Suture Materials, Patterns and 'What Knots'

Anne Madeleine Sylvestre BSc, DVM, DVSc, CCRP
Diplomate ACVS/ECVS

There are many different types of suture material and suture patterns used in veterinary medicine. My training taught me to choose a suture material and pattern based on the specific biologic environment and needs. The truth is that we tend select partially based on the suture material’s properties but mostly based on our preference and inventory.

Suture Materials
The characteristics of a braided material vs a monofilament are well described in textbooks. Mostly practitioners choose one over the other based on the feel and handleability.

Why use braided vs mono
All have similar tensile strengths (tensile strength is defined as the force a suture can withstand before breaking) in the beginning at approximately 12-16 newtons.

PDS (polydioxonone)- retains 80% of its strength at 2 wks, 44% at 8 wks and is completely absorbed within 6-7 months. The blue dye disappears from the suture before the suture completely dissolves so several months later the PDS found within tissues will appear clear.

Vicryl (polyglactin 910) - retains 75% of its strength at 2 wks, 25% at 4 wks and complete absorption around 2.5 months.

Monocryl (poliglecaprone 25) - retains 60% at 1 wk and 40% at 2 wks and 30% at 4 weeks; absorption is complete at 3-4 months.

Breakage of suture occurs at the knot 74% of time because of shear stresses between the loop and 1st throw.

If a practitioner performs mainly routine surgical procedures such as spays, neuters, cystotomies, wounds and lumpectomies; and wishes to minimize the different types of suture inventory; then a material like Monocryl or vicryl would be an excellent choice. Both have plenty of strength in the short term and are quickly absorbed. Quick absorption of a material is important especially when subcuticular patterns are used. With subcuticular patterns, be sure to stay out of the dermis, especially with a braided suture. There are hair follicles within the dermis and they harbour bacteria. The combination of braided material and bacteria may result in increased inflammation.

On the other hand, a practitioner that likes to do surgery and performs a larger variety of surgeries, may want to add a material that holds its strength longer, such as PDS. For instance, closure of a long linea alba incision in a labrador type dog with a simple continuous pattern would be more secure with PDS than with monocryl or vicryl.

Needles
The types and sizes of needles are even more varied than the suture material. Note the type that you like and keep on ordering it. The cost of the suture material is the needle that comes with the suture. Determine the type of needle that you prefer to work with and be sure to order your suture with the appropriate needle. Typically, heavier the suture material is used on larger patients and therefore may be better 'equipped' with a larger rather than smaller needle. My preference for absorbable suture materials is a CT-1 needle on 2-0 or larger and an SH-1 for 3-0 and 4-0.

Suture Patterns and Knots
Knot security depends on the type and size of suture material used; the number of throws; the suture pattern and the surgeon's experience. In general, braided suture material has better knot security than monofilament. A recent study showed that Vicryl, Caprosyn, Ethilon, Monosof and
Surgipro only require 3 throws to have a secure knot whereas most other suture materials require 4 throws. Previous reports indicated that 5-7 throws were better for the beginning knot of a continuous suture pattern but a recent study found that 4 throws for the beginning knot were sufficient and there was little advantage to additional throws. The end of a continuous pattern has 3 strands incorporated into the knot, making the knot much bulkier and therefore likely to untie. Failure of a continuous pattern therefore typically occurs at the ‘ending’ knot. Surgeon with experience had 73% of knots secure whereas student at 59%

Knotless subcuticular pattern: Enter the beginning of the incision by starting in the skin adjacent to the incision. take a subcuticular bite on the left side then on the right side creating a “box-like” effect with the suture. Then take a smaller bite on the left side within the first bite and repeat the same on the right, a smaller bite within the first one, creating a small box within the first ‘larger’ box. Tug gently and evenly on the suture to close the beginning of the incision. The ‘box within box’ pattern will effectively lock the suture in place. Continue the subcuticular pattern as usual to near the end of the incision and repeat the ‘box within box’ pattern. Pass the needle into the subcutaneous tissues and exit through the skin adjacent to the incision.

The Slip knot: When dealing with tissues under a mild or moderate amount of tension, a slip knot is a great solution for apposing the edges while applying a controlled amount of tension on the suture. The slip knot is simply a square knot that is allows the suture to be tightened in a controlled fashion over the tissues. Once the desired effect/knot placement position has been achieved, the slip knot is allowed to revert to a square knot. Start by creating a normal single throw using the needle driver (wrap right end of suture around needle driver and grasp left end of suture, pull suture through the). Once the second throw is created, do not allow the suture ends to cross over (as with a square knot) and maintain tension on the one strand of suture until the desired tissue apposition has been reached.

Tissue glue: Tissue adhesives (cyanoacrylate) are used frequently in practice. They are supposed to replace suture that is a 5-0 in size, so be sure to have a good subcutaneous layer. The edges of the incision must be approximated and the glue is placed on top of the epidermis of the apposed wound edges, effectively binding the two sides of the incision. The glue will be sloughed as the epidermis undergoes its natural course of exfoliation (5-10 days).

References
Marturello DM, McFadden MS, Bennett RA, Ragetly GR, Horn G: Knot security and tensile strength of suture materials. Veterinary Surgery, 2014, 43; 73-79