

The Ties That BIND and The Bindings That Tie

by Norm Kidder

At the cosmic scale things are held together by gravity. At the molecular/nuclear level, electromagnetism does the trick. In our world it's friction and adhesives. A nail or screw depends on friction, as does a knot. The greater the friction the stronger the binding. Friction is a function of surface contact (which increases with rough textures) and pressure. Adhesives generally work by greatly increasing the area of contact (their opposites - lubricants, reduce contact). A loose knot may work if there's enough surface contact, and a very tight knot needs little string. Each binding method is suited for different situations - permanent versus temporary, binding material available, material to be bound and your skills.

As a Boy Scout I learned many useful knots and lashings that served me well in most circumstances. As I got into primitive skills situations, some of these knots continued to work while some entirely new needs turned up. The following is a compendium of my thoughts on this "bind" we find ourselves in as well as some of the more useful bindings one might need, and descriptions of some varied natural binders and special ways of dealing with them.

Tying knots with flexible cordage (thread, string or rope) is pretty well covered in books put out for Scout groups, sailors, etc. so I won't dwell on them here. Instead I will concentrate on bindings which work using found, natural binding material and some specialized cases where the books I have read don't provide information.

Some binding terminology:

1. **Knot** - technique for attaching things with cordage.
2. **Bend** - knot used to attach one cord to another.
3. **Hitch** - knot used to attach a cord to something else (often a pole).
4. **Lashing** - knot used to hold two or more things to each other.
5. **Lacing** - techniques used to connect a piece of fabric to something else along its edge.
6. **Active end** - end of a cord that you're working with.
7. **Standing end** - part of a cord that's left behind in the binding. Or the fixed end of the cord..
8. **Open loop** - 'U' shaped turn in a cord (the ends don't cross).
9. **Closed loop** - 'O' shaped turn in a cord where the ends simply lay one on top of the other.
10. **Overhand loop** - 'O' shaped turn in a cord where the ends intertwine around each other

11. Weave - working the running end over, then under, then over . . . a series of adjoining strands.

12. Frapping - wrapping a cord around two or more parallel bindings and pulling them together, tightening both.

13. Gordian Knot - a knot you untie with a cutting tool.

Working With Stiff Stuff

The most common problem with 'instant' natural binders is that they are stiff (except for wet rawhide). Most knots don't work well, with a few exceptions. Knots in string typically increase friction by creating some kind of loop in the cord. Picture, if you can, a square knot, as two interlocked open loops. Pulling around a corner increases pressure tremendously, so friction soars. Many stiff materials refuse to make tight loops, but improving surface contact can increase friction. A good example of a knot that uses surface contact is the clove hitch.

Review of Binding Material

1. Whole Vines, Roots and Shoots. Whole vines, roots and willow branches can be used in many crude binding situations. They have the disadvantage of being round, and often stiff. If dry, they are brittle, if green, they shrink while drying (in diameter, not length) and loosen. A stiff, round cross-section limits the surface area in contact and therefore the friction. If stiff, contact may not be continuous, further reducing the friction surface and ability to pull tight. These work best tying bundles of soft material such as grass or reeds that compress easily, increasing friction surface and conforming to uneven bending. Their greatest advantage is lack of preparation time, just cut and use.

2. Willow Wythes. Increased flexibility is achieved with whole shoots by twisting the stems back and forth around their axis. This separates the individual fibers and lets the wythe act like a piece of single ply cordage, with greatly increased friction.

3. Bark Strips. Willow, maple, basswood and many other woody plants have bark that can be stripped off in long strips when the sap is flowing. These ribbon like strips are normally much stiffer than cordage, but being flat have a large friction surface and can be very strong when tied with appropriate binding techniques. When stripping single pieces, they tend to get smaller as you pull. I find it best to cut a stick about an inch in diameter and peel the whole thing at once into two strips. I can further split these down later. Bark strips can be dried and re-soaked, which also makes them a bit less prone to loosening through shrinkage than when used green. Some barks can also be separated into layers, increasing the quantity and usability of the material. Bark bindings will become quite stiff when dry, making it difficult to retighten them, but reducing the chance they will come loose even after shrinking.

4. Split Shoots. Many woody materials are split for use in basketry. In the west, willow, redbud, sedge roots, spruce and pine roots, and buck brush to name a few can be split into halves or thirds, then the harder central section further split out to leave the flat and flexible cambium layer for binding. This is usually stronger than bark, and can be preshrunk by drying and soaking if time permits. This is excellent for long term projects, but may be time consuming for quickie, disposable applications and takes a bit of practice to perfect.

5. Reeds and Grasses (and other stringy leaves and stems). With few exceptions, reeds, sedges and grasses are not very strong, but may be sufficient for quick tying of bundles for transport. They are best used when cut and wilted (partially dried to a leathery feel). This happens naturally to reeds attacked by muskrats or insects, so check out the stand for yellow colored stems. All these materials become much stronger when twisted into one or more ply cordage.

6. Yucca-type Leaves. The long, straight, and somewhat flat leaves of some agaves, yuccas and their relatives, New Zealand flax, and a few similar leaves can be used much like bark strips. Agaves are usually too flat unless they have dried out, and also may contain irritating juice. These may be used whole or split depending on their shape and state of dryness. When time is available to process them, they can produce progressively finer cordage.

7. Single Ply Cordage. Single ply refers to a bunch of fibers, either separated (like rope) or in a soft matrix (like reeds) which is uniformly twisted around an axis (either clockwise or counter-clockwise). Twisted fibers do not receive strain along their length, but at an angle, giving them some stretch. This elasticity allows them to take up shock gradually, reducing the risk of breaking. Also, as the separate fibers rub against each other, this friction helps equalize the load, allowing them to work together. In untwisted cordage, strain builds up in the shortest fiber first, until it breaks, then the next, and so on. Disadvantages include more time to make than some of the above and a strong tendency to unravel if not in use. Good for fixed bindings but not for fish lines, nets, or bowstrings, etc.

8. Two Ply Cordage. Two ply is made by wrapping two single plies around each other in the opposite direction of the twist in the plies (both plies must be twisted the same direction). This counter twist creates friction between the plies, holding them tightly together, and limiting unraveling to the ends. This cordage is the strongest in almost all situations (except for three-ply, which is really hard to make by hand).

9. Braided Cordage. Braiding (or plaiting as it is sometimes called) involves diagonal weaving of three or more strands. Braiding is slower to do than thigh rolling two-ply cordage, but is usually done with flat leaves (cattail, juncus, etc.) which require little preparation. Also, the braid can be kept flat, making it more suitable for some applications than round cordage. As with all flat binding material, it requires different lashing techniques than flexible round cordage, but has more surface area for increased friction.

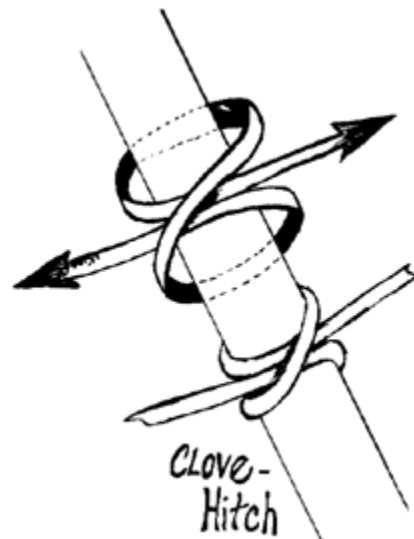
10. Rawhide. Cut strips of rawhide (babiche to French Canadian trappers) bound together snow shoes, drums, houses, clothing, basket rims, and many other items. It has some big advantages and disadvantages. On the plus side: it's easy to make in quantity anywhere large animals are

hunted; when it's wet it is very flexible and takes knots well; when it dries it shrinks in both diameter and length, making it self tightening; and in a pinch, you can eat it. Negatives: mice eat it; when it gets wet, it stretches; when dry, it tends to be brittle; when it gets wet, it stretches (I'm repeating this for emphasis).

11. Leather (braintan of course). Similar to rawhide except that it doesn't shrink up as tight, nor get as stiff and brittle when dry.

12. Sinew. Sinew is the connective tissue that attaches an animal's muscles to its bones. It is very strong and fine. It is used for thread, to make bowstrings, and strengthen the backs of bows. It is good for making arrows, etc., but like rawhide, it may come loose if it gets wet. It is a bit tricky to knot.

13. Animal (including human) Hair. Hair varies greatly in strength, length, texture and usability. Curly hairs spin into the best yarn, while very straight hair wants to slip apart. In primitive skills applications, this is not a likely option (unless you're in Mt. Goat country in the spring). Single human hairs are recorded as quail snares.



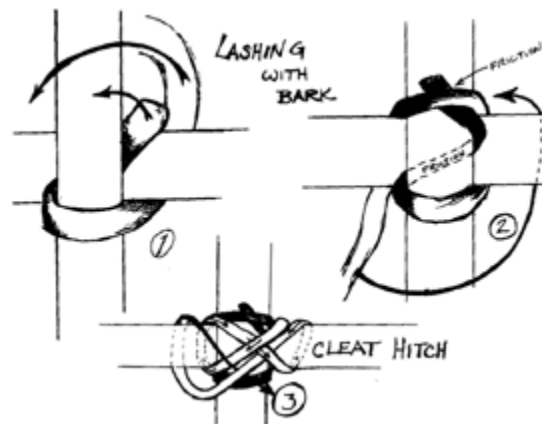
Real Life Applications

You've just collected a bunch of willow stems for basket making and you want to use one of the sticks to tie the bundle together. After neatening the bunch, pick a long stem (I prefer to use one with a gall or other defect) and insert the thick end through the middle of the bundle so that it sticks out the other side. Wrap the thin end around, passing next to the protruding end. The next time around, bend the protruding end over and wrap into the bundle. Finish by tying a clove hitch around half or less of the willow twigs, or, wrap around some of the twigs and push the bent side of the wrapper over one and under the next of the wraps (Figure 2). If the bundle is tapered, finish by pushing the binding towards the thicker end to tighten. A couple of things are

at work here: a lot of wrapping creates a lot of friction; and by starting through the middle of the bundle, the binding can't rotate back and become loose. This same principle applies when wrapping any roundish object. When possible, both start and finish either through the center, or by tying off to a crossing piece (in lashing).



You are building a shelter, and are lashing poles together with bark strips. If you were using cordage, you would start with a timber hitch, wrap twice around in a square, over under pattern, then frap (wrap at right angles to first wraps, tightening them). The end would be secured with a clove hitch. Bark doesn't want to do much of this. Begin by doubling the end of the bark strip over one of the poles. Leave enough overlap so that the double section (with the short end under) crosses over the second pole. Being flat, there should be enough friction to hold. The second round of wrapping should cross over the first so as to increase the pressure on the double section. Finish with a cleat hitch over both ends of one of the poles (Figure 3). Frapping is not very affective on stiff bark, so if the lashing is not tight enough, using a wedge between the poles can tighten it. A wedge can be used to retighten any binding that has become loose due to shrinkage of the wood as it dries.



You are tying a reed boat together with single ply cattail rope. You want to tighten a spiral wrapping but if you pull hard enough on the end to overcome the friction, the rope breaks. Even weak rope can be tightened if you tighten it section by section. Work the binding around, spreading the pull out over as much length as possible. If a rope breaks (or if you need to extend a binder), attach by creating a short piece of two-ply cord instead of tying a knot. This will hold as long as the rope is tightly wrapped around the bundle. Once the binding is tight, bury any ends inside of the bundle.