

# FIELD NOTES

## Trekking Pole Science

by David Noyes

**LIKE MANY HIKERS, my experience on the trails started as a kid playing in the woods near where I grew up, and the occasional camping trip with family and friends. We didn't call it hiking or trekking at the time, just playing around in the woods.**

**W**E ALSO NEVER considered that tons of stress-load was being applied to our joints as we ran up and down the rocky trails. The tree branch I would always pick up along the trail was more for poking at things than adding stability and reducing vertical ground reaction forces. We could walk and play for hours and never develop a sore muscle.

This, of course, changed as I got a little older and started backpacking. But even then the first trekking pole I purchased was a photo model I wanted as a light, portable monopod for my 35mm camera — its secondary purpose was as a trekking pole. I would walk with the pole dangling off my left hand ready to clear sticks from the trail or (heaven forbid) protect me from a snake in my path. I never learned proper pole technique or gave much thought to the science of lower extremity gait mechanics or knee flexion moments — until my

second day on Pine Mountain a couple of years ago.

For the first time in my life, I was experiencing a sharp, piercing knee pain with every step I took and had two grueling days ahead hauling around a very heavy pack. I looked down at the high-tech staff dangling from my left hand and clearly remember thinking, "Okay, Mr. LEKI, you gotta get me outta here." In a truly anthropomorphic moment I bonded with my pole, and for weeks scarcely considered getting out of bed without it nearby.

Since then I have done some homework, learned how to use my poles better, and have spent a lot of time on



the trails without much knee pain. In recent months I have hiked with dozens of people, and invariably our conversation on the trails would turn to trekking poles. Poleless trekkers often asked me "how" and "why": "how" they actually helped, and "why" they cost so much. I smiled as they slipped in the mud and huffed and puffed over tough terrain, but didn't have many good answers. My experience was very personal and my evidence purely anecdotal. I felt stronger on the trail, I could move faster, and had more stability with the poles, but I didn't really understand why.

So I started searching the web for hiking pole "science." No kidding, with the increased popularity of hiking and backpacking in recent years, institutes of science and sports medicine have turned their attention to the benefits of hiking poles. Here is a taste from *Knee joint forces during downhill walking with hiking poles* by Austrian researcher Hermann Schwameder, et al: "Ground reaction forces,

## Why Poles?

- ▶ **Reduce loads on the knee and hip joints.**
- ▶ **Increase balance and stability on uneven terrain.**
- ▶ **Fewer injuries from falls.**
- ▶ **Reduce stress fractures, sprains, and tendonitis.**
- ▶ **Improve posture, reducing lower extremity stress.**
- ▶ **Allow for better breathing efficiency.**
- ▶ **Less knee flexion at heelstrike.**
- ▶ **Increased stride length.**
- ▶ **Hike faster with less effort.**
- ▶ **Cheaper than new knees.**

were significantly smaller for both the single (16%) and double support phase (25%). The reductions in the patellofemoral compression force, the quadriceps tendon force and the activity of the vastus lateralis varied, but not significantly so, between 9% and 16%."

Sorry about that. I don't plan to burden you with a lot of technical writing. I just wanted you to know that I actually read the science so you wouldn't have to. I will attempt to confine myself to an accurate interpretation of the findings and conclusions that are most interesting and compelling.

## Pole Science

AS I LEARNED AS A YOUNG-STER, having a walking stick in my hand can serve multiple functions; the most obvious are to add increased stability on uneven ground and poke at snakes, but scientific inquiry has demonstrated that there are many others. The multiple studies I reviewed concentrated on different aspects of hiking pole use including: the effects of ground forces on lower extremities; knee joint forces walking downhill; and uphill backpacking with a load 30 percent of body mass on a -25 degree grade. They all made

reference to the fact that there aren't any uniformly accepted poling techniques per se, and that their studies were conducted indoors on treadmills, not on backcountry trails; still, I was surprised to find many similarities in their conclusions. I can now answer some of the "how" and "why" questions about trekking poles.

## Load Distribution

MANY OF THE load distribution benefits of trekking poles can be quite easily understood by most hikers. As the pole is planted in the ground, some of the force that would normally be absorbed by our leg muscles and joints is redistributed to the pole and to our upper body. Author Christopher Knight, et al, in *Muscular and metabolic costs of uphill backpacking: are hiking poles beneficial?*, states, "During any given stride the poles accommodated 10, 13, and 7 kg of load on uphill, downhill, and level terrain, respectively."

This force reduction can add up to as much as six tons over the course of one mile.

Similar findings were published by Schwameder, who concluded, "For the entire cycle of three steps, the reductions in external and internal loads using hiking poles during downhill

walking at a decline of 25 degrees varied between 10% and 16%" with direct reductions of shear forces absorbed by the anterior cruciate ligament (ACL).

Yes, I know that ligament! That was the source of my pain on Pine Mountain. If 10-16 percent load reduction to your ACL doesn't impress you, consider that over several hours or several days on the trail that load transfer can add up to an easily quantifiable reduction in ... pain.

The next obvious question is, where does all that redistributed force go? The pole itself absorbs some of it, and some of it is transferred to your wrists, arms, and shoulders. Unlike a solid wood hiking stick, many modern

**Poleless trekkers often asked me "how" they actually helped, and "why" they cost so much. I smiled as they slipped in the mud and huffed and puffed over tough terrain**

trekking poles also employ shock absorption systems inside their heat-treated aluminum shafts that function like the cushioned spring action of a good mattress on every pole plant. Hiking with two poles (one in each hand) also adds to the redistribution of stress load, since one pole will typically remain planted as the second is placed forward in the movement cycle.

## Hiking Mechanics

IN ADDITION TO the direct load reduction benefits of hiking poles, there are other less obvious factors of pole use that contribute to their effectiveness; namely, we hike differently with poles. On level ground hikers with poles walk more upright, faster, with less knee stress, and better breathing efficiency than hikers without poles, while backpackers actually adopt different hiking mechanics. Carrying a heavy load tends to force hikers to make shorter, more frequent

steps, and to compensate for the load with a "straighter knee at mid stance" which could cause compression damage to the knee. Christopher Knight notes, however, that pole use "allowed the subjects to adopt more normal walking kinematics, including an increased stride length. This strategy

also allowed the subjects to decrease the activity level of a number of lower extremity muscles."

But, in a contrary research project to examine "ground reaction forces and braking forces while walking downhill," Julianne Abendroth-Smith and Michael Bohne found an increase

**HOOPERS**  
the outdoors are waiting, are you ready?

camping gear  
climbing  
mountain bikes  
kayaks  
backpacks  
apparel  
and much,  
much, more...

Western Kentucky's Only  
Outdoor Retailer

Just minutes from The Land Between the Lakes

**Hooper's Outdoor Center**  
3790 A Hinkleville Road, Paducah, Kentucky  
**270-443-0019**

in braking forces at -15 and -20 degree gradients for women in their study. They concluded that “these differences may indicate that either incorrect pole use can lead to greater forces acting on the body, or that pole use might hinder walking while hiking downhill at certain gradients.”

Ultimately, your trekking poles are just one factor toward an injury- and pain-free hiking experience. They are not, however, a substitute for overall fitness, leg strength, flexibility, and common sense on the trail. Know your limits and use your poles. They don't provide any of the wonderful stress reduction benefits to your body if they are dangling by your side just in case you lose your balance.

## Pole Technique

### The GRIP

**M**ANY POLES COME WITH a positive grip angle, which means your hand is bent at a natural angle to relieve stress from the wrist joint – always a good thing. Your grip should be relatively light, causing less fatigue to hand and arm muscles. The proper use of the retention straps will also allow for a lighter grip with a higher level of control.

### The LENGTH

**P**OLES ARE ADJUSTABLE for a reason! You will definitely develop your own style, but a few simple rules of thumb will help you get the most out of your investment.

## To achieve the PROPER GRIP



- 1** Bring your hand into the strap from underneath.
- 2** Grip the pole with the strap under the palm of your hand.
- 3** Pull the strap snug over the top of your wrist.

On flat terrain, adjust the pole length so your arms are bent at 90 degrees.

As you go up and down hills, take the time to adjust your poles accordingly — shorter going uphill and longer for downhill treks. This will allow you to keep an upright posture and use your poles for maximum benefit.

You may also find yourself traversing across the face of a slope, in which case you should shorten your uphill pole and adjust your downhill pole to keep both poles at a comfortable 90 degree bend in your elbow.

### The PLANT

**H**IKING WITH POLES WILL take a little practice. To achieve the most lower-extremity stress reduction and maximum balance on flat terrain, use an opposite hand and leg technique as you walk (plant the right pole as you step with your left leg, and vice versa). You will find a rhythm after a while.

Trekking uphill on steep terrain may require a different technique. Try stepping with the same leg as your pole plant and angle the poles slightly backward for some additional upward momentum and reduced ankle stress.

Finally, on downhill slopes, remember to increase your pole length so you can lean slightly forward as you walk, placing weight on your poles and off your knees. Angling your poles slightly forward will also reduce compression in your joints while helping to keep your posture upright. ■

## Principal Sources

**Knee joint forces during downhill walking with hiking poles**, by Hermann Schwameder, Robin Roithner, Erich Muller, Wolfgang Niessen, Christian Rachner. Institute of Sports Sciences, University of Salzburg, Akademiestr. 26, A-5020, Austria. Published in *Journal of Sports Sciences*, 1999, 17, 969-978.

**Muscular and metabolic costs of uphill backpacking: are hiking poles beneficial?** By Christopher A. Knight and Graham E. Caldwell. Department of Exercise Science, University of Massachusetts, Amherst, MA. Published in *Medicine and Science in Sports and Exercise*, 2000; 32:2093-2101.

**Effects of walking poles on lower extremity gait mechanics**, by John Willson, Michael R. Torry, Michael J. Decker, Thomas Kernozek, J.R. Steadman. Biomechanics Research Laboratory, Steadman-Hawkins Sports Medicine Foundation, Vail, Colorado. Published in *Medicine and Science in Sports and Exercise*, 2001; 33:142-147.