

RESEARCH & RACE BOOTS: THE PERFECT FIT

By Lou Rosenfeld

AS CONSUMERS, RACERS AND COACHES, WE'VE COME TO BELIEVE THAT THE DOGMA OF SKIING IS BASED ON SCIENCE. MY EXPERIENCE IN SCIENCE AND BOOT FITTING HAS SHOWN ME OTHERWISE. WHERE HAS OUR KNOWLEDGE OF ALIGNMENT, BALANCE AND BINDING POSITION COME FROM? HAS THAT KNOWLEDGE BEEN SUPPORTED BY REAL RESEARCH? IF NOT, WHAT SHOULD YOU BE DOING TO MAKE YOUR SKIING FASTER, EASIER AND MORE BALANCED?

A story from last season can help illustrate. I talked with a female receptionist at a cat-skiing operation concerning equipment arrangements for a female client. We talked about her equipment setup and I mentioned I'd be changing boot and binding ramp angle. The reaction was enthusiastic and immediately she mentioned how heel wedges had helped her stay forward. I explained that typically my experience has been opposite and I regularly find that clients (men and women, high level, club racers and recreational skiers) benefit from ramp angle reduction of several degrees.

A loooooonnnnnnnnnng pause followed, during which I swear the bells, whistles and sirens going off in her head were audible to me. Finally she said, "How does that work?" Her tone of voice implied, "You have no idea what you are doing, you are seriously screwing up, and you are going to ruin our client's holiday!" Well, in order: I actually do, I didn't and Susan had her best skiing holiday ever. I get some of the credit, as does the two feet of powder we finally got.

THE DOGMA IN SKIING RUNS LIKE THIS:

- ➔ Ramp angle helps you stay forward, as does boot forward lean, and more is usually better.
- ➔ Females need additional ramp angle and need to have their bindings moved forward when compared to a man.
- ➔ Boot position on the ski is designed by talented engineers using complex calculations we mortals can't understand and it definitely shouldn't be messed with.
- ➔ Boots should be tiiiiight, locking the foot in correct alignment with your lower leg, and foot orthotics should solidly support your foot in neutral position.

Let me discuss three topics: binding position, ramp angle and boot tightness (ankle volume).

Binding position A common belief is that binding position is built into the ski during design. However, of the seven or more manufacturers I've either contacted directly or asked others to contact, none calculated binding position. All experimented on-snow with testers, who may ski better or worse than you, prefer different ski or balance

characteristics from you or been briefed to find specific characteristics.

Marking on-ski boot position was started by manufacturers in the late 1970s or early 1980s, to make binding mounting faster and more consistent. Before that, shops mounted skis with a skier's ball of foot (BF) over the center of the ski running surface (CRS). We were given a plus/minus 1-centimeter tolerance for slalom or giant slalom use. The rationale was that the center of pressure was the BF and pressure should be over the center of the ski. A centimeter move forward or rearward increased or decreased ski response without upsetting skier balance, which in my experience is made substantially more difficult at over 2 cm.

Current mounting systems, based on boot center, allow the BF to wander on the ski. Ski response now varies with foot length, as does balance. In addition, different manufacturers routinely select foot positions that are different by several centimeters. Typically that difference is rearward of BF/CRS. Very few race or high-performance recreational skis are mounted too far forward.

Recent research at Snowbird (Rosenfeld, Bagley, Schoenberger, 3rd International Congress on Skiing and Science) on a balancing device used to determine individual recommended binding position used a position for the experiment more than 3.5 cm forward on average from the manufacturer's recommended position on a 70 mm carving ski. All subjects preferred the balanced position which generally is close to BF/CRS.

Ramp angle If you find your skis require an aggressive forward body position to turn or if you regularly lose control stuck in the back seat, it is possible, even likely, your position on the skis is several centimeters behind BF/CRS. Similarly, excessive forward lean and ramp angle will result in you compensating by staying in the back seat.

We don't often think about angle, nor do we consider that bindings have ramp, is additive to boot ramp and increases boot forward lean. We have been trained that more ramp is better, especially for women. However, some manufacturers' team bindings have less ramp than their matching recreational binding. The boot boards I have seen of some national team skiers have had ramp reduced. In my experience with customers, many compensate for ramp angle by straightening their backs, which effectively puts them in the back seat. When standing on ramp of more than 5 degrees, many skiers feel tippy when they

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actually bend forward, their quads are straining and foot flexors working overtime to prevent tipping. But when ramp is reduced, they can stand relaxed and solid in a more upright position, actually relaxing back muscles and quad muscles while maintaining a forward position at the waist. Range of motion is also increased. Increased range and relaxation are precursors to fine balance control with our feet.

Boot tightness Fine movement control is most accurately accomplished at the ends of our extremities. Toward our core, movements are progressively larger and more powerful, but certainly less subtle as larger and larger muscles become involved. Specifically it means that fine balance is best accomplished with foot movement. This movement, when standing, moves the ankle inward and outward, often into direct contact with the shell, which immediately blocks foot motion and inhibits balance. In this case everything rolls uphill until we use large, difficult-to-control hip movements to edge skis. Fortunately the solution is easy.

When they are barefoot in shells only, I find many skiers' inner ankle bone (medial malleolus) is against the shell, even when standing balanced and perfectly erect. Sometimes liners can reduce the associated pain, but they do nothing to restore lost foot motion. Punching the shell in the ankle and maybe the navicular (bone below and in front of the inner ankle) area can restore the missing motion that is very helpful for a smooth transition between turns.

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The science of ski equipment setup is really not very large or completely researched. There is much to be done. Much of what we hear is rationalization about the *assumed reasons* a new design is better, rather than cited evidence based on an understanding of kinesiology or biomechanics that give sound reasons for why and how a design works. Individual experimentation is often necessary and in a direction away from what the dogmas and taboos teach. Fortunately it is often very rewarding.

Below: ramp angle testing (left) and Campbell balancer for binding position.



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