



AAC Publications

Know The Ropes: Protection

The "Ins And Outs" Of Sport And Trad Climbing Protection

Along with a rope, protection is the most essential part of the climbing system. A bolt and quickdraw, a cam or nut—these are the things that keep climbers from taking dangerous ledge falls or hitting the ground. While not the most common cause of incidents reported in *Accidents*, failures of a lead climber's protection system occur frequently.

In 2012, for example, *Accidents* recorded data on 11 incidents where protection pulling out was the immediate cause of an accident. Placing no protection or inadequate protection were contributory causes for 27 accidents. Similar numbers were reported in 2013. So the lead climber's protection system, or lack thereof, is clearly worthy of consideration as climbers strive to be more skilled, more prudent, and less accident-prone.

While many climbs present rock features that cannot be adequately protected, the vast majority of failures of the protection system do not happen on such routes. As accident statistics continue to demonstrate, an error in judgment, a misunderstanding of protection systems, or lack of technical prowess are more often to blame when the protection system fails in some way.

In this installment of Know the Ropes, we will present perspectives and concepts designed to consolidate best practices in the implementation, evaluation, and reliance upon a lead climber's protection. We will cover the two main genres of rock climbing: sport climbing and traditional climbing.

SPORT CLIMBING

While sport climbing is not the most easily categorized genre in climbing, we will rely on this definition: On sport climbs the entire protection system involves bolts and quickdraws; all bolts adequately protect the lead climber from ground or ledge falls (except in cases of human error); and the anchor components are fixed and permanent.

Sport climbing was created to optimize physical and athletic difficulty by de-emphasizing equipment challenges. Since the lead climber does not need to evaluate the rock, place his or her own gear, or make choices about the frequency and position of those placements, how is that accidents still occur? What kinds of protection-related best practices could reduce the number of sport climbing accidents?

Clip Quickdraws Correctly

When a leader climbs up to a quickdraw and connects the climbing rope, there are two main variables: (1) where the leader's body is positioned on the climb relative to the quickdraw, and (2) how the climbing rope interacts with the carabiner being clipped.

The first variable is easy to imagine. If the lead climber falls before he/she can successfully clip a quickdraw, the fall length will be shorter if the quickdraw is at the leader's waist or chest level. If the

lead climber reaches overhead to clip the rope into a quickdraw, extra slack will be needed, thereby increasing the fall length if the leader fails to make the clip. Often, doing one more move to reach a good hold will make for an easier clip and less rope to pull up. If this is imprudent or impracticable, the lead climber should be hyper-vigilant and careful when clipping overhead.

If the leader finds he or she can't reach a good clipping hold or must clip from an out-of-balance stance, two temporary measures may be useful:

(1) Use a "stiff draw," in which a stick or other stiffener is taped to the quickdraw so it can be grasped low on the draw, giving the leader a few extra inches for clipping out-of-reach bolts.

(2) Clip a quickdraw to a distant bolt and then extend it with one or two additional draws clipped to the first. This allows the leader to clip the rope without pulling up additional slack. For redpoint attempts, a longer draw or sling can be left in place.

In both of these cases, the leader should place a normal quickdraw on the bolt and clip the rope to it as soon as he or she reaches a better stance.

The second important variable in clipping is found in the simple connection between a climber's rope and a bolt. Common errors include backclipping, gate interference, and carabiner leverage. To avoid all of these errors it is important to remember a few critical concepts.

First, the lead climber's rope should always travel along the plane of the rock, enter a carabiner from the rock side of the carabiner, and connect to the climber on his/her side of the carabiner's plane. If the rope is "backclipped" [see photos] it can unclip itself from the carabiner when the rope runs over the gate during a leader fall.

Second, a quickdraw should be clipped to a bolt so that the carabiner gates are oriented away from potential interference from rock features like knobs or other protrusions.

Third, to mitigate the risks of a carabiner coming unclipped from either the bolt or the rope, it's important to assemble your quickdraws so that both carabiner gates are oriented in same direction. The quickdraw always should be clipped to a bolt so that the gates of the carabiners are oriented in the opposite direction from the leader's anticipated direction of travel. This helps to prevent the rope from rubbing over the gate or pressing against the carabiner's gate in the event of a fall, potentially unclipping. This also helps prevent the lead climber's motion and the corresponding rope action from levering the carabiner gate against the bolt hanger, possibly causing it to unclip [see photos].

Here's an example: If a climber is ascending a corner and all the bolts are on the left wall, which way should the gates on the quickdraws face? Answer: All the gates should face to the left, away from the climber.

Be cognizant of the different ways the lead climber's rope and body movements can jostle and alter a carabiner's position. In the case of a bolt, for example, a quick upward movement can cause a carabiner to load horizontally, backclip from the bolt, or be levered by the bolt hanger. Take a quick look at the draw after you move past it to make sure you didn't move it into a dangerous position.

If a route causes unusual concern about quickdraws unclipping, assemble a quickdraw with one or two small locking carabiners. Some climbers like to use a quickdraw with locking carabiners on the first bolt of every sport climb—or the first bolt above a ledge.

Finally, even though most sport routes are intended to be climbed without supplemental protection, in some cases placing an additional piece can prevent dangerous run-outs—or simply ease the mind.

Check the guidebook for gear recommendations—does it suggest a particular nut or cam?

Use Reliable Bolts

Bolts can fail for a number of reasons. Maybe they were placed improperly, they could be past their useful life, the rock around them could be compromised, or they could be corroded. While it is tempting to regard bolts as “bomber” protection, all climbers should consider the blind faith they place in these critical links.

Since the developer of a given route is usually not on hand to ask directly, how should lead climbers evaluate a bolt’s integrity? There are three main clues: corrosion, the rigidity of the bolt stud, and the tightness of the hanger.

Many bolts were not designed to be used in an outdoor setting, and extensive visible corrosion should be an immediate warning for a lead climber. Bolts also may be corroded inside the rock with no visible damage. Corrosion is especially common in marine settings (like seaside cliffs), wet or humid venues, or bolts placed in consistent seeps or drainages; climbers should be particularly vigilant in these environments.

If the bolt stud moves up and down, pulls in or out, or if it has visibly damaged the surrounding rock, due to leverage, there is clearly a problem. A quick outward pull on the hanger will usually reveal these weaknesses.

Spinning hangers can be a sign that something is not quite right with the bolt. It is possible a hanger is spinning because the bolt stud has pulled out of the rock slightly. Or a hanger might be spinning because the nut that is supposed to be pinning it against the rock has loosened. In either case, a quick test of the bolt stud, with an outward and side-to-side pull, will suggest whether there is a real hazard. Nuts that have simply loosened from continuous use should be tightened; a slight turn of a wrench should do the trick—the nut should be snug but not over-tightened.

If you suspect a bad protection or anchor bolt, never rely on that bolt alone. Back it up, if possible, or downclimb to better protection before retreating. (Leave a carabiner/quickdraw on a good bolt and lower to the ground.) If you spot a bad bolt and don’t have the tools or expertise to fix it yourself, let the local community know with a note or online post.

Avoid Worn Or Defective Carabiners

Through repeated use, carabiners eventually become worn and grooved. Deeper grooves create sharper edges, and particularly sharp edges can knife the sheath off a climbing rope or sever it altogether. Similarly, repeatedly clipping an aluminum carabiner to a steel bolt or cable can cause burrs, abrasions, and rough teeth on the carabiner’s otherwise smooth surface. Much like any serrated material, these burrs can seriously damage a climbing rope.

With the increasing popularity of pre-hung draws on sport climbing projects (this includes chain, cable, and nylon quickdraws), more ropes are being cut by carabiners that have been worn and have sharp edges. For example, in 2010, in the Red River Gorge, a leader clipped his rope into a quickdraw that had been left earlier on the first bolt of a difficult route. When the leader fell before the second

bolt, his rope severed on the badly worn carabiner in the fixed draw and he hit the ground, suffering head injuries. While technology continues to make carabiners lighter, this can also cause them to wear faster.

Ideally, every carabiner in the protection system should be carefully inspected before use, though this is not always practical (especially when attempting onsights). Yet some climbers still blindly head up every route assuming the fixed gear is in good condition. While the send is important, it is not as important as making sure the equipment is in good shape.

It is advisable for lead climbers to always hang their own quickdraw on the first bolt of a sport climb equipped with "perma-draws." The angle between the first quickdraw and the belayer tends to sharpen the carabiner on a permanent quickdraw here much faster than the carabiners higher on the route. If the first bolt is left empty as a standard practice, much of the deep grooving caused by the rope can be avoided, or at least concentrated on the leader's personal quickdraws. This also makes for easier stick-clipping.

Additionally, any fixed nylon quickdraws should be considered suspect unless you know their history. Damage from UV radiation can degrade nylon and cause the dogbone on a quickdraw to fail.

Burrs and grooves on carabiners are not only problematic with fixed draws but with your personal quickdraws as well. For example, bolts can cause abrasions in the carabiner's aluminum frame that can shred a climbing rope. To reduce this risk, dedicate one carabiner on each draw to clipping the bolt and one to clipping the rope.

Avoid Unnecessary Risks

Stick-clipping the first or even the second bolt of a route is a great way to prevent a ground fall. If the first bolt is 15 feet off the ground, the next bolt should be no more than 5 feet higher if it is going to protect a leader from ground fall, given rope stretch and displacement of the belayer as he or she catches the fall. But many sport routes do not adequately protect a leader from ground fall in the first 20 feet. If they haven't stick-clipped, lead climbers then have to make a personal choice about whether to proceed. Too often, climbers rely entirely on their own ability to get them out of trouble. When a hold breaks or moves prove to be harder than predicted, it is too late to make an informed decision.

Sometimes, when the main difficulties of a sport climb have passed, lead climbers will confidently saunter into ground-fall or ledge-fall terrain, eschewing protection along the way. Skipping bolts and taking victory whippers are two common examples of unnecessary risks.

TRADITIONAL CLIMBING

Every protection failure that can occur in sport climbing can also occur in traditional climbing. A climber should be just as concerned about faulty equipment, clipping hazards, fixed hardware, and making informed choices in a traditional environment as at a sport crag. Moreover, traditional

climbing involves vastly more variables, decision-making, and risk management. Creating and managing the protection system in traditional climbing takes expertise, craft, and artistry. Sadly, failures of the protection system usually result from human error.

In this section, we will discuss some important factors in creating a reliable protection system. We will discuss the placement decisions that result from an understanding of rock quality. Lastly, we will discuss fixed gear and route selection.

Protecting The Pitch

Protecting the pitch is a term that is thrown around a lot, but what a climber is actually doing is creating an integrated protection system. For example, most climbers understand that the terrain before the first piece of protection has an unavoidable ground-fall consequence. From the first piece on upward, the lead climber is creating an integrated protection system that is supposed to mitigate the risk of ground fall, ledge impact, or other incidental impacts (hitting a slab, swinging into a corner, etc.). Unfortunately, lead climbers often climb into ground-fall terrain again before placing their second piece, or fail to protect sections altogether if the climbing feels fairly easy.

As in sport climbing, if you place a piece of gear 12 feet off the ground, your next piece must be no more than 4 feet above this to avoid a potential ground fall. (This is also true of any protruding terrain features like ledges.) Once you are well above the ground you can start to space gear farther apart, but it is prudent to always have a couple of pieces keeping you off the ground in case one fails. (If you find yourself with less than optimal protection, doubling up a placement is a good way to work some redundancy into the system.) In general, climbers should consider the consequences of going more than 10 feet between protection placements—falls of 20 feet or more may easily generate the kinds of forces that can seriously injure a climber, especially on less-than-vertical terrain.

Special consideration must be given to the first piece of gear. It should be able to hold an upward force as well as downward force to prevent zippering. Zippering is when multiple pieces of protection pull out as the rope impacts them in a fall— protection may zipper downward or upward. Depending on the angle between the belayer and the first piece, upward force may be generated when a fall happens and the first piece can be yanked up and out. In some cases, the subsequent pieces may fail in succession due to a similar angle in the rope. [See photos above.] In severe cases, it is possible that the only piece left would be the one that the climber fell onto, thereby reducing the entire protection system to a single piece of protection. Thankfully, most modern cams are designed for multidirectional pulls. They make excellent choices for the leader's first piece.

Placing Protection

It would be impossible in an article of this length to fully discuss the placement of removable protection. Suffice to say, all removable protection generally relies on the same principles. When protection fails, it is almost always because one or more of those principles was ignored, overlooked, or misinterpreted. Removable protection requires sound rock quality (discussed later), security and stability, optimal surface contact between the piece and the rock, and an orientation that anticipates the loads that will be applied to it. Trad climbing is full of delightful trickery, but efficient leaders recognize that square pegs pretty much go in square holes.

Orientation: Cams, nuts, tricams, and hexes should all be placed in ways that anticipate the loads that will be applied to them. Nuts should be placed in constrictions in the rock that point downward. Cam stems should point toward the fall line. Hexes and tricams should lever along the fall line. Make no mistake, a lead fall will load the top piece of a protection system along the fall line, so it should be

placed accordingly.

Security and Stability: Once a piece of protection is placed, a variety of forces interact with that placement. Some of those forces can alter the orientation and quality of the placement. The rope, drawing through a carabiner, can swing a placement back and forth. In the case of cams, this side-to-side action can cause cams to “walk” out of their optimal placement. If the swinging motion of the rope creates an outward pull on nuts, hexes, or tricams, they can be lifted out of their constrictions. Managing the path the rope follows is essential if cam and nut placements are to be secure. An appropriate length of extension (usually a long quickdraw or standard 24-inch or 48-inch nylon/dyneema sling) usually can mitigate this problem, because rope action tends to interact directly with the sling, instead of the placement. Another common tactic with nuts, hexes, and tricams is to give a light tug on the placement, thereby mashing the aluminum unit into the rock slightly. (Tugging too hard can make the unit difficult to remove, however.) Lastly, try to place cams in parallel features where you don’t anticipate they can walk.

Square Pegs in Square Holes: It is vital, in terms of efficiency and effectiveness, to place protection in the most obvious ways, in order to optimize the amount of surface contact between the unit and the rock, to make timely choices and placements, and to get the most potential holding power and security. For example, all trad leaders should think of placing a cam when they attempt to protect a parallel feature in the rock. They should think of placing a nut or hex when they see a constriction, and they should think of placing a tricam in oddly shaped pods, pockets, or flares. Cams should be placed within their camming range. Nuts and hexes should have surface contact on all sides of the unit. Tricams should be placed and set within their rotational range. Clearly, there are ways to make any trad piece work in almost any placement, given enough inventiveness. But, when trad leaders resort to putting square pegs in round holes, it should be for unique and demanding reasons, and there should be an understanding of the risks and time cost of these choices. Trad trickery can be an incredible waste of time—and dangerous—if it is indulged too whimsically. It should be needless to say that if gear is so tattered by use and abuse that one can no longer tell if the pegs are round or square, the gear should be retired. When cam slings become visibly damaged or decomposed, they should be replaced. (A professionally sewn replacement sling is an option.) Similarly, frayed trigger wires, nut cables, and hex cables should be replaced with appropriately strong cord or webbing.

Fixed Gear

Many traditional climbs are replete with abandoned nuts and cams, pitons, and aid climbing gear such as copperheads. These can be efficient to clip, but there can be great hazard in using them as well. Leaders always should be suspicious of fixed gear. Some fixed protection can be visually inspected, but, as with bolts, the key components of fixed gear may be obscured or buried. Imagine the wire on a nut that has rusted completely through, a sling that is mostly cut, the axle of the cam that is broken, or a piton that has completely decomposed or destroyed the rock around it. It is wise to back up fixed gear whenever possible.

Pitons are a remnant of the past in most rock climbing venues but are still placed infrequently in the alpine arena. Pins should be considered no good unless they can be tested with a hammer, which most free climbers don’t carry. Pins can degrade behind the surface but still present a good-looking piece. Any corrosion on the pin can be an indication of corrosion deeper in the placement. Is the piton eye bent or cracked? Is there any movement up and down? Does it wiggle side to side? Back up pins whenever possible.

Managing The Rope Line

Unlike sport climbs, protection for traditional climbs may be placed along a wandering crack or other line of weakness, a traverse, a series of overhangs, or other variable features. As a result, keeping the rope running in a straight line is often an intricate challenge. A traditional lead climber should understand that excessive rope drag not only encumbers the leader's movement, it also decreases the dynamic properties of the protection system, thereby increasing potential impact forces on the protection and the lead climber.

A simple assortment of quickdraws will not suffice. Instead, lead climbers must use a variety of tactics to keep the rope running as straight as possible: placing slings of various lengths; possibly climbing with more than one lead rope; and sometimes downclimbing to remove lower protection once a good piece is placed higher up.

A lead climber should also understand that every sling or extension comes with a consequence: If the distance between the protection point and the attachment of the rope increases, the fall distance increases too. Prudent leaders learn to extend only when necessary to straighten the rope line—and only as far as necessary.

Rock Quality

Evaluating the rock is at least as important as knowing how to place gear in it. Often, lead climbers are simply trying to get up a pitch and don't always use all of their senses. Take a look at the rock, first at the big picture and then narrowing to the micro setting. Is this a solid crack or a flake of rock sitting on top of another rock? Can you see debris, ice, or vegetation inside the rock? Look at everything.

Next, how does the rock sound? Using a larger cam or nut to bang around the rock can help determine if a rock is loose, hollow, or perfectly solid. (An open palm or door-knocking motion also works.) The rock provides valuable clues about the viability of a placement. Is it loose? Crumbly? Slimy? Icy or wet? Try to use as many senses as possible to create a complete portrait.

When a leader must resort to placing gear in less than ideal rock, passive gear may create less prying forces on the rock than cams will; passive placements also may be more secure in flakes or jumbled boulders. Look around for other options. A solid placement off to the side of the route—with appropriate extension—may offer better protection than a placement in poor rock directly on the line. In softer rock (desert sandstone, for example), the leader should place pieces closer together to minimize fall forces. Double up on smaller pieces to decrease the odds of a catastrophic failure.

Route Selection

When we head out to the crag we should pick routes within our climbing ability, risk tolerance, and technical ability. For example, take the Original Route on Whitesides Mountain, North Carolina, which is rated 5.11a or 5.9 A0. If you are a 5.12 climber but are uncomfortable with long runouts or multi-pitch climbing, this may not be a good route for you. Any of the pitches could be considered "R-rated," and the first pitch, while only 5.7 slab, is mostly a free solo. However, if you are a solid 5.10 leader with extensive traditional climbing experience, and these pitches are within your risk tolerance, this

can be a very manageable route.

To develop your skills as a leader, work up through styles and difficulties of routes to gain situational awareness. Reading topos and getting info from guidebooks and online resources also will help you pick an appropriate adventure and start the risk management process.

PUTTING IT ALL TOGETHER

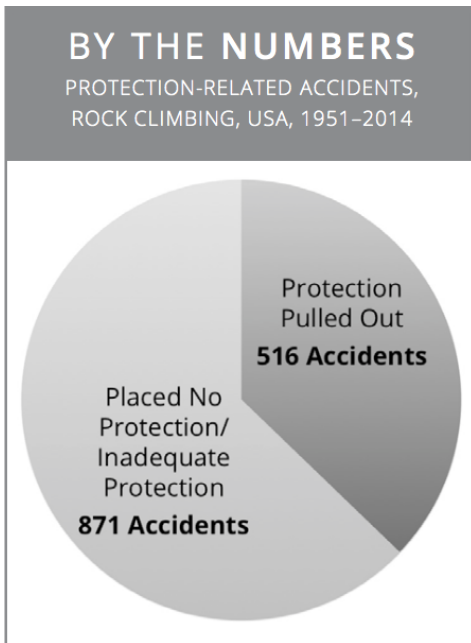
If there is a theme that unites all of the strategies in this article, it is simply that informed decision-making is a huge part of safer climbing. Before a lead climber makes any move, there should be an understanding of the stakes of that move. What happens if a hold breaks? Where is my next protection? Given my strength and skill, what is the likelihood that I will make this move without falling? Stress, fatigue, social and performance pressures, and blind faith all are distracting, and these circumstances inhibit sound decision-making in any sport. But in climbing the consequences can be especially severe. While risk in climbing is inevitable, understanding and following the practices we've addressed in this article will mitigate that risk and prevent many accidents.

About The Authors:

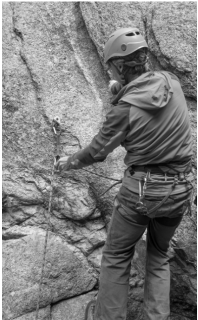
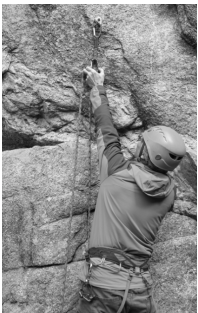
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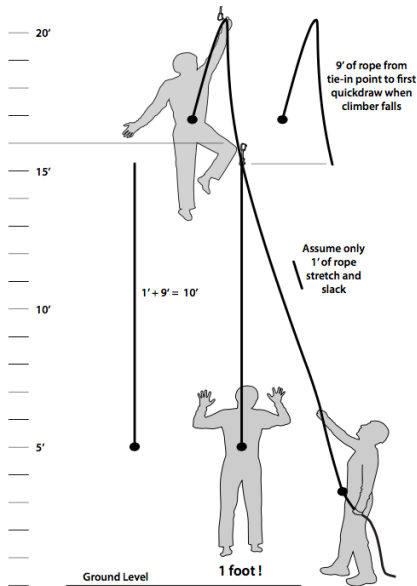
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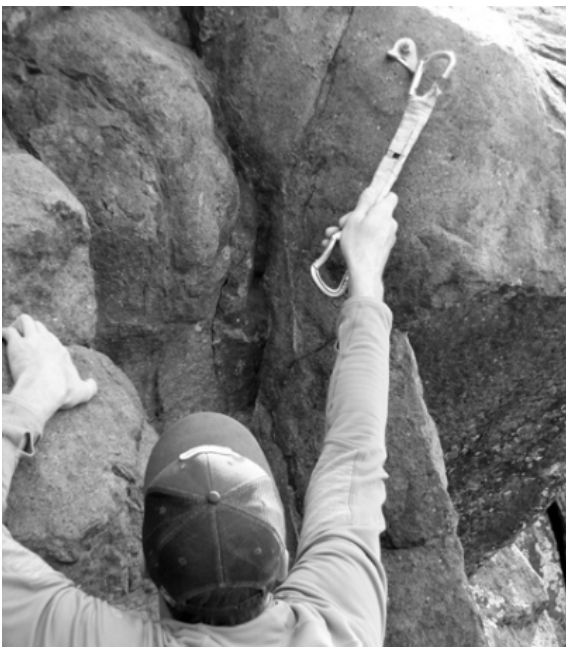
Protection-Related Accidents, Rock Climbing, USA, 1951-2014



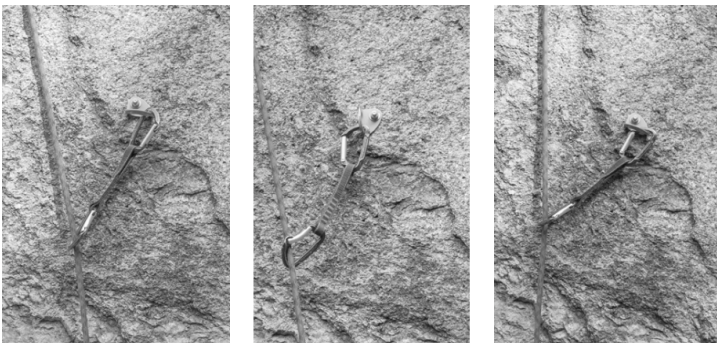
[Top] The lead climber is stretching to clip overhead. Unless the clipping stance is very good, this generally isn't recommended because the extra rope can make for a big fall if the climber slips while clipping. [Bottom] It's often best to clip at waist or chest level. This uses less energy and results in less slack in the rope system should the climber fall while clipping.



This illustration shows what can happen if the leader falls while clipping an overhead bolt. Though clipped into a bolt 16 feet up, he stops only one foot above the ground; with additional slack or rope stretch his feet easily could hit the ground.



Use a "stiff draw" for out-of-reach bolts.



[Left] A properly clipped quickdraw, where the rope enters the carabiner from the rock side and exits

on the climber's side. Ideally, the carabiner gates should be oriented opposite the direction of travel. [Middle] An incorrectly "backclipped" quickdraw. In a fall, a backclipped draw can come unclipped. [Right] Be careful in scenarios such as this, where the upward motion of the rope could cause the carabiner gate to press against the bolt hanger and unclip. Orienting both carabiners on the quickdraw in the same direction can help mitigate this issue.



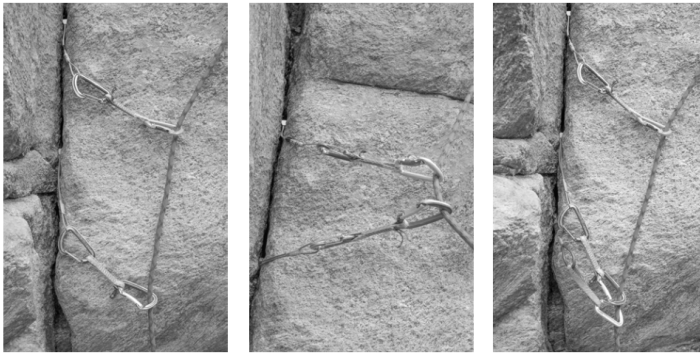
Deeply grooved carabiners. Replace any carabiners that look like this.



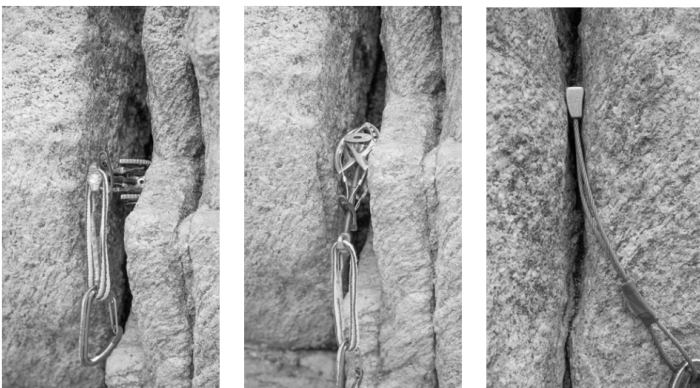
A variety of tools can be used to stick-clip the first bolt of a route. Make sure you do not backclip the draw.



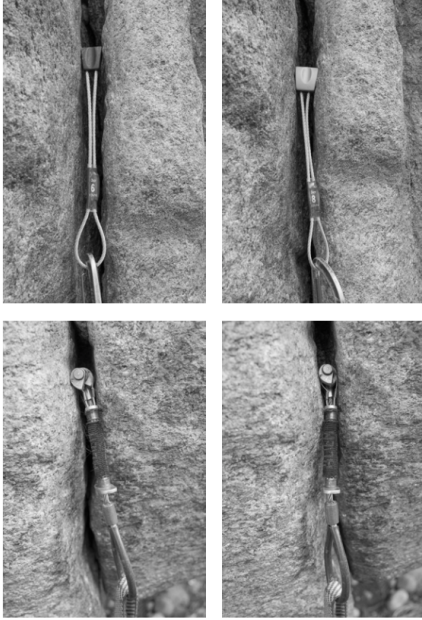
In this composite image, the climber has placed protection at 10-foot intervals yet is risking a ground or ledge fall throughout the first 30 feet of the climb. Place protection early, often, and at cruxes to avoid ground falls or unnecessarily long falls.



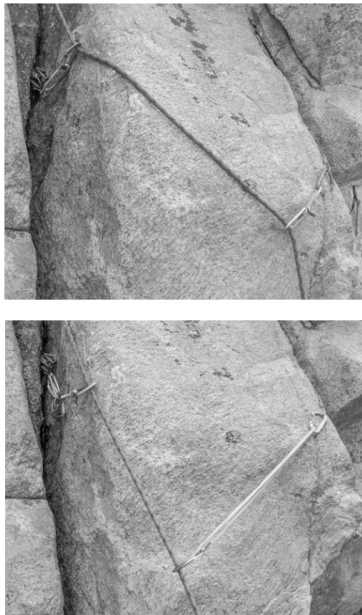
[Left] Nuts are often not a good choice for the first pieces of protection on a pitch. [Middle] As soon as tension is applied to the rope (for example, a fall) the nuts can be lifted up and out of constrictions, causing the protection to “zipper.” [Right] A cam is a good choice for the first piece since it can sustain upward pulls and prevent other protection from pulling out.



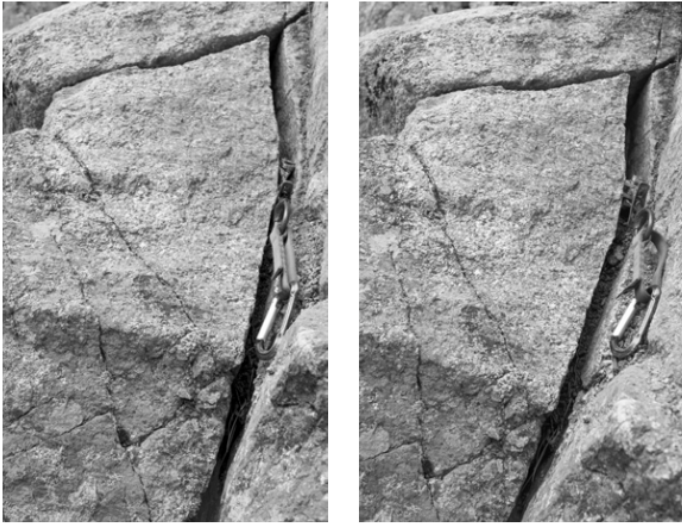
[Left] Don't place protection perpendicular to the rock plane. A fall can cause the protection to rotate and pull out. [Middle] Instead, place protection so that it anticipates the fall line. [Right] Nuts are best placed in downward-facing constrictions.



[Top, left] This nut does not have adequate surface contact on all sides and can pull out or fail. [Top, right] A slightly lower placement yielded a good constriction with optimal surface contact on the sides of the nut. [Bottom, left] The two upper cam lobes are not engaged with the rock. [Bottom, right] Moving the cam down resulted in a secure placement with all four lobes engaged.



[Top] In this scenario the protection is not adequately extended, causing the rope to bend and the protection to "walk." [Bottom] A long sling and quickdraw have been added to the pieces to straighten the rope path and reduce tugging on the protection.



Climbers should be wary of cracks formed by loose blocks such as this. A quick tug drastically expanded this placement.

Article Details

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