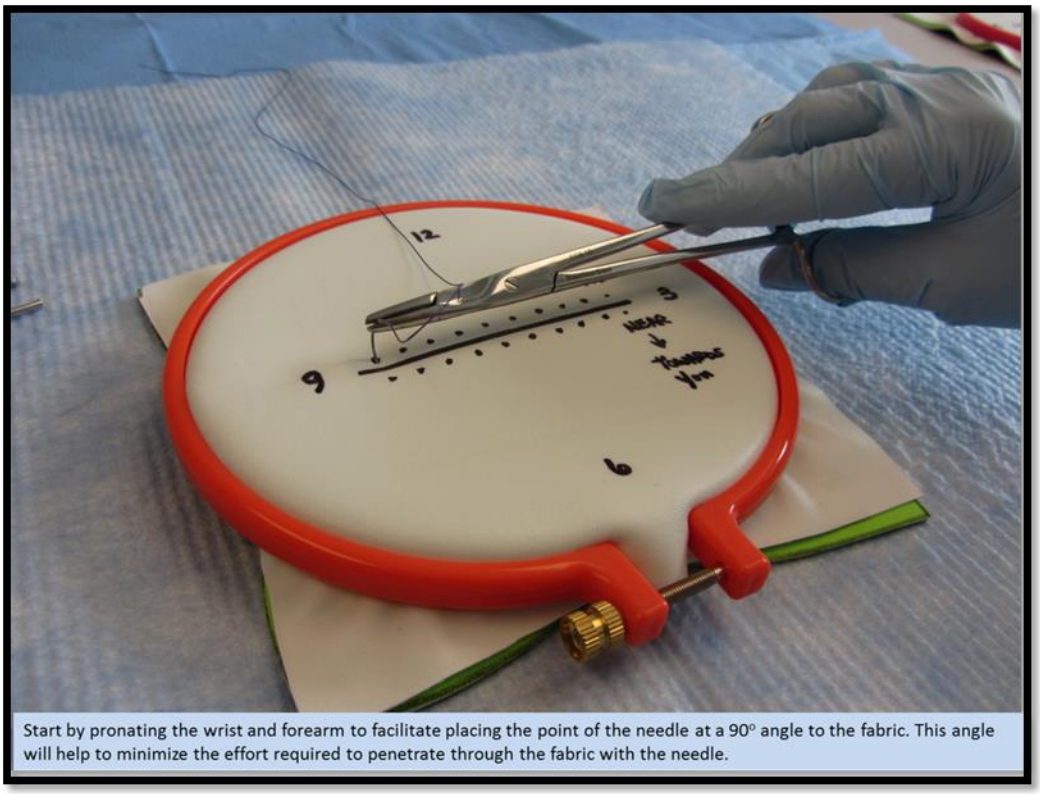
Instructions for use:

First, the trainees are asked to observe as we use the tool to demonstrate the steps and hand movements used to perform an instrument tie. Then the trainees are required to go through the motions themselves. As the trainees go through each step, we find it helpful if the trainer also has this tool in hand demonstrating each step as the trainee performs it. Trainees will continue to practice until comfortable and competent at placing and tying the sutures as instructed. This exercise focuses primarily on the use of the needle holder. Thumb forceps are used to manipulate the suture material during the ties.

Provide the trainees with the following instructions:

1) Safely load the needle into the needle holder in the manner practiced in the earlier in the session.
2) Hold the needle driver in the proper grasp.
3) Following the markings on the tool, perform a simple interrupted suture pattern.
4) Start by pronating the wrist and forearm to facilitate placing the point of the needle at a 90^{o} angle to the fabric. This angle will help to minimize the effort required to penetrate through the fabric with the needle.
5) Begin to arc the needle through the fabric, using a supinating motion or the wrist and forearm. At this stage of training, do not worry about whether one or two layers of fabric are penetrated by the needle.
6) When the needle emerges from the opposite side of the incision, pull the needle through the fabric using either the thumb forceps or needle holder.
7) Pull the rest of the suture material through the fabric, leaving a 1.5 inch suture tail on the far side of the incision.
8) To begin tying the surgical knot, place the needle holder in “home position”. At this point, we work step by step with the trainees through the process of performing an instrument tie.

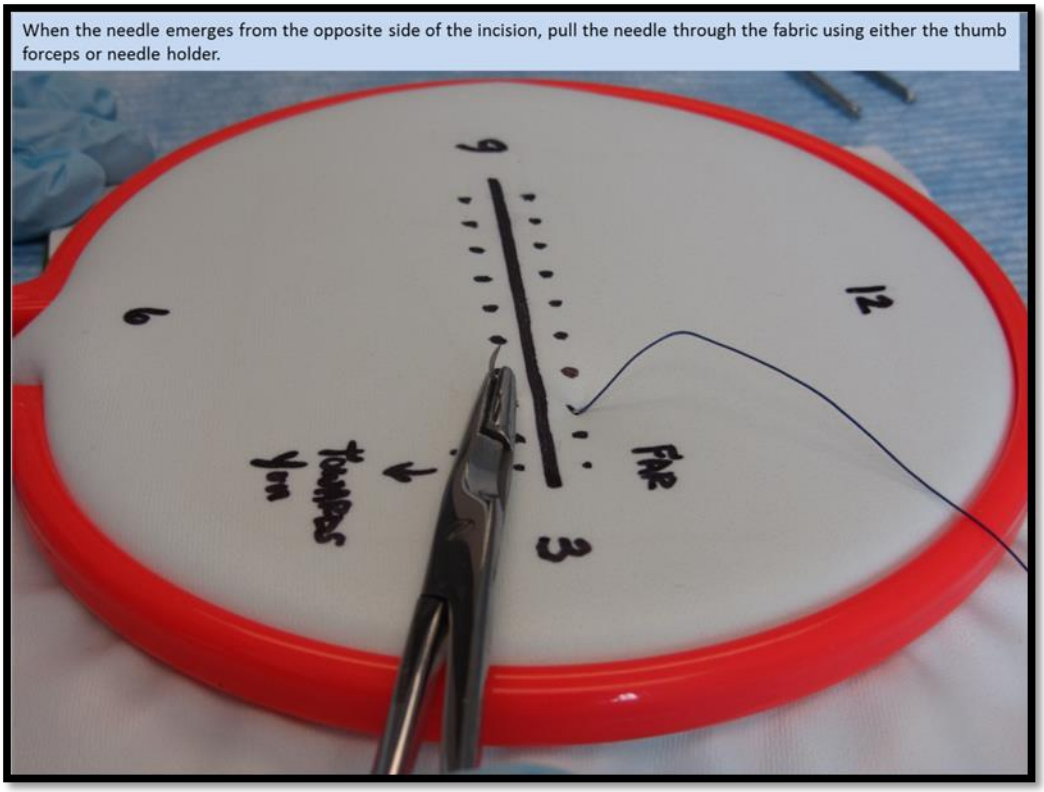
Please refer to the images provided on the next few pages of this document. These images are typical of those that we use in the training manuals and presentations used as supplemental training aids, during the suture training sessions. We include some terminology to help give clarity to the verbal instructions that accompany the supplemental material.

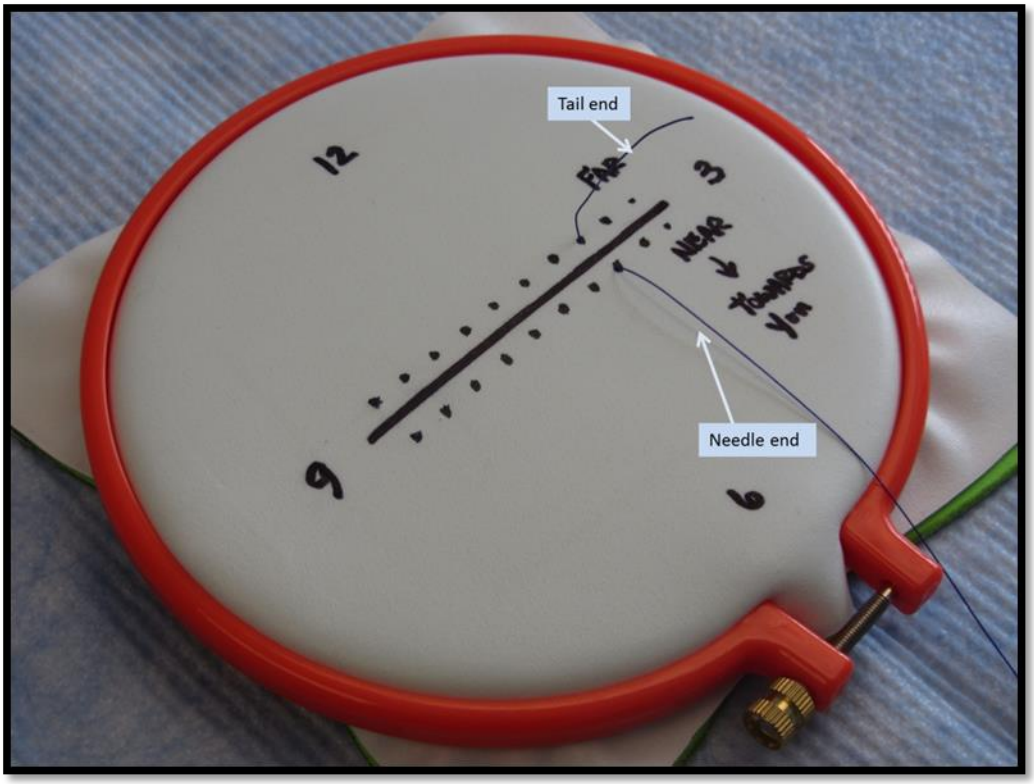


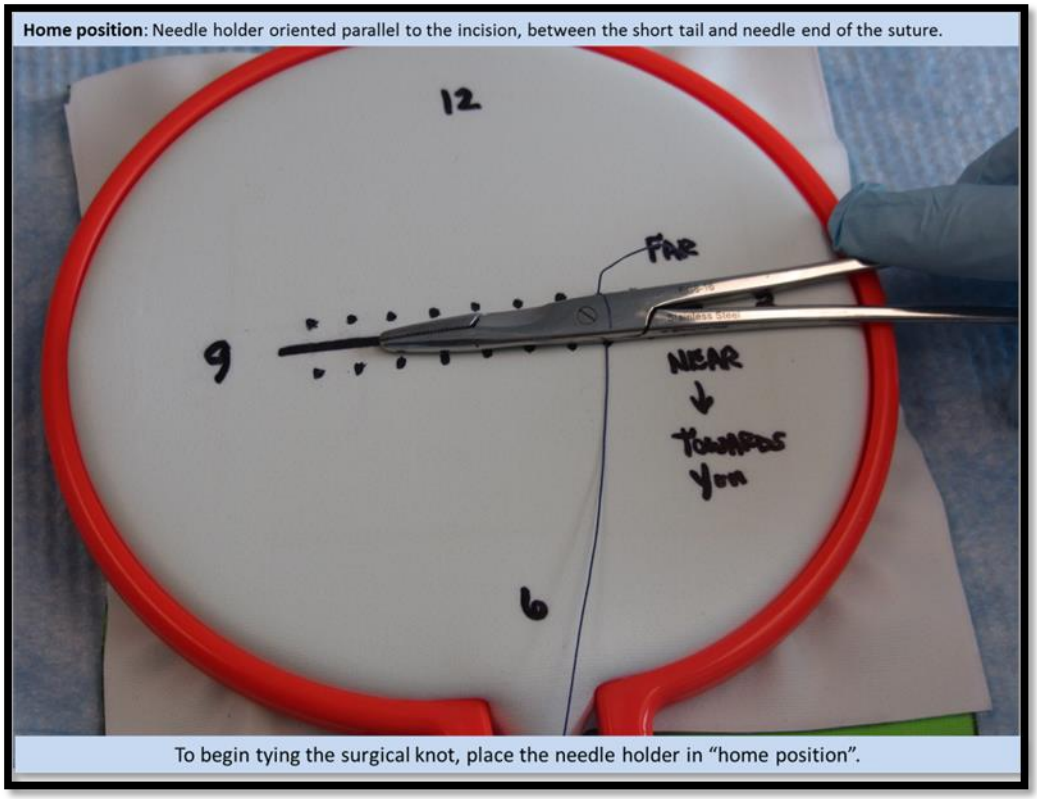
Start by pronating the wrist and forearm to facilitate placing the point of the needle at a 90° angle to the fabric. This angle will help to minimize the effort required to penetrate through the fabric with the needle.

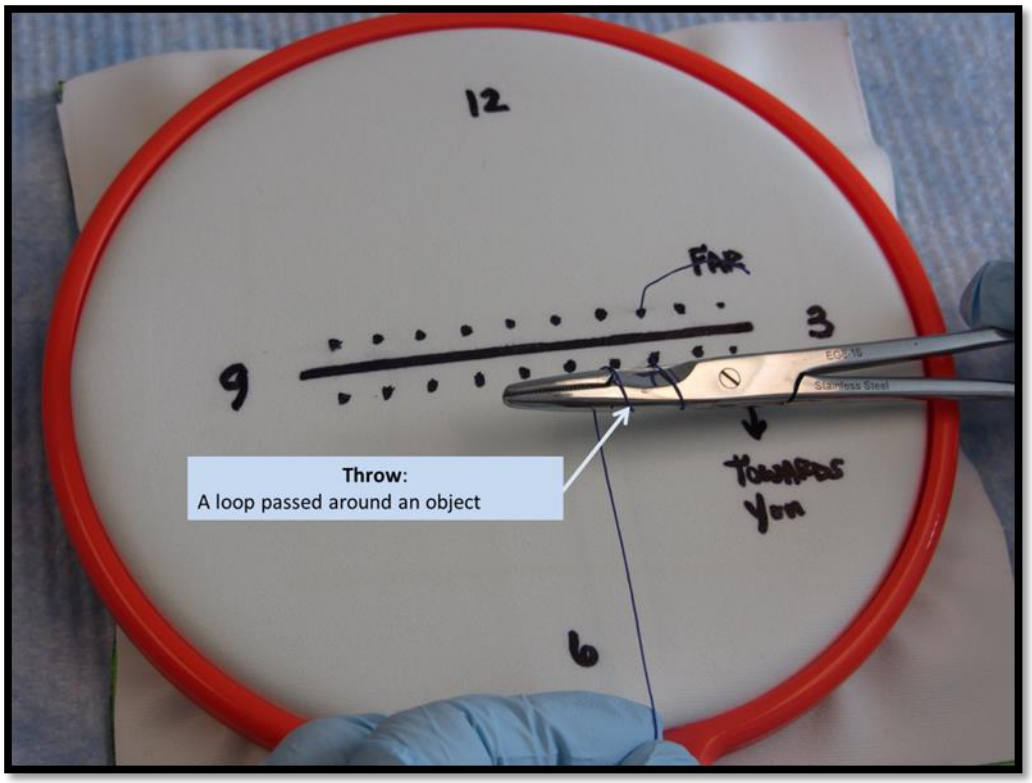
Begin to arc the needle through the fabric, using a supinating motion or the wrist and forearm. At this stage of training, do not worry about whether one or two layers of fabric are penetrated by the needle.

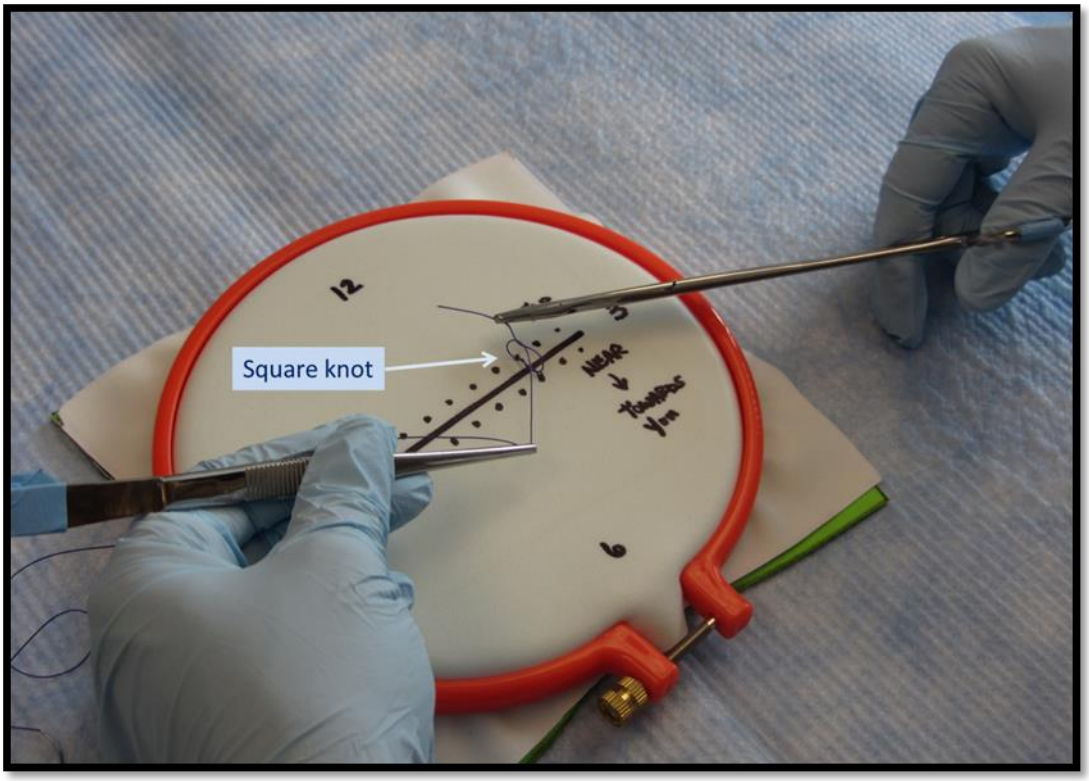
When the needle emerges from the opposite side of the incision, pull the needle through the fabric using either the thumb forceps or needle holder.






Home position: Needle holder oriented parallel to the incision, between the short tail and needle end of the suture.
12
FAR
9
NEAR
6
To begin tying the surgical knot, place the needle holder in "home position".


12
FAR
3
9
Throw:
A loop passed around an object
6


Square knot
12
3
6

iii. Rubber band board

Description:

Thick rubber bands are placed around a wooden board or another rigid object. The bands are intended to mimic the edges of a skin incision. As with the **Embroidery Suture Rings™**, dots can be drawn onto the rubber bands to designate where sutures should be placed.

Key Learning Issues:

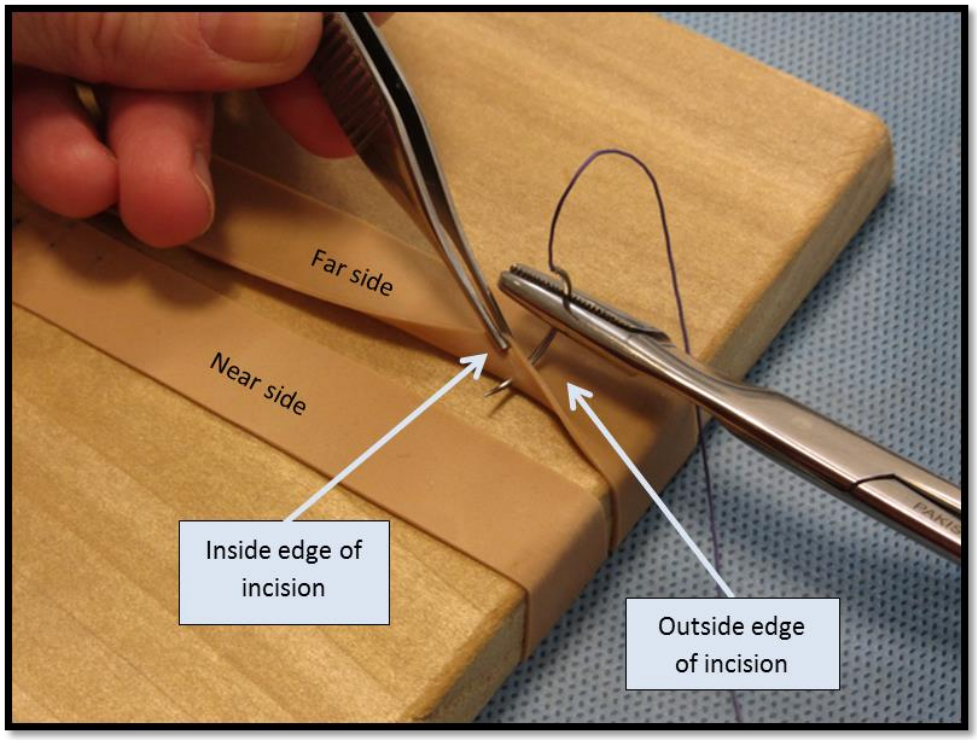
- Reinforcing skills learned in the previous exercise.
- Using the thumb forceps to evert the incision edges to help facilitate visibility and efficiency when penetrating of the needle through the tissue.
- Achieving proper tissue apposition during suturing.

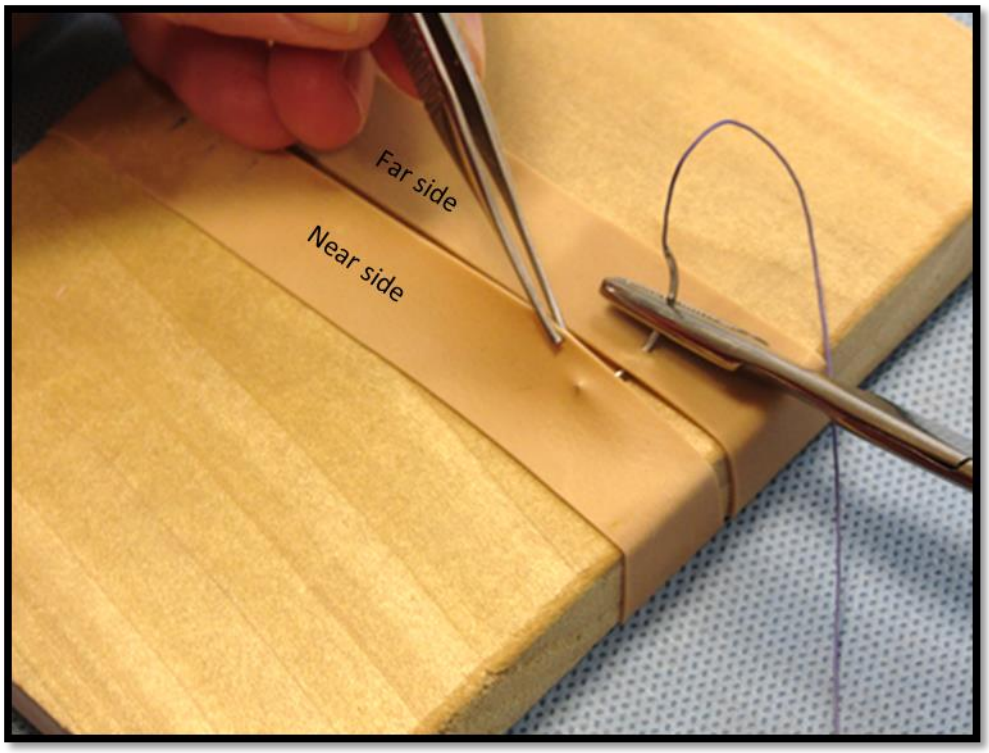
- Mastering the coordination of using the thumb forceps and needle holders together to maximize the efficiency of the suture placement and knot tying.

Instructions for use:

Provide the trainees with the instructions to practice a simple interrupted suture pattern to bring the two rubber bands together. Note that many of the instructions will be similar to those given in the **Embroidery Suture Ring™** exercise. Practicing with this tool will require more two-handed dexterity, as the trainee learns to manipulate the rubber band edges mimicking tissue edges.

1. Safely position the needle into the needle holder.
2. Pick up the edges of the rubber bands with the thumb forceps. Everting the band, will help with the visibility of the needle placement on the inside surface of the mock incision. Everting the band edge also helps make the exercise more ergonomically friendly, as the needle driver hand requires less pronation to place the needle at a right angle to the outer surface of the rubber band.
3. Keep the bands taut by placing mild tension on the band with the forceps. This tension will help to provide stability to the band to better facilitate penetration of the tissue with the needle.
4. Working from far to near with the needle loaded in the holder, take a bite of the rubber band.
5. Using the same supinating motion that was used in the previous exercise, pass the needle through the band on the far side and then the band on the near side of the 'incision'. Note that it may be necessary to use a two-step process of passing the needle entirely through the far side first, then perform a second step of repositioning the needle on the inside edge of the near side of the incision to pass the needle entirely through this side of the incision.
6. Bring the two rubber bands together so that the edges are gently apposed, but not overlapping.
7. Do a proper instrument tie, making sure that square knots are placed.
8. Cut the ends of the suture once the knot is complete.
9. Repeat the process to create a simple interrupted suture pattern, along the length of the two rubber bands.


Far side
Near side
Inside edge of incision
Outside edge of incision


Far side
Near side

iv. Embroidery Suture Ring™ – 2 layer incision and closure

Description:

The **Embroidery Suture Ring™** tool that was used in the second exercise is used again for this part of the suturing practice. A line has been drawn on the outer layer of fabric, to indicate the point at which to incise the tissue. A black line has also been drawn on the second layer of tissue to mimic the *linea alba*. Similar to the **Cutting Ring™** used in the **Dexterity Exercises** session, the embroidery ring can be rigged up with rubber bands, string or balloons to mimic blood vessels. During this part of the class, trainees will perform a two layer incision. The trainee will then suture the two layers using a simple interrupted pattern. We build upon the skills learned in the dexterity class and on skills learned earlier in the suturing class.

Key Learning Issues:

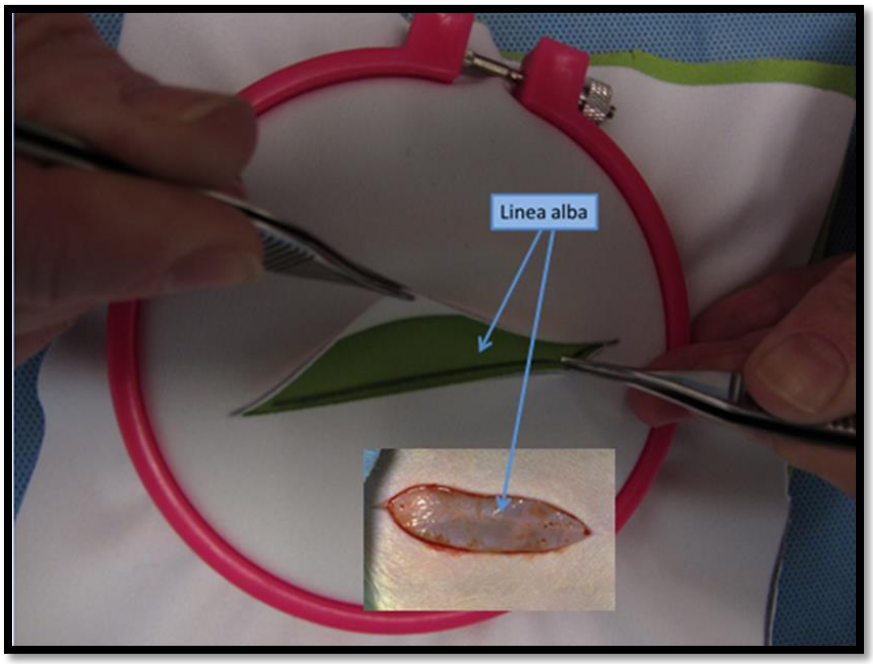
- Making a skin incision.
- Making a stab incision into the muscle layer.
- Suturing two layers of tissue.
- Taking bites in two steps.

Instructions for use:

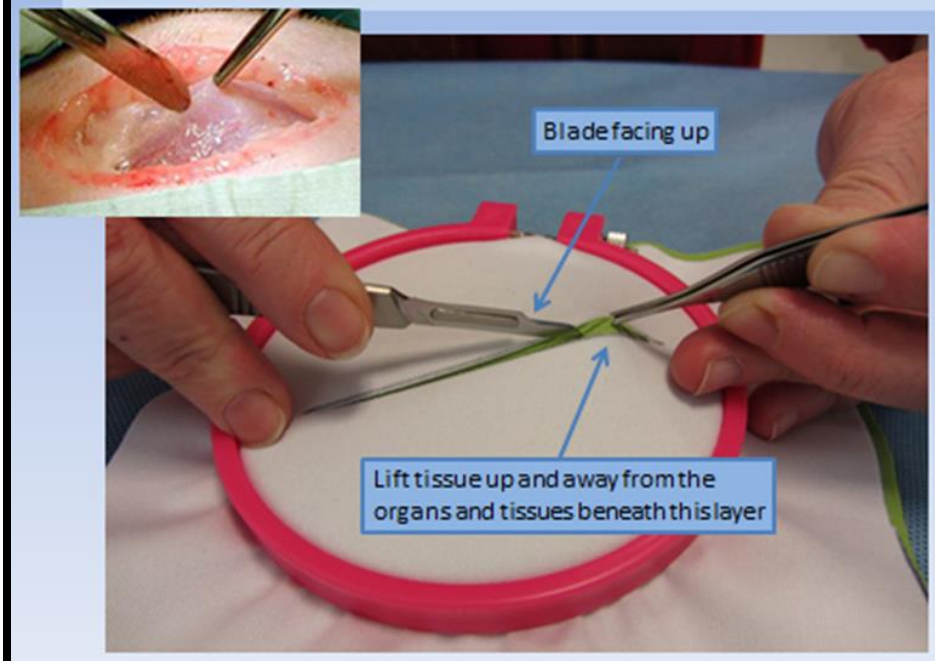
Provide the trainees with the following instructions for using this tool for two layer incisions and closures.

1. Safely load the scalpel blade onto the handle.
2. Using the scalpel blade in a smooth controlled motion, cut through the superficial layer of the fabric along the black line.
3. Perform a stab incision of the deeper layer of the fabric, using the instructions provided below:
    a. Use the thumb forceps to grasp the muscle layer along the black line.
    b. Elevate the inner fabric with the forceps such that it forms a tent. This elevation is essential when incising layers of tissue, such as the abdominal muscle, under which there are delicate organs to avoid cutting.
    c. With the scalpel blade facing upward, place the point of the scalpel blade into and through the elevated ‘tent’ of fabric.
4. Using Metzenbaum scissors extend the incision, taking care not to cut any underlying structures.
5. Proceed with performing a simple interrupted suture pattern on the inside layer of fabric.

6. When the inside layer closure is complete, proceed with closing the outer layer of fabric with a simple interrupted pattern. **NOTE**: We use a simple interrupted suture pattern in practice sessions to encourage ample practice of knot tying.

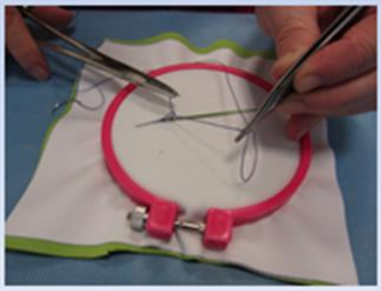


Stab Incision



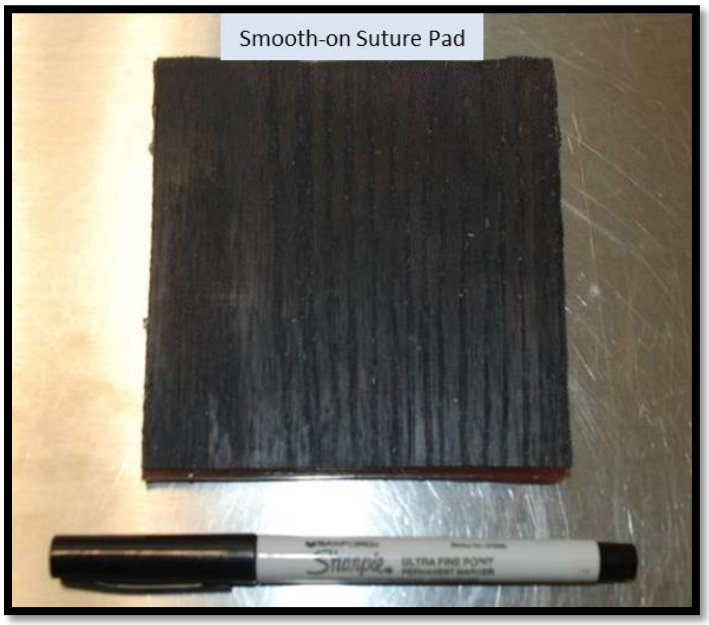
Two layer closure using simple interrupted

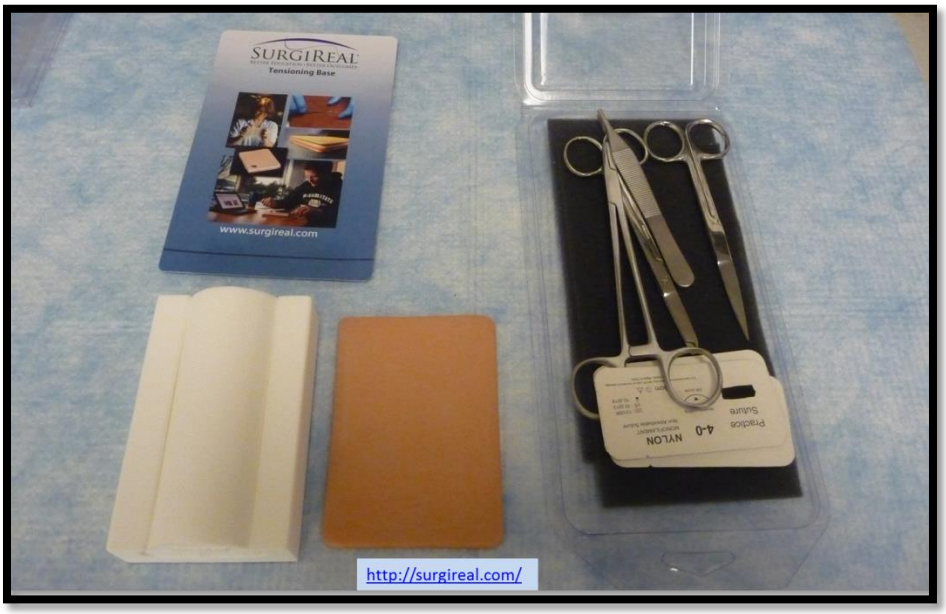
- Use a simple interrupted suture pattern to close both layers
- Reinforce the steps learned in the previous exercise with the rubber bands



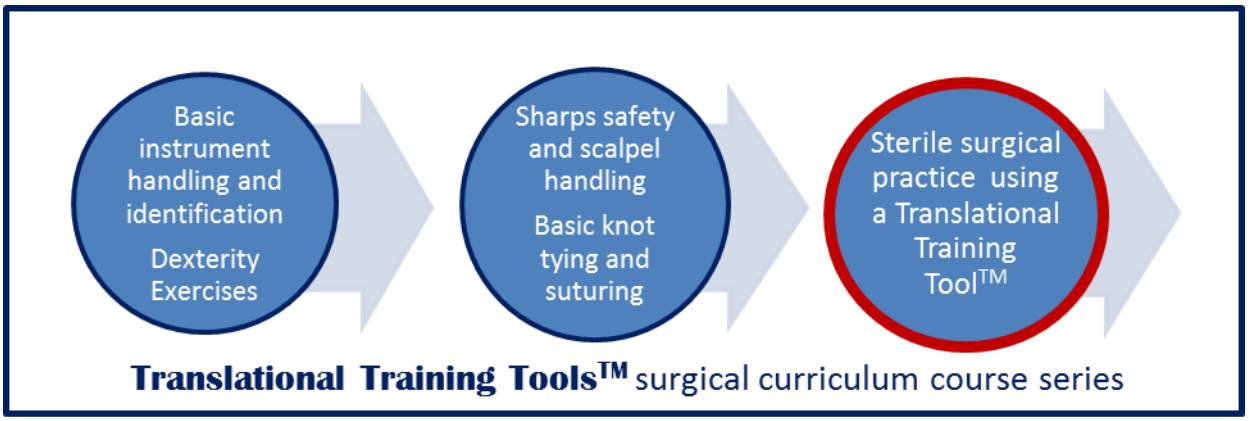
v. Smooth-on suture pads and Surgireal suture pads;

Note that for training on more advanced suture patterns, we may use homemade suture pads using a product called **Smooth-on** (http://www.smooth-on.com). We also use commercially-available, affordable suture pads from **Surgireal**. The **Surgireal** products can be purchased as a kit that includes the instruments required for suturing practice (http://surgireal.com).





c. Aseptic Technique Training, Practice and Assessment:



Tools used for Aseptic Technique Training:

i. **Glo Germ™**
ii. **FP Balloons™**
iii. DASIE

We use the **Glo Germ™** and **FP Balloons™** together to create and exercise for practicing a surgical procedure under sterile conditions. We emphasize that the skills learned in the previous training sessions should be applied during this mock surgery practice exercise. We provide guidance in the form of a step by step hand-out; which is pasted on the wall beside the surgery area. We are in the process of editing a video recording of the mock procedure. Once completed, trainees will have access to the video, both before and after the mock surgery practice exercise.

i. Glo Germ™:

Description:

Glo Germ™ is a commercially available product that is used during training of proper hand-washing for various health care professions. The product comes in a powder and liquid form. The liquid version can be rubbed into the hands. The powder version can be dusted onto surfaces and objects.

Key Learning Issues:

- Setting up a surgery area without contaminating the surgical field or equipment.
    - Opening sterile equipment onto sterile surface in preparation for surgery.
- Accomplishing proper hand washing.
- Performing proper aseptic technique during the surgical procedure.
- Determining if and when contamination occurs and taking corrective action.

Instructions for use of Glo Germ™:

Note that the instructions provided below are a simple overview of the process we proceed through with the trainees. During this training session, we provide more extensive instructions to the trainees.

We notify the students that the tables, some of the equipment surfaces and the surgical surrogate (**FP Balloon™**) have all been dusted with **Glo Germ™** powder. The goal is to avoid contaminating the sterile areas, equipment and surgical garb. Additionally, trainees are provided with visual feedback of areas as we stop to check the area with the black light at regular intervals throughout the procedure.

Overview of the exercise:

1. Place a few drops of **Glo Germ™** lotion onto the hands and rub the lotion into the hands.
2. Prepare a sterile surgery area, including all of the equipment and supplies that will be needed during the procedure.
3. Avoid getting **Glo Germ™** on the surgical site or any of the sterile equipment.
4. Prepare the animal for surgery.
5. Scrub hands.
6. Don surgical garb.
7. Perform a sterile procedure consisting of a 2 layer opening and 2-layer closer on the **FP Balloons™.**

To demonstrate the level of sterility achieved, Glo Germ ™ is sprinkled on the surgical table. The Glo Germ ™ lotion is applied to the hands prior to scrubbing the hands for surgery.

The goal is to prevent all surgical instruments, equipment and surgical garb from glowing.

In this photo, the surgery area has been contaminated significantly.

ii. FP Balloon™:

Description:

This tool is a surgical surrogate used to practice surgery on a small animal. It consists of soft squishy substance stuffed into two layers of balloon. The substance inside the balloons represents the contents of the abdominal cavity. The inside layer of balloon represents the muscle layer and the outside layer of balloon represents the skin.

When practicing surgery, the skills previously learned are applied; however, the smaller size and thin balloon layers of the **FP Balloon™** challenge the trainees to use the microsurgery skills that have been developing throughout the surgical curriculum. The **FP Balloon™** can be used for non-sterile surgical practice, or in conjunction with **Glo Germ™** to practice a sterile procedure.

The **FP Balloon™** is a versatile tool. In addition to using this tool as a surgery surrogate, we use this tool for training and practice of basic rodent handling, and for both subcutaneous and intraperitoneal injection training. Please refer to the Volume 1 of 3 Ts for non-surgical procedures.

Key Learning Issues:

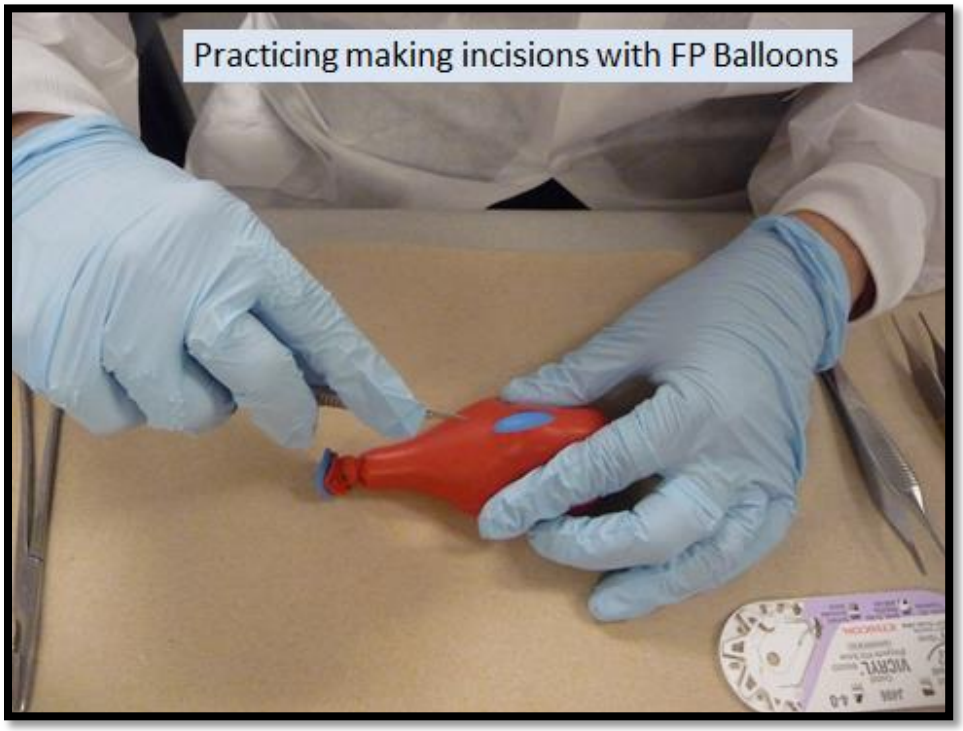
- Performing surgery on a small subject.
- Performing a 2-layer incision and closure.
- Optional: Performing an implant procedure.

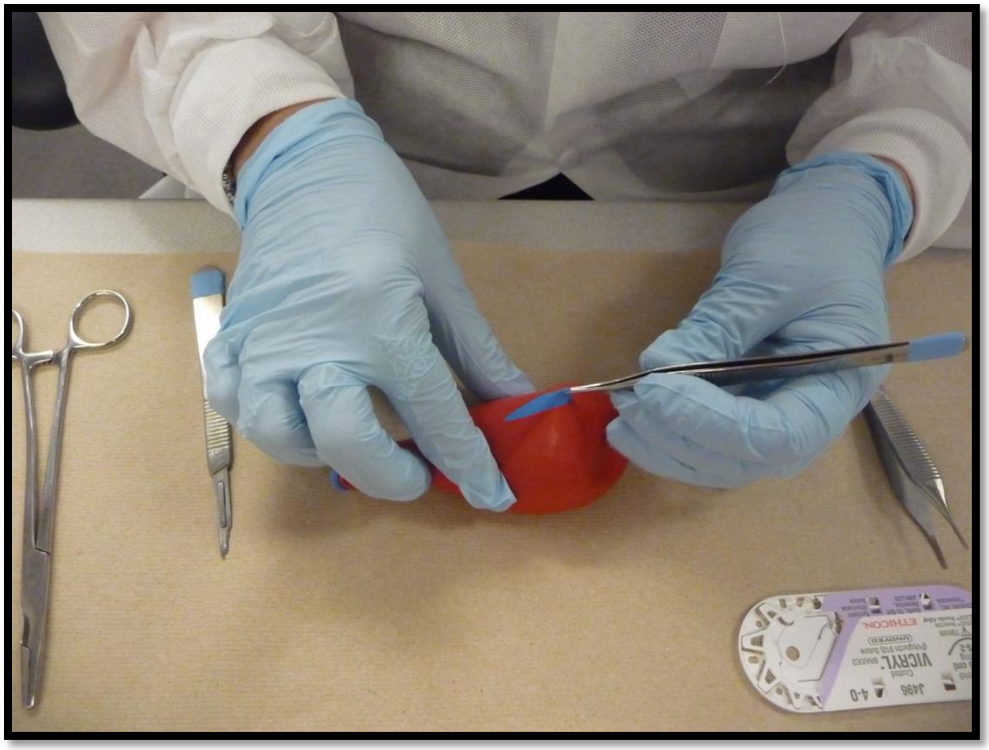
Instructions for use:

1. Perform a 2-layer incision:
    a. With a smooth motion of the scalpel blade, make a 1 cm incision through the outer balloon only.
    b. Recall the steps for performing a stab incision as practiced on the **Embroidery Suture Ring™** during the previous class in the series.
    c. Use the thumb forceps to elevate the inner balloon up and away from the contents of the balloon.
    d. Using the scalpel with the blade facing upward, pierce a small hole through the inner balloon.
    e. Place the lower blade of blunt ended scissors, such as Metzenbaum scissors into the hole created by the stab incision on the inner balloon.
    f. With the lower blade of the scissors elevated such that the inner balloon is lifted up and away from the contents of the balloons, extend the inner balloon incision so that it is slightly shorter than the out balloon incision.
2. Using the thumb forceps, explore the inner contents of the balloons.

3. Optional step: place a small plastic bead (mimicking an intraperitoneal implant) into the abdomen of the balloon surrogate.
4. Using a simple interrupted suture pattern perform a 2-layer closure of the incision; starting with closure of the inner layer of balloon.
5. Close the outer balloon incision with either wound clips or an interrupted suture pattern.

Note that the **FP Balloon™** can also be used to practice a subcutaneous procedure; incising the outer layer of balloon only. As an optional step, a plastic bead can be used to mimic a subcutaneous implant.




ETHICON
VICRYL
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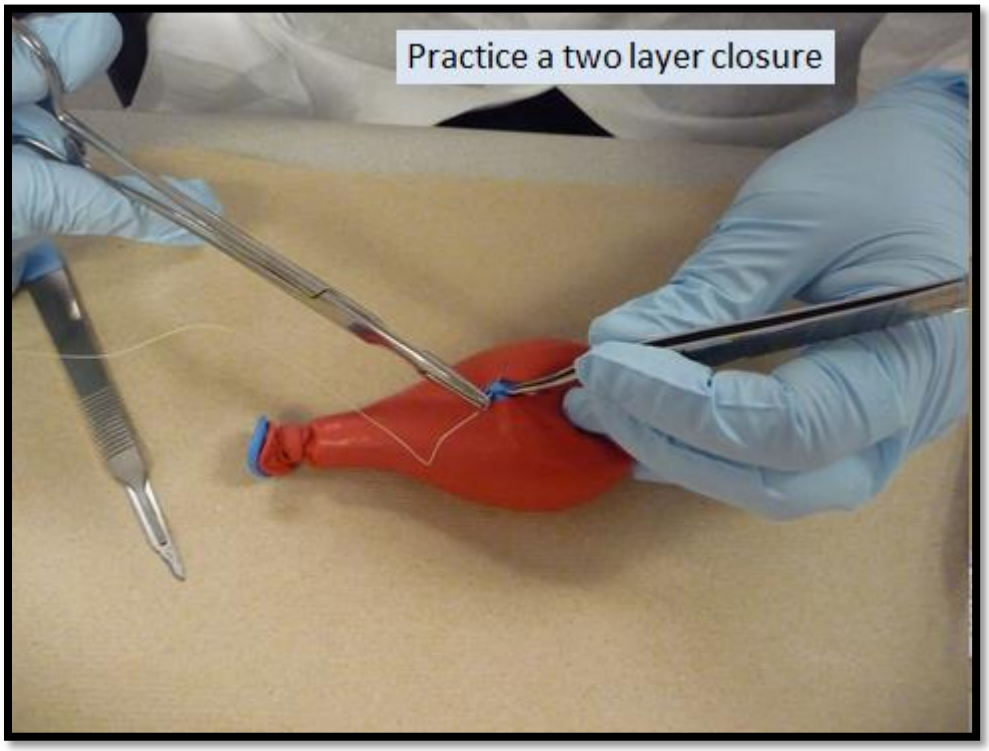

Practice a two layer closure

Option: Inject some fake blood between the two balloons. When the incision is made, some of the blood will ooze from the incision. The trainee will have to respond appropriately to the bleeding.

iii. Dog Abdominal Surrogate for Instructional Exercise (DASIE™)

For larger animal surgery practice, we conduct the series of classes as for rodent or other small animal surgery training. The exception is that we use a **DASIE™** in place of the **FP Balloon™**. More information on **DASIE™**, please refer to the following link:

http://www.dasiesurgery.ca/DASIE/DASIE.html

PART II

1. Instructions for making the tools used to teach the 3 Ts Surgical Curriculum

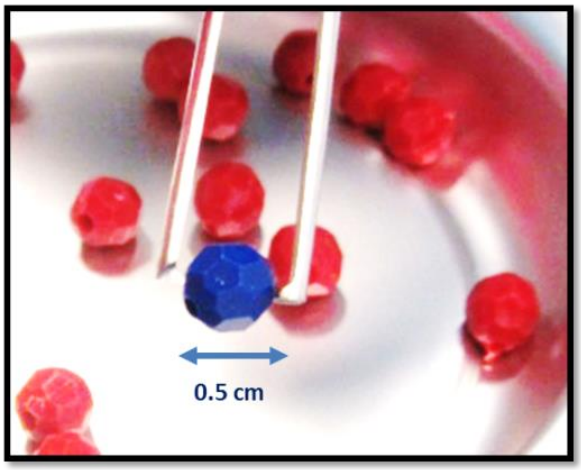
Note that the prototypes for some of our **Dexterity Tools™** were made of sealed hardwood and were home-crafted by David Mooneyhan. We later replaced some of the wooden tools with Plexiglas materials. For other tools, we replaced the wooden version with store bought materials that could serve the same version as the home-crafted prototype. In this manual, we do not include the instructions for all of the wooden versions of the tools. If interested in instructions for the wooden version, please contact David Mooneyhan at dem15@cornell.edu.

a. Macro Dexterity Tools™:

i. Bead Board™

Ingredients:

- Several different colors of craft store beads of approximately 0.5 cm diameter.
- Shallow baking tray or lollipop molds; about 1 cm deep.



Supplies:

- Small container to hold the beads when not in use.
- When in use, equip the trainee with at least two pairs of thumb forceps

Instructions:

1. Place an relatively even number of mixed-colored beads in each of the wells
2. Supply at least two pairs of thumb forceps to the trainee for bead manipulation. Include thumb forceps with different types of tips e.g. rat tooth, smooth tip, serrated tips.

NOTE: As an alternative to the baking trays or molds, shallow wells can be crafted from sealed hardwood. For more information on the wooden version, please contact David Mooneyhan at dem23@cornell.edu .

ii. Neuter Board™

Ingredients:

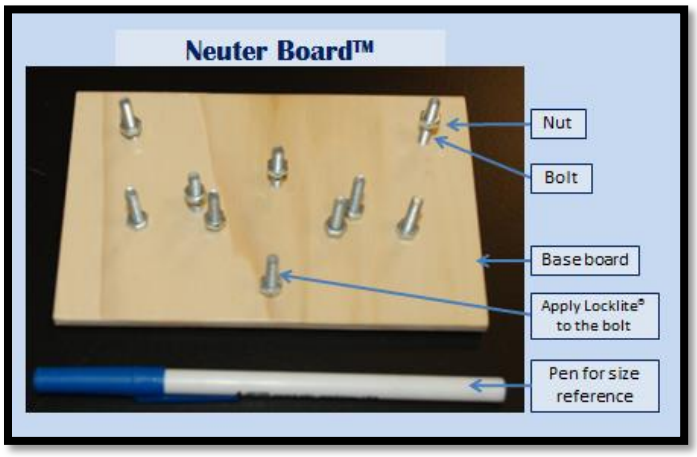
- One base board made of sealed hardwood: We used a base board cut to the following dimensions: 7”x5”x0.25”
- Box of bolts and corresponding nuts. We used bolts with the following dimensions: 5/32nd” diameter x 1.25” long

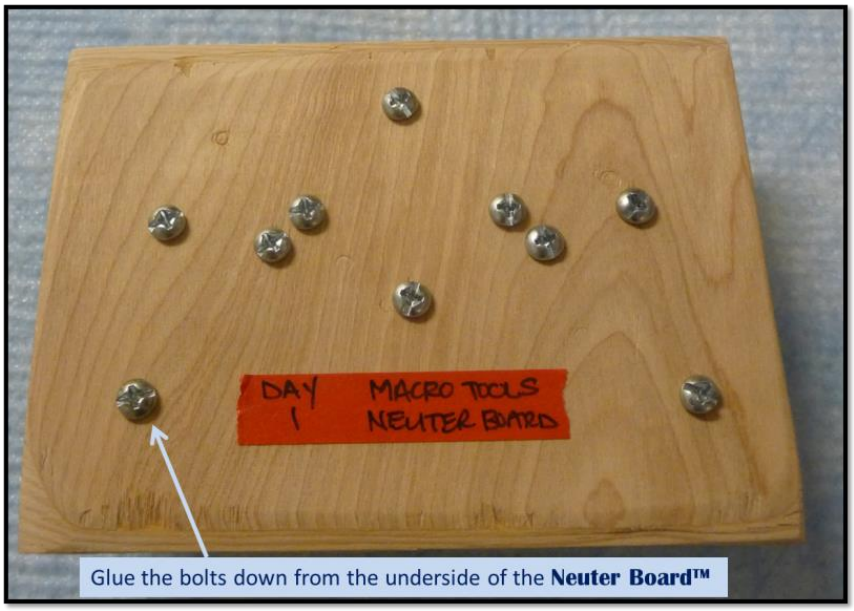
Supplies:

- Glue
- A clamp or heavy weight to hold the wooden base in place while drilling holes into it
- **Locktite**® nut and bolt locker (http://www.loctiteproducts.com/)
- When in use, equip the trainee with at least one needle holder

Instructions:

1. Using a pencil, mark the base board with the pattern that you want to use for placement of the bolts. We used an elongated star pattern to create bolts that were aligned in various distances from one another, to allow for different levels of challenge for removing the nuts during the practice exercises.
2. Secure the base in place using a clamp or heavy weight.
3. Drill holes over the marked areas to create a pattern of holes into which the bolts will be placed.
4. Once the bolts are flush with the base board, glue the bolts to the back of the base board to securely hold them in place and prevent them from spinning.
5. Apply a small amount of **Locklite**® to the bolt to make the nuts a bit more difficult to remove. If applied too liberally, the nuts will become too tightly adhered to the bolts to be effective as a training tool.
6. Screw the nuts down onto each of the bolts.




DAY 1
MACRO TOOLS
NEUTER BOARD
Glue the bolts down from the underside of the Neuter Board™

iii. Tissue Board™

Ingredients:

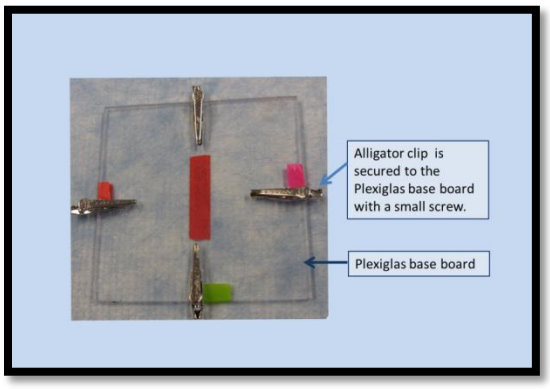
- One Plexiglas® or sealed-hardwood base board. We used a base board cut to the following dimensions: 5.5”x5.5”x0.25”
- 4 small alligator clips, approximately 1.5 inches long
- Small screws that can fit in the holes of the alligator clips
- Thin tissue, tissue paper or **Kimwipes™**
- When using the tool, equip the trainee with at least one needle holder and one pair of thumb forceps

Supplies:

- Screw driver
- Drill with fine tip
- Strong glue
- Small squirt bottle filled with water

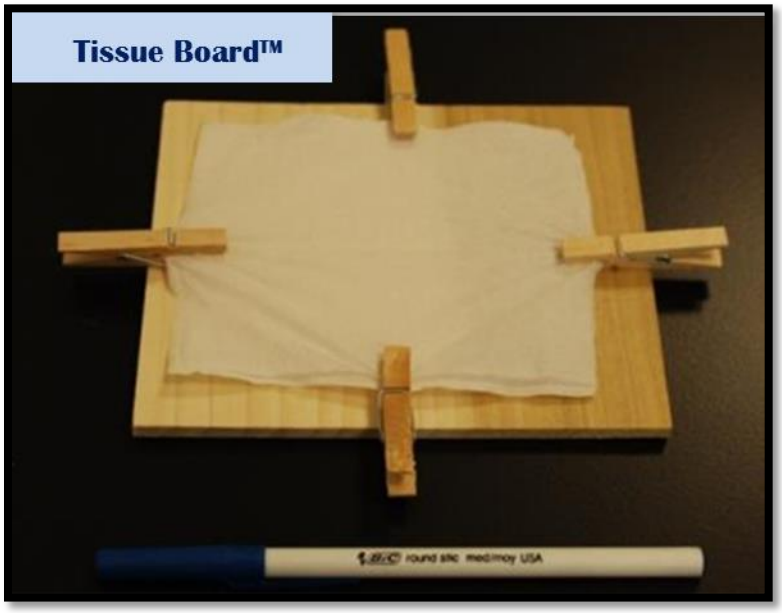
Instructions:

1. Glue one alligator clip onto the top of each of the 4 sides of the base board. Make sure one clip is placed in the center border of each side.
2. From the back of the base board, pre-drill 4 holes into the base board, and into the base of the alligator clip. Note that the holes should just slightly smaller than the wood screws.
3. From the bottom of the base board, place a small wood screw into the pre-drilled hole.
4. When ready to use, place a tissue into the jaws of each of the alligator clips, removing all slack from the tissue.
5. Use the squirt bottle to dampen the tissue before use.



The underside of alligator clamp is shown bolted to the Plexiglas® in the picture on the right

Note that the prototype for the tool is made with a hardwood base of the same dimensions as the Plexiglas version. Instead of alligator clips, we used small clothes pins that were glued to the base board. While this version was fairly easy to make, we consistently had to re-glue and sometimes replace the clothes pins. The wooden version is shown in the photo below.



iv. Nail Board™

Ingredients:

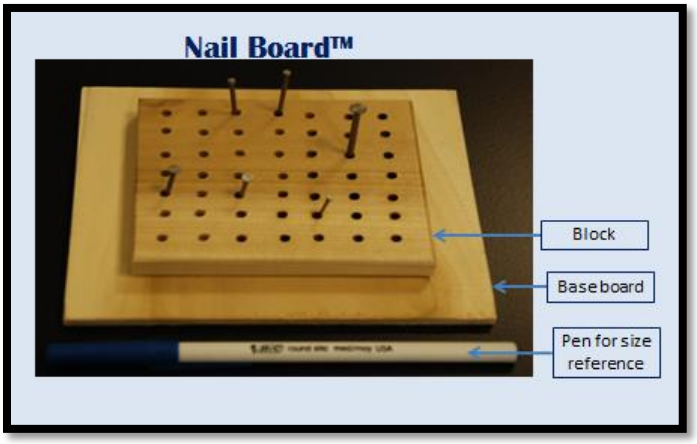
- One base board made of sealed hardwood. We used a base board cut to the following dimensions: 6.5”x4.5”x0.25”.
- One wooden block. We used a block cut to the following dimensions: 3/8”x 4.5”x 3.5”.
- A small box of nails of a variety of sizes; we have cut and filed the nail tips to make the nail blunt, therefore safer to use.
- When using the tool, equip the trainee with at least one needle holder and one pair of thumb forceps.

Supplies:

- Glue
- A clamp or heavy weight to hold the wooden base in place while drilling holes into it.

Instructions:

1. Once cut to the dimensions, drill several rows of holes into the block. Rows should be slightly misaligned from each other.
2. Clean away any loose wood from the back of the block.
3. Apply glue over the back of the block.
4. Place the wooden block on top of, and in the center of the base board.
5. Keeping the block and base board on a level surface, clamp the two pieces together or pace a weight on top of it and leave for the next 6 hours or until the glue dries.
6. Pair the tool with the box of assorted nails.




Blunted nails

v. Cutting Ring™

Ingredients:

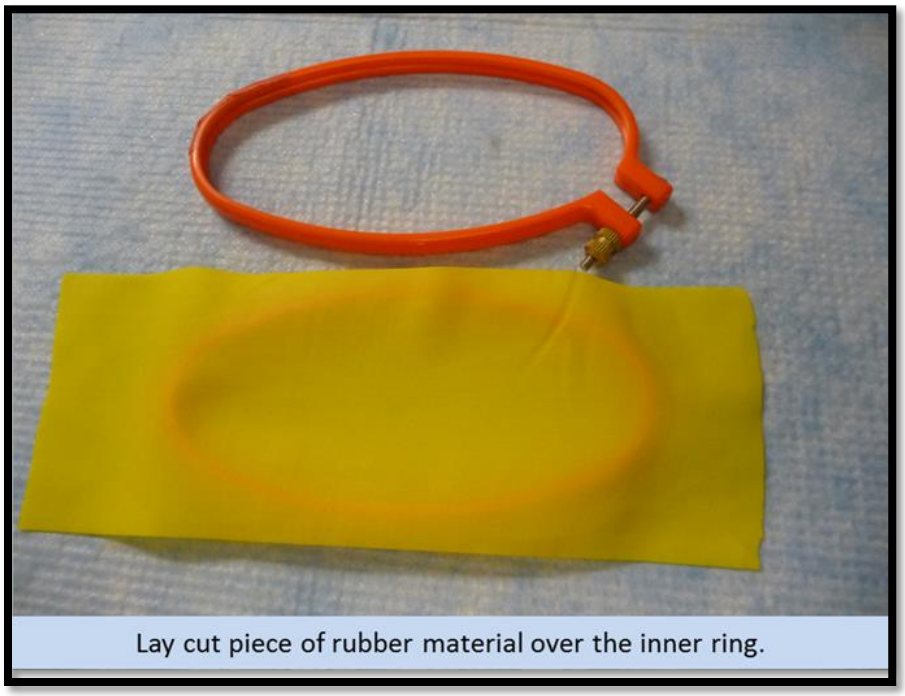
- Embroidery ring: we use various sizes mostly oval rings of the following dimensions: 2” x 6” and 3” x 8” *or* round rings of 6” diameter
- Thin rubber material. We use either one of the following materials:
    - **Qualatex®** 36” diameter latex balloons (http://www.qualatex.com)
    - **TheraBand™** exercise band material (http://www.thera-band.com/)
- When using the **Cutting Ring™** for surgery practice, equip the trainee with at least one pair of Metzenbaum surgical scissors

Supplies:

- Craft scissors for cutting the rubber material

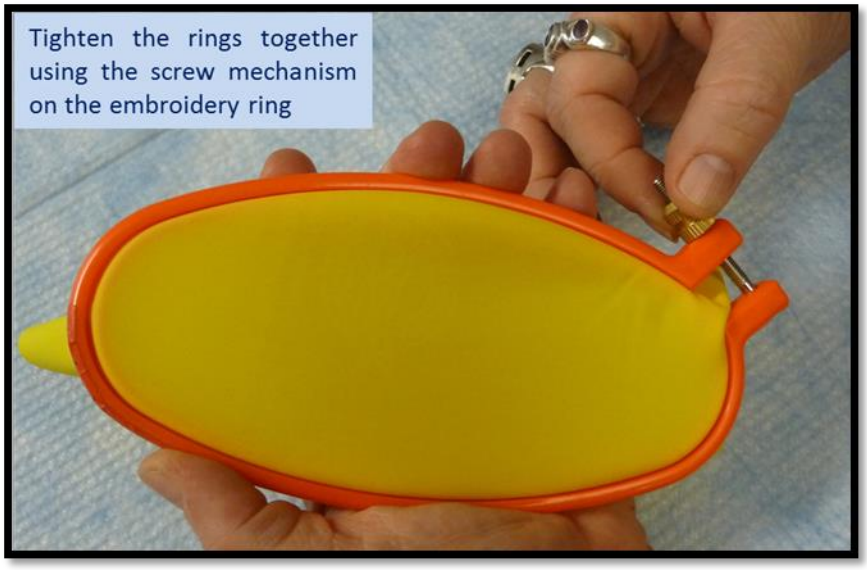
Instructions:

1. Cut the rubber material to a size that is about 1.5 inches larger than the border of the embroidery ring.
2. Separate the larger, outer portion of the embroidery ring from the smaller, inner portion.
3. Lay cut piece of rubber material over the smaller inner ring.
4. Place the larger, outer ring over top of the rubber material.
5. Tighten the rings together using the screw mechanism on the embroidery ring.
6. Cut 3 holes approximately 1/2” long, at one end of the rubber material. These holes are for placement of the Metzenbaum scissors during the training exercise.

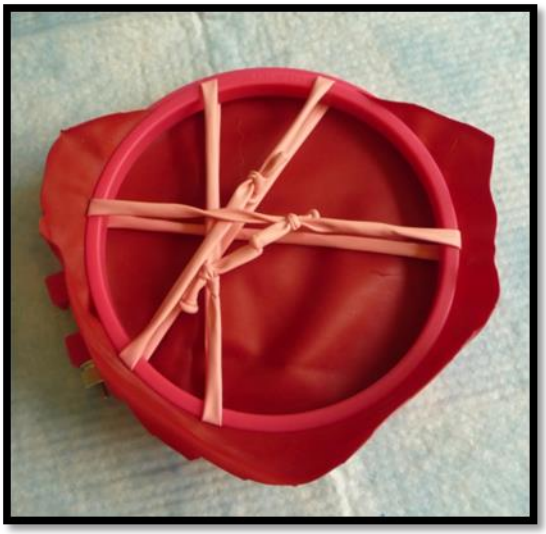

Lay cut piece of rubber material over the inner ring.


Place the larger, outer ring over top of the rubber material


Cut 3 holes approximately 1/2” long, at one end of the rubber material



- For a more challenging version of the tool, secure pieces of thread, string or balloons into the rings, under the rubber. These objects represent blood vessels and other delicate structures to avoid when cutting animal tissues.



b. Micro Dexterity Tools™

i. Peg Boards

Ingredients:

- Small cylindrical beads. Our preference is **Perler® Biggie Beads** which are approximately 5mm long and 4 mm in diameter.
- A peg board onto which the cylindrical beads can be placed. The **Perler® Biggie Beads** come with a board that is ideal for our purposes.
- During the **Peg Board** exercise, provide the trainee with at least two pairs of thumb forceps.

Supplies:

- Storage cup for the beads

Instructions:

1. Place the peg board on a level surface
2. Open a cup of beads beside the peg board and pour 30 to 50 beads into the lid of the cup for easier access for the trainee
3. The **Peg Board** is now ready for the trainee to begin the exercise

ii. Bead Threading

Ingredients:

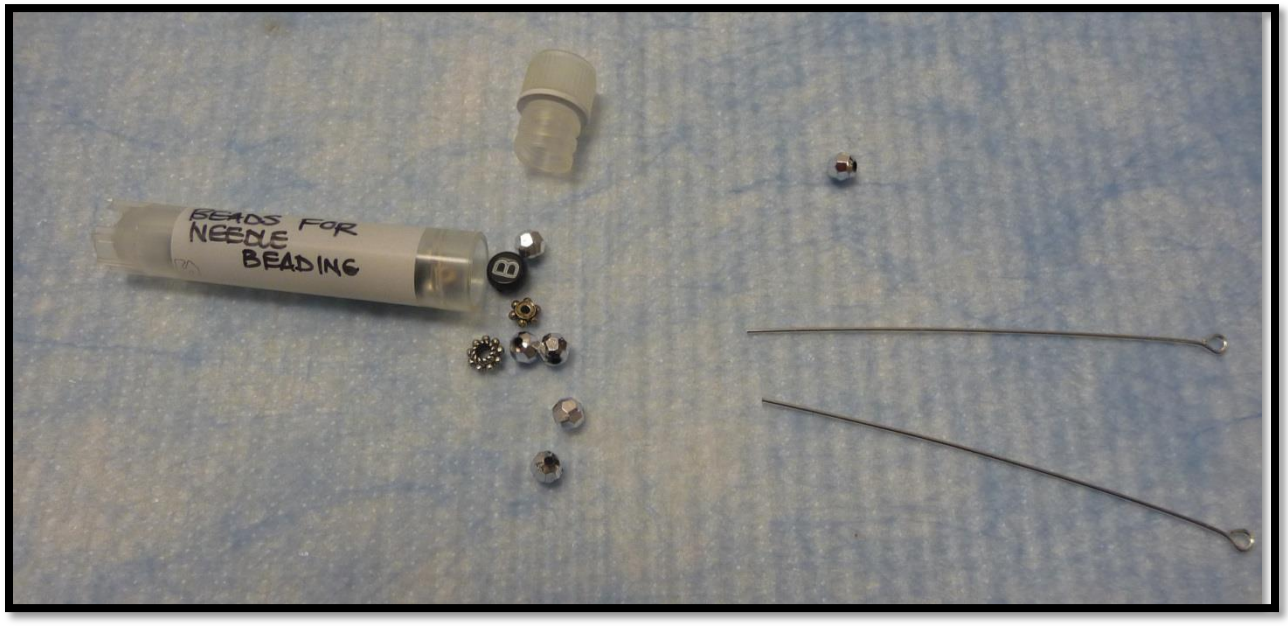
- Small beads of less than 5 mm diameter. Choose beads of various sizes, shapes and textures.
- One blunt beading-needle
- During the **Bead Threading** exercise, provide the trainee with a least one pair of hemostats and one pair of thumb forceps.

Supplies:

- Containers to hold the beads
- A small bag into which the beading needles and bead container can be stored together
- A non-slip mat to place on the table to help prevent the beads from rolling away during the exercise

Instructions:

1. Open the bead container and place the beads and beading-needle on the non-slip surface
2. The Bead Threading exercise is now ready for the trainee to use



iii. Earrings and Backs

Ingredients:

- Basic stud earring
- Basic stud earring backs
- During the **Earrings and Backs** exercise, provide the trainee with a least one pair of hemostats and one pair of thumb forceps.

Supplies:

- Containers to hold the beads
- A small bag into which the earrings and backs can be stored together
- A non-slip mat to place on the table to help prevent the beads from rolling away during the exercise

Instructions:

1. Open the container and place the earrings and backs on the non-slip surface
2. The **Earrings and Backs** exercise is now ready for the trainee to use

iv. Color Band Boards™

Note that the instructions to make similar to those used to make the **Neuter Board™**. Potentially the **Neuter Board™** can double as the **Color Band Board™**.

Ingredients:

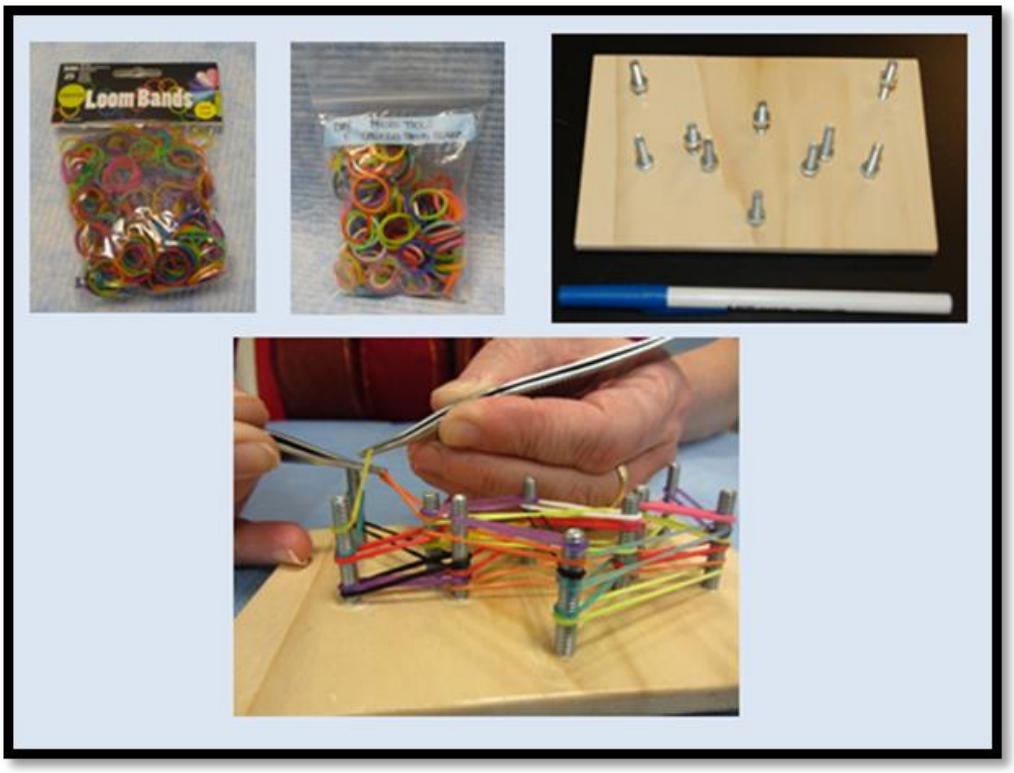
- One base board made of sealed hardwood: We use a base board cut to the following dimensions: 7”x5”x0.25”
- Box of bolts. We used bolts with the following dimensions: 5/32nd” diameter x 1.25” long.
- Small colored rubber bands. We use Loom Bands.
- When ready to use, equip the trainee with at least two pairs of thumb forceps.

Supplies:

- Glue
- A clamp or heavy weight to hold the wooden base in place while drilling holes into it

Instructions:

1. Using a pencil, mark the base board with the pattern that you want to use for placement of the bolts. We use an elongated star pattern to create bolts that were aligned in various distances from one another, to allow for different levels of challenge for removing the nuts during the practice exercises
2. Secure the base in place using a clamp or heavy weight
3. Drill holes over the marked areas to create a pattern of holes into which the bolts will be placed
4. Once the bolts are flush with the base board, glue the bolts to the back of the base board to securely hold them in place and prevent them from spinning
5. Attach a network of rubber bands of the bolts in an overlapping and underlapping pattern to increase the level of difficulty for the trainee to remove the bands. Arrange the bands in a manner that will encourage the trainee to use both tissue forceps during two-handed manipulations.


Loom Bands

v. Bead Cup Exploratory™

Ingredients:

- One shallow cup, about ¾” deep and 3” diameter.
- Various small objects e.g. small rubber bands (**Loom Bands**), small pieces of string, various beads.
- 4 different colors of seed-beads: the beads we use are 2 mm.
- One piece of thin rubber material cut to a size that will fit over top of the shallow cup, with about an inch extra. We use either one of the following materials:
    - **Qualatex®** 36” diameter latex balloons (http://www.qualatex.com)
    - **TheraBand™** exercise band material (http://www.thera-band.com/)
- One standard rubber band
- When ready to use, equip the trainee with at least two pairs of thumb forceps.

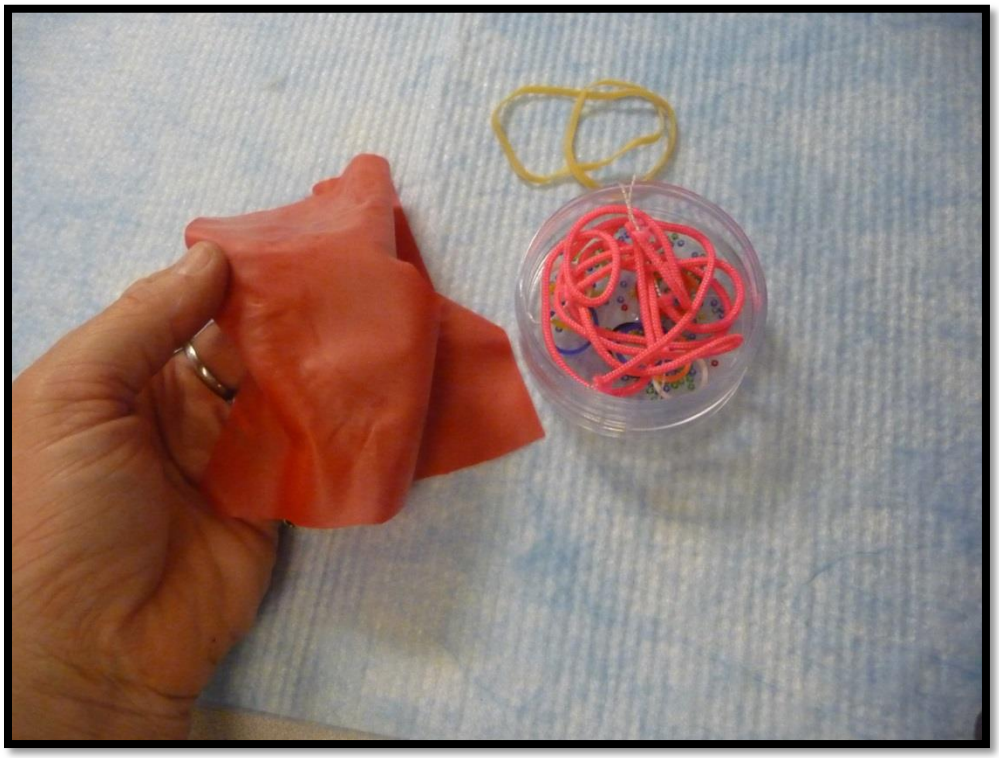
Supplies:

- No other supplies are required to make this tool

Instructions:

1. Place the shallow cup on a level surface
2. Place all of the small objects into the cup and include at least one of each color of seed bead in the cup
3. Place the rubber material over top of the bead cup and secure it in place with the standard rubber band.
4. Cut a straight slit through the rubber so that the items inside can be accessed with the surgery tools


CARE TRAINING



c. Scalpel Handling and Suture Training Tools

i. **Ethicon Suture Board**
ii. **Embroidery Suture Rings™**
iii. **Rubber band board**
iv. **Smooth-on Suture Pads**

i. Ethicon Suture Board

This tool is a commercially made tool. Please refer to the following link for more information on how to obtain one of the Ethicon Suture Boards:

http://www.ethicon.com/healthcare-professionals/education/student-knot-tying-kit

ii. Embroidery Suture Ring™

Ingredients:

- 1 embroidery ring diameter 5” to 7“
- Two pieces of stretchy, no fray fabric cut into squares that are large enough to fit into the embroidery rings. We tend to use two fabrics of different thickness and texture to mimic different tissues. Materials we use include the following;
    - Faux leather
    - Neoprene
    - Crib covering

Supplies:

- Scissors to cut the fabric
- Medium point **Sharpie®** marker
- Ruler

Instructions:

1. Cut both pieces of fabric to a size that is at least 1.5 inches larger than the border of the embroidery ring.
2. Draw as straight line in the center of each piece of fabric.
3. Draw small dots on either side of the line, to indicate where sutures should be placed.
4. Optional: Write the numbers 12, 3, 6, and 9 on the border of the outer material to indicate the points on a clock.
5. Optional: Indicate in writing, the far side of the incision (the side farthest away from the surgeon) and the near side (the side closest to the surgeon).
6. Separate the larger, outer portion of the embroidery ring from the smaller, inner portion.
7. Lay both pieces of cut fabric over the smaller inner ring.
8. Place the larger, outer ring over top of the fabric on the inner ring.
9. Tighten the rings together using the screw mechanism on the embroidery ring. Make sure the fabric is not neither too taut nor too lax.

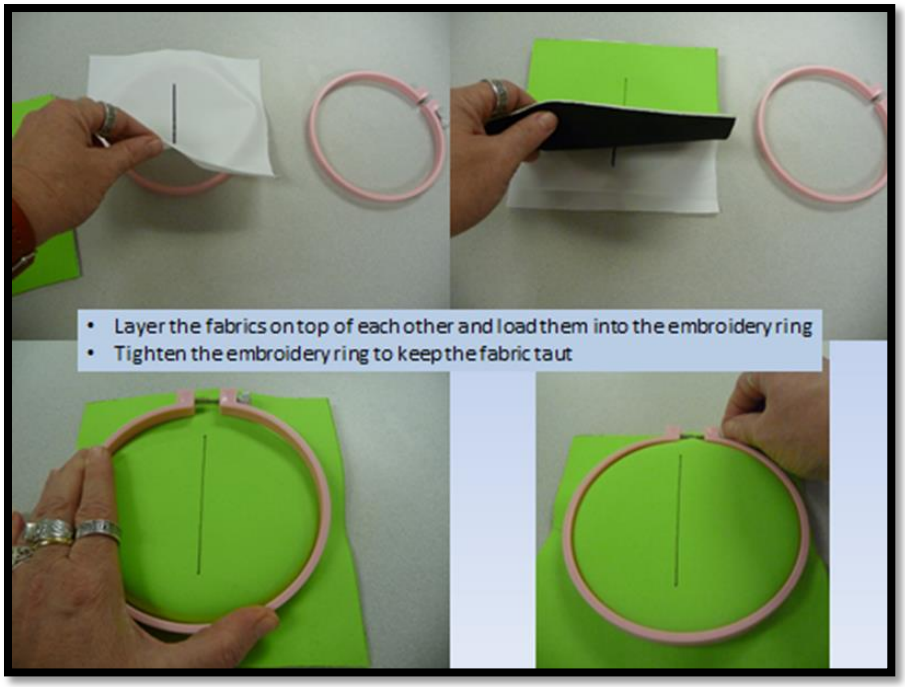
Embroidery rings to practice suture placement, two-layer incision and two-layer closure

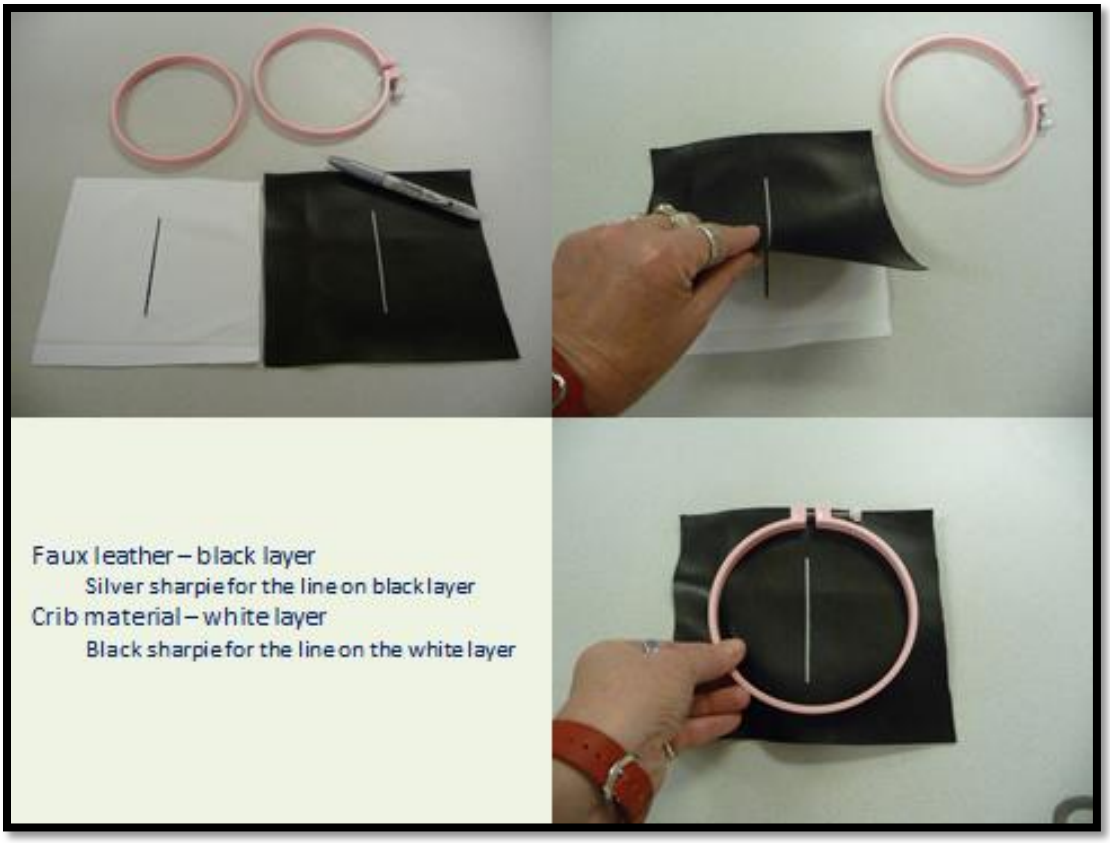
Supplies:

- Embroidery ring 5”
- 2 types of fabric
  - Stretchy
  - No fray
    - E.g. neoprene
  - Different colors
- Sharpie marker

Instructions:

- Cut fabric into 6” x 6” pieces
- With a Sharpie, draw a line down the center of each piece of material




Faux leather – black layer
Silver sharpie for the line on black layer
Crib material – white layer
Black sharpie for the line on the white layer

iii. Rubber band boards

We first discovered this tool on the AALAS learning library module: Aseptic Technique for Rodent Survival Surgery.
https://www.aalaslearninglibrary.org/Pages/Courses/CourseAllPages.aspx?intLessonID=27581

Ingredients:

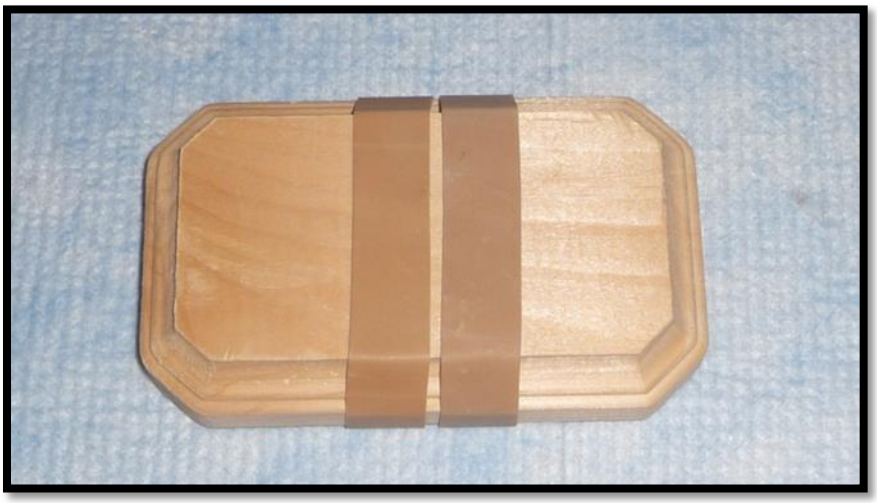
- Block of wood. We purchase wooden plaques of various sizes from JoAnn Fabrics. Please refer to the following link for an example of one of the plaques we use:
http://www.joann.com/7x7-square-plaque/8163313.html#q=wooden%2Bplaques&start=7
- Two thick rubber bands
- Fabric or felt to cover the block: We use a sticky back felt that we cut to size and stick directly to the block of wood.

Supplies:

- Optional: medium point **Sharpie®** marker or similar marking device.

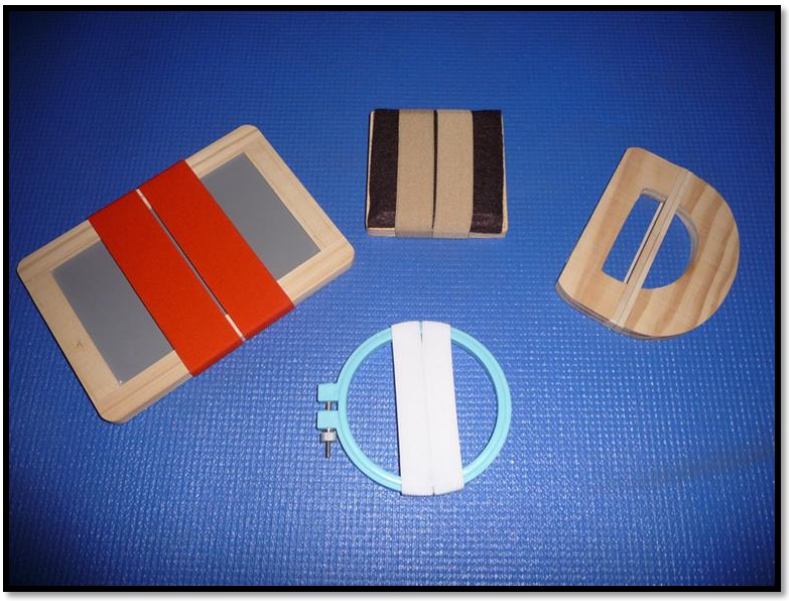
Instructions:

1. Optional: place fabric or felt over the block.
2. Place the rubber bands around the wooden block.
3. Line up the bands side by side and separated slightly form one another by several millimeters.
4. Optional: Use a marker to place black dots near the border of each rubber band to designate where the sutures should be placed. This option is not shown in the images below.



We use various modified version of the tool to increase or decrease the level of difficulty of the suturing exercise. Modifications such as the ones listed below, can make the band easier to pick up with the forceps:

- Using textured elastic instead of rubber bands. We use waist band elastic on some of our Band Boards
- Adding a textured surface to the wooden base.
- Using a base that allows to band to be slightly raised above the base to allow space for the forceps to reach underneath the bands to better grasp them.
- Any combination of the above modifications e.g. textured band on a textured board; textured band on a raised board.



iv. Smooth-On suture pads

Please refer to the following YouTube video on how to make **Smooth-On™** suture pads: https://www.youtube.com/watch?v=G6HdZpXdEiM

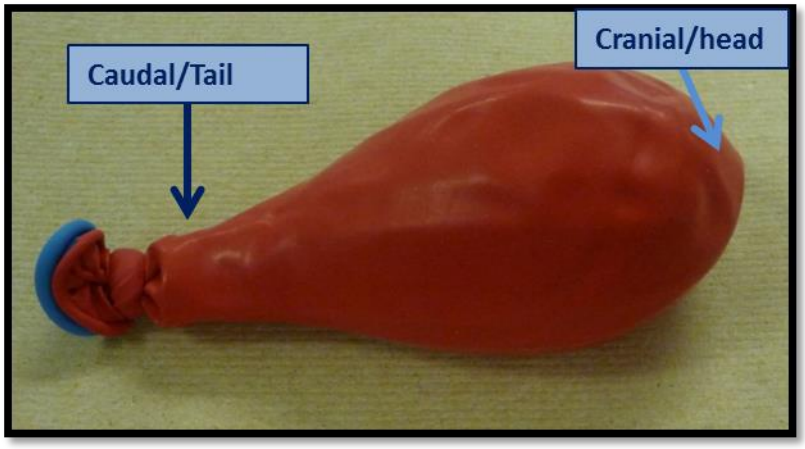
d. Aseptic Technique Training, Practice and Assessment

i. Glo Germ™

Glo Germ™ is a commercially available product. More information is available at the following link: http://www.glogerm.com/

ii. FP Balloons™

This tool is also used for demonstration, teaching and practice of mouse handling and restraint; and rodent intra-peritoneal and sub-cutaneous injection; and rodent surgery practice (refer to The Joy of Training Volume 1 for non-surgical tools)



Ingredients:

- 1 - Container of 3“ Fart Putty® (FP) or a similar product *
- 2 - 12” balloons in contrasting colors from each other and from the FP
- 1 - 5 cm piece of 6 mm width pipe cleaner (optional)

Instructions:

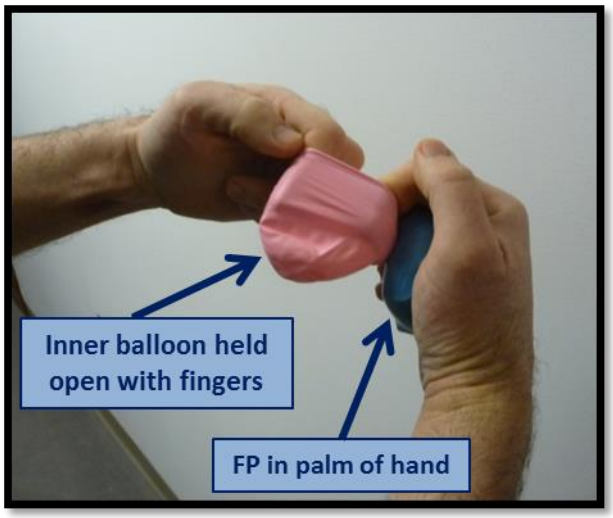
1. Fill one balloon with the FP or a similar substance
2. Tie off the FP-filled balloon leaving a moderate degree of laxity to the balloon
3. Insert the FP-filled balloon into the second balloon
4. Tie off the outer balloon leaving a moderate degree of laxity to the balloon

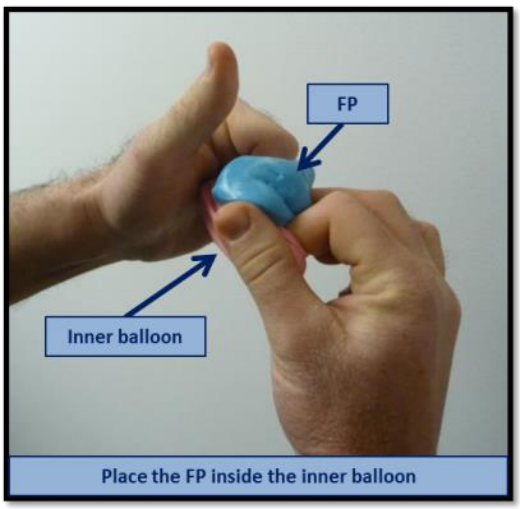
** Recipes are available online to make a similar product to Fart Putty®
http://www.stevespanglerscience.com/lab/experiments/glue-borax-gak

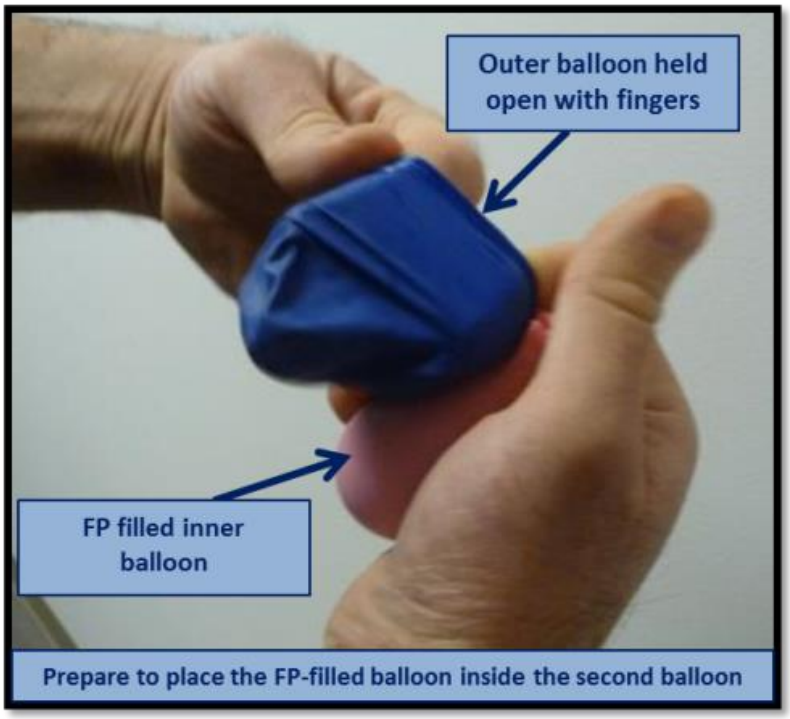
OPTIONAL STEP 1: After completing step 3, insert a syringe filled with fake blood between the two layers of balloon. Dispense some fake blood from the syringe between the internal and external layers of blood. The blood will ooze a little from the incision as the outer balloon is cut and during suturing. Hemostasis can be practiced with this version of the tool.

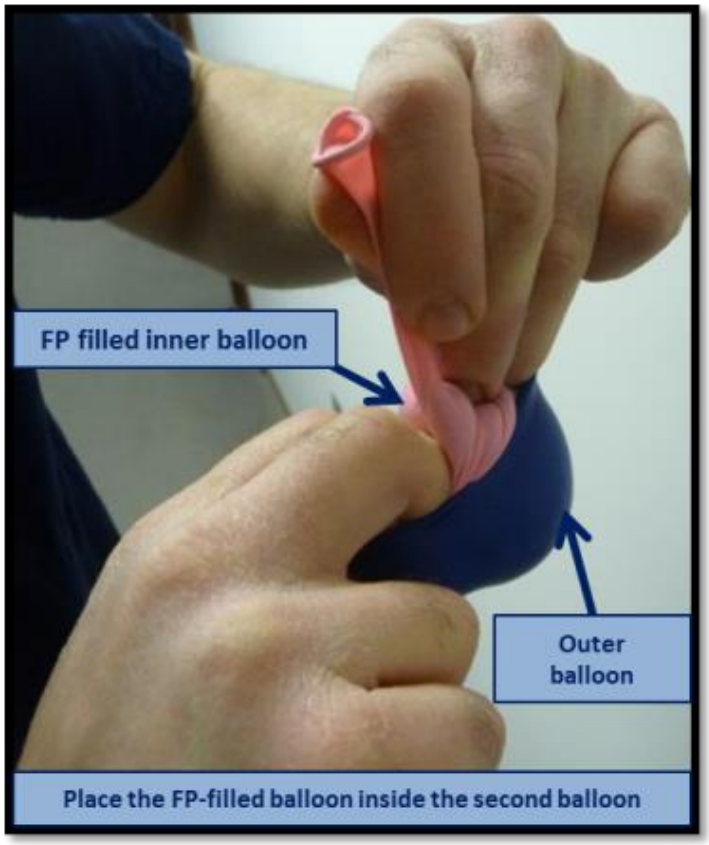
OPTIONAL STEP 2: After completing step 3, insert the pipe cleaner piece between the two layers of balloon. Orient the pipe cleaner piece longitudinally. The pipe cleaner is intended to mimic the spinal vertebrae. We have used this version of the tool when practicing spinal cord lesion surgery.

Images to help guide the process of making an **FP Balloon™**






Outer balloon held open with fingers
FP filled inner balloon
Prepare to place the FP-filled balloon inside the second balloon


FP filled inner balloon
Outer balloon
Place the FP-filled balloon inside the second balloon

References

Dr. Michael Patkin https://mpatkin.org/index.htm

American Association of Laboratory Animal Science (AALAS) Learning Library Module on Aseptic Rodent Surgery https://www.aalaslearninglibrary.org/

Glo-germ™ http://www.glogerm.com/

Surgireal™ http://surgireal.com/

Smooth-on™ www.**smooth-on**.com/ and https://www.youtube.com/watch?v=G6HdZpXdEiM

http://www.stevespanglerscience.com/lab/experiments/glue-borax-gak

http://www.dasiesurgery.ca/DASIE/DASIE.html

Acknowledgements

We are grateful to Dr. David L. Holmberg, BS, DVM, MVSc, Diplomate ACVS, 1949-2008; formerly of the Department of Clinical Studies at the Ontario Veterinary College (http://www.dasiesurgery.ca/DASIE/Holmberg.html). Dr. Holmberg was an inspirational surgical instructor who was known for creating innovative methods of teaching surgical techniques. Dr. Holmberg was also the creator of the DASIE, a surrogate device used by many medical and veterinary schools to teach basic surgical skills without having to sacrifice animals. His instruction during Wendy O. Williams' veterinary training helped to seed the concept of the Dexterity Tools implemented in this training curriculum.

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