Preventing Job-Site Knee Injuries

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An orthopedic surgeon explains what goes wrong with knees and suggests ways to protect them

BY STEVEN D. BOND

wo years ago, Bob had a business as a siding contractor, keeping a couple of crews busy all the time. I met him after he hurt his knee. He was a little behind schedule siding a house and didn't take the time to clean off his scaffold. That afternoon, he stepped on a small cutoff and twisted his knee, tearing three ligaments and injuring a nerve.

I fixed his ligaments, but his nerve damage is permanent. Bob has trouble climbing ladders and even walking across broken ground. He builds wooden toys and birdhouses in his basement now.

John is a roofer who has carried bundles of shingles up ladders since he was in high school. He developed a little knee pain and swelling, but just took increasing doses of ibuprofen and kept going. When John finally came to see me, he couldn't walk down stairs without holding both rails, never mind climb a ladder.

John had so much damage to his knees that I had to operate on him. He's back working almost a year later, but he makes only a fourhour day, and he doesn't climb steep or high roofs anymore because he can't trust his knees not to buckle unexpectedly. If he had followed the exercise regimen in the sidebar on page 75, odds are he never would have needed surgery.

We all recognize that construction is a dangerous occupation, and some accidents are unavoidable. Still, I see a lot of patients whose problems could have been prevented, or at the very least minimized, without much effort. A clean job site and a little maintenance to the tradesman's most important tool, his or her body, go a long way toward preventing injuries.

Knee pads don't help if you leave them in the truck

Working on your knees is a setup to develop prepatellar bursitis, commonly called housemaid's or preacher's knee. I would call it tilesetter's or drywaller's knee.

Knees have a small sac, known as a bursa, in front of the patella, or kneecap. The bursa normally holds a few drops of fluid that allow the skin over the knee to move independently of the underlying bone. Without the padding provided by the bursa, kneeling would always hurt, and we would scrape our knees daily.

Habits that abuse the knee, such as kneeling all day or using a bent knee to hold up sheets of drywall up while securing them (photo right) can cause excess fluid to collect in the bursa. This condition, prepatellar bursitis, makes bending the knee difficult and



kneeling painful. Worse, it sets the stage for a serious infection that may require surgical cleaning to prevent damage to the knee.

If the pressure from prepatellar bursitis is tolerable, I prescribe ibuprofen, a snug wrap and perhaps ice. If the knee is too uncomfortable, I draw out the excess fluid with a hypodermic needle. Failing this, a shot of cortisone in the knee may help, but there is an attendant risk of infection. If all else fails and the knee hurts too much to ignore, surgery is the last option.

Wearing knee pads can usually help you to avoid this trouble (sidebar, p. 73). I favor knee pads with a hard shell and a doughnutshaped pad inside. The hard shell offers good protection against penetrating injuries, and the doughnut spreads the load over the largest possible area. Most important, though, is to buy comfortable knee pads that you will wear. Knee pads that stay in the truck don't help. For drywallers, Stanley/Goldblatt (800-782-6539) makes a simple lever-and-fulcrum device (inset photo above) that slides between the bottom of a sheet of drywall and the floor. Step down on the tool, and it raises the drywall panel tight to the upper sheet without stressing the knee. This drywall lifter sells for about \$15. Knee surgery averages \$5,000 to \$20,000.

Don't stretch carpet with a kneedriven kicker

The classic case where using the right tool for the job makes all the difference is laying carpet. Many installers use a kicker, a tool that stretches the carpet and is powered by blows from the installer's knee (top photo, p. 74). I wince when I see someone stretching carpet with a kicker. Even if the installer is wearing pads, this action traumatizes the attachment of the quadriceps muscle to the top of the kneecap (drawing p. 72). In most

THE KNEE IS A COMPLEX JOINT THAT ROTATES AS WELL AS BENDS



cases, power stretchers can do the same job. They are more expensive and perhaps slower than kickers. But power stretchers are cheap compared with surgery and can allow you to avoid a lot of pain.

Overload injuries frequently damage the same part of the knee that using a carpet kicker does. A typical overload injury happens ifyou're coming down a ladder or stairway and your lower foot slips (photo p. 70). All the load is taken by the other leg, and this action ruptures the quadriceps muscle or tendon (drawing above). I've even seen severe cases where part of the patella was torn off. Avoiding overload injuries can be difficult; the best advice is to keep a clean job site and to exercise caution on stairs and ladders.

This injury must be treated surgically. I drill holes in the kneecap and reattach the muscle to the bone with heavy suture material. A lengthy rehabilitation period follows, and the patient often ends up with some restriction bending the knee.

Do you lift, climb or crouch?

The patellofemoral joint, where the femur, or thigh bone, meets the kneecap, is a com-

mon spot where I see preventable problems. Everyone who engages in physical work or sports ought to do some simple exercises that can help to reduce the risk of knee injury (sidebarp. 75).

In the building trades, stressing the knees by lifting, crouching and climbing is pretty much universal. By the way, choosing between crouching and kneeling is difficult. Medically, sitting on a wheeled scooter board is the best alternative, but that may be impractical. Kneeling with knee pads is probably a close second.

Bending the knees to lift heavy objects places a heavy load on the patellofemoral joint. Regardless, you should bend the knees while lifting to protect your back. Lifting with the legs is always better than lifting with the back. Backs are even harder to fix than knees. (For information about keeping your back healthy, see *FHB* #85, pp. 76-81.)

Most people have misaligned patellofemoral joints

To get an idea of how the patellofemoral joint works, think of a rope that runs around the hinge side of a door and attaches to the knob. To close the door, you pull on the rope. If you want the rope to be more stable, you might cut a groove in the hinge jamb.

That is essentially how the kneecap works. The front muscle group of the thigh, the quadriceps, pulls on the kneecap, which slides in a V-groove on the femur. A tendon attaches the kneecap to the lower leg bone, or tibia. Other parts of the quadriceps run over the kneecap and attach directly to the tibia. When you contract your quadriceps, it pulls through this assembly, straightening the knee or, for that matter, keeping it straight while you stand.

If everything in the knee is perfectly aligned, then the force on the patellofemoral joint is distributed over the maximum area. However, this joint is misaligned to some degree in most people. (When was the last time you remodeled a house that was dead plumb and level?)

Misalignment makes the joint bear loads unevenly, so some areas get more than their share of wear. With heavy use, pain and, eventually, disability set in. This is what happened to my roofer patient, John.

The-early warning signs for patellofemoral joint problems are creaking or snapping noises in the front of the joint, especially when rising from a crouch or when descending stairs, and pain in the front of the knee.

If you have these symptoms, visit a doctor. Caught early, appropriate exercises can make a big difference. If you let patellofemoral problems go, as John the roofer did, your only option may be surgery.

Strong, coordinated muscles help, but they can't prevent every injury

At first glance, the knee seems to be a simple hinge. But the knee is really a complex joint that allows not only bending but also pivoting within a limited range.

Tough, gristly cartilages, the menisci, pad the joint between the femur and the tibia, keeping the bones from rubbing and holding them aligned throughout the knee's normal motion. These menisci are remarkable in that they are self-lubricating, shock-absorbing and usually last 70 years or more. However, the menisci are prone to damage from twisting injuries.

Tripping on clutter is a common cause of twisting injuries. A sideways stress on the knee pinches the meniscus, and a twist tears it. Overloading can cause similar damage,

Meniscal tears can often be removed or repaired by arthroscopic surgery. The area is numbed, and a tube is inserted through a small incision. An internal camera guides this tube to the site of the injury, and the

Pros pick pads

by Andy Engel

I kicked off this informal survey by asking a patternedconcrete floor contractor what knee pads she relied on. "Callous power," she replied sheepishly. She was in the minority, however. I found that tradespeople who kneel—tilesetters, flooring installers, concrete finishers and some carpenters—frequently do wear knee pads.

Bob Rhule, a Maryland flooring contractor, swears by Skitter's pants (photo below; 724-282-8581; pants with pads, \$48). The pads are separate and slide into pouches in



the knees. Says Bob, "They're a floor-layer's dream. I put them on in the morning and don't have to think about them for the rest of the day." Bob claims the nylon pants don't scratch floors and that they're comfortable and durable. He gets about two years' service from a pair of pants and five years from a set of pads.

Steve Schroer, a Colorado carpenter who alternates between standing and kneeling while he lays out wall plates, wears Patella-T pads (photo below; Fluid Forms; 303-527-5190). He says the \$65 pads have doughnut-shaped cush-



ions that keep his knees warm when he's kneeling on cold concrete slabs and that their mesh lining is cool in the summer. And the neoprene cap is durable. After a year's wear, Steve says, "I can still read the Patella-T logo on the front." Further, "They don't slide down my (eg. I fit the lower strap just above my calf, and loosely fasten the upper strap behind my knee so it doesn't cut off my circulation."

"I wear \$8 foam pads with Velcro straps (photo below)," says Massachusetts tileset-



ter Tom Meehan. "I leave them on all day and buy a new pair about every month. Flexing the pad breaks hardened grout free, and the knee pads don't scratch finished floors." Tom doesn't favor a brand, but similar pads are almost universally available.

Matt Mordecki of Farmington, New Mexico, takes a longer view of the economics. A stone- and tile-floor contractor, he spent \$160 on a set of ProKnee (photo below; 888-549-5018) pads. ProKnees are individually



sized. like shoes. "They cradle the knee and the shin. The straps go around the upper calf and the ankle, so they don't pinch behind the knee like other pads I've used." Matt says the hard plastic shell protects his knees from pebbles and nails, and the replaceable synthetic-leather face doesn't scratch floors. Matt's ProKnees are three years old and going strong. Because most of the parts are replaceable, he expects another ten years from them.

Fred Lugano of Charlotte, Vermont, earns his living crawling over the joists in his



customers' attics, sealing costly air leaks. Even in snowy Vermont, attics get hot. Fred uses generic leather-and-felt pads (photo above) that cost about \$20 because "they're absorbent and keep the sweat from dripping down my legs." Also, Fred knows a carpet installer "whose wife sewed the back pockets from an old pair of jeans to the knees of his current pants. He stuffs these recycled pockets with scraps of carpet padding."

Jim Britton, a trim carpenter in Oregon, favors hard-plastic faced pads. "I use Alta Industries (photo below; 707-588-



0230) pads. Instead of a Velcro strap that gets clogged with sawdust and lint, theirs fasten with a regular buckle."

-Andy Engel is an assistant editor at Fine Homebuilding.



Carpet installation is hard on the knees. Carrying ponderous rolls of rug, constantly kneeling and—worst of all—stretching carpet with a kicker set up carpet installers for knee trouble. Power stretchers offer a safer alternative.

Don't hook your foot around a ladder

rung. The author once treated the severely injured knee of a painter who fell backward from this position.

procedure is done with tiny instruments inserted through the tube.

Even repairable injuries increase the chances of arthritis

If we live long enough, all of us will probably suffer some form of arthritis, or the wearing out of joint surfaces. However, traumas, fractures, misalignments or cartilage tears give arthritis a head start.

Treatment for arthritis ranges from antiinflammatory medications such as ibuprofen to cortisone injections into the joint; treatment can bring temporary relief. A new, possibly effective therapy involves injecting a synthetic fluid into the joint. However, this may be little more than the equivalent of adding sawdust to a failing transmission.

Once arthritis damages the joint surfaces, a mechanical repair is needed. This repair can



range from bracing to physical therapy to surgery. Surgery can mean procedures that realign the joint so that forces across it are borne by healthy tissue, smoothing the joint surface or total joint replacement.

Expect trouble when the lower leg stops and the upper leg doesn't

Ligaments tie bone to bone and control the stability of the knees. There is a limit to how much stress ligaments can take. Any mechanism that pushes the knee in a direction it's not supposed to go when the lower leg is fixed will likely injure at least one ligament.

If something traps your foot while the rest of you moves on, you may hear and feel your knee pop. Pops are bad. Mud does this, for example. I once treated a carpenter who tried to save a few seconds by jumping down a couple of feet rather than descend a ladder. His boot went ankle deep into the mud. His upper body kept moving, though, and he tore his anterior cruciate and his medial collateral ligaments (drawing p. 72). Reconstructive surgery and rehabilitation got him back to work, nine months later.

I saw a similar ligament injury in a painter who, in order to reach a little farther, put his

leg through a ladder and locked his foot around a lower rung (bottom photo, facing page). Then he fell. The fixed foot held him on the ladder, and getting him down required the services of the fire department.

Some torn ligaments can be surgically resewn. Others, notably the anterior cruciate ligament, won't heal. For these injuries, the original is removed, and substitute ligaments are taken from elsewhere in the body.

Even minor punctures can lead to infections requiring surgery

Penetrating injuries are serious and happen remarkably easily. An injury to a paperhanger I treated is a good example. He habitually discarded his used trimming blades into his dropcloth. One day, he kneeled on a dropped blade that cut deeply into his knee. I had to take him to the operating room to clean the wound safely and to prevent an infection that could have destroyed the joint.

The danger of infection arises, even from relatively shallow punctures, because the bones in the knee are so close to the surface. Superficial infections can migrate to the bones where, once established, they are difficult to treat. Bone has a limited blood supply, sometimes limited enough that the blood can't carry sufficient antibiotics to the site to knock out the infection. Surgically removing all the infected bone may be the only choice.

Don't avoid the doctor

When should you go to the doctor for a knee problem or injury? Obviously, if the knee is deformed in appearance after an injury. Severe pain, loss of motion and swelling are signs that something is significantly wrong. You should at least find out what the problem is and if there's a fix for it.

If you have even a small penetration injury, followed by redness, heat, swelling and pain, seek medical attention immediately. These symptoms indicate an infection.

Finally, even mild pain that's always in the same area and that doesn't go away with ice, rest, ibuprofen and a gently wrapped elastic bandage is a hint to consult a doctor. Please, read the label on the ibuprofen container. The cautions are there for good reason.

You wouldn't expect abused, unmaintained tools to work well. Don't expect more from your body. Your knees will function well for a long time if treated with respect. Spare parts are available, but they aren't the ideal substitute for the knee you started with.

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Strong knees are less likely to be injured

Stretches and exercises help the knees in two ways. The quad stretch (photos right) makes the quadriceps muscles more flexible, thereby reducing the chance of hurting them or their tendons.

Exercises strengthen the muscles surrounding the knee, enabling them to carry a greater load. This strength reduces the compressive force on the knee joint, making it less susceptible to overload injuries. The exercises also tend to correct minor misalignments of the patellofemoral joint, reducing point-loading and enlarging the surface-contact area, which decreases wear and tear of the menisci.

Do ten repetitions of each of these exercises twice daily, say at coffee break and before bed, except for the last, which should be repeated five or six times a day. These exercises shouldn't hurt. If they do, you may already have some damage to your knees. Please, see a doctor before continuing.

—S. D. B.

Stretching makes the quadriceps muscle more flexible and less injuryprone. Keeping the knees together, the back straight and the upper leg pointed straight down, raise your lower leg toward your butt. Pulling your foot toward your body should generate a gentle pull in the front of the thigh. Hold each leg for a six count.



Don't let the upper leg point away from your body.

Bend the inactive leg so that you won't injure your back during this exercise. While seated in a slightly reclined position, raise one leg at a time 6 in. to 8 in. off the floor. Point the toes toward the head and slowly count to six.



You can do this exercise at your coffee break. With the legs angled out before you (photo near right), tighten the quadriceps muscles at the fronts of the thighs, pushing the knees backward (photo far right). Hold for a six count, relax, and do six to eight repetitions, five or six times a day.



