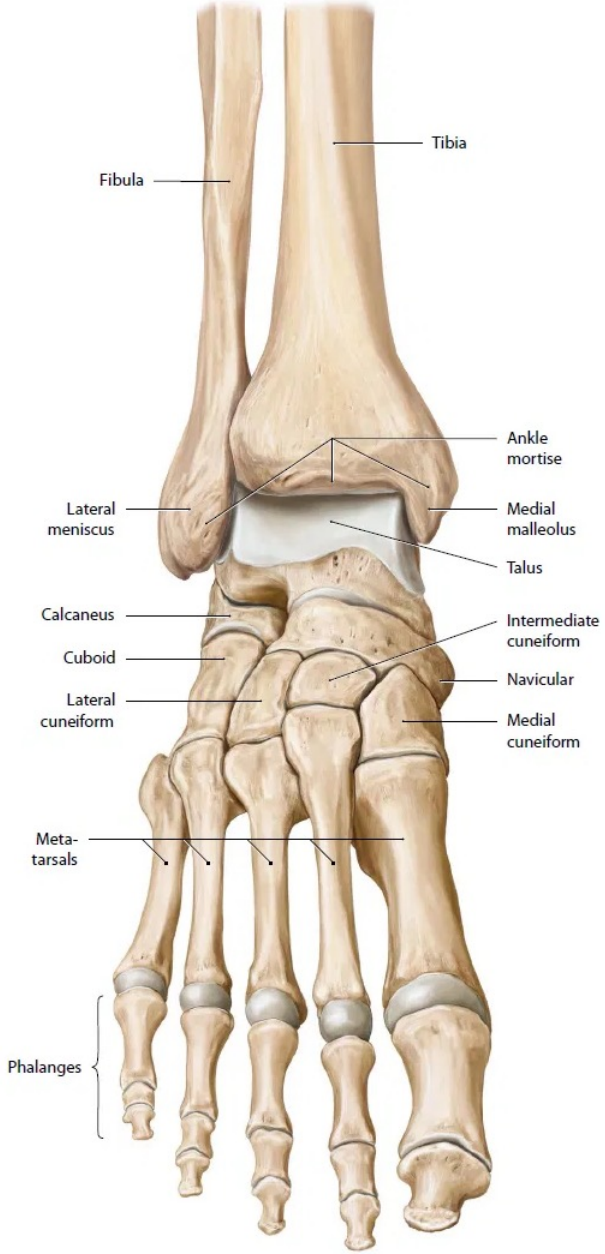

ACA Webinar Series 2021 - 2022
Boot fitting, the Ankle and Functional Foot

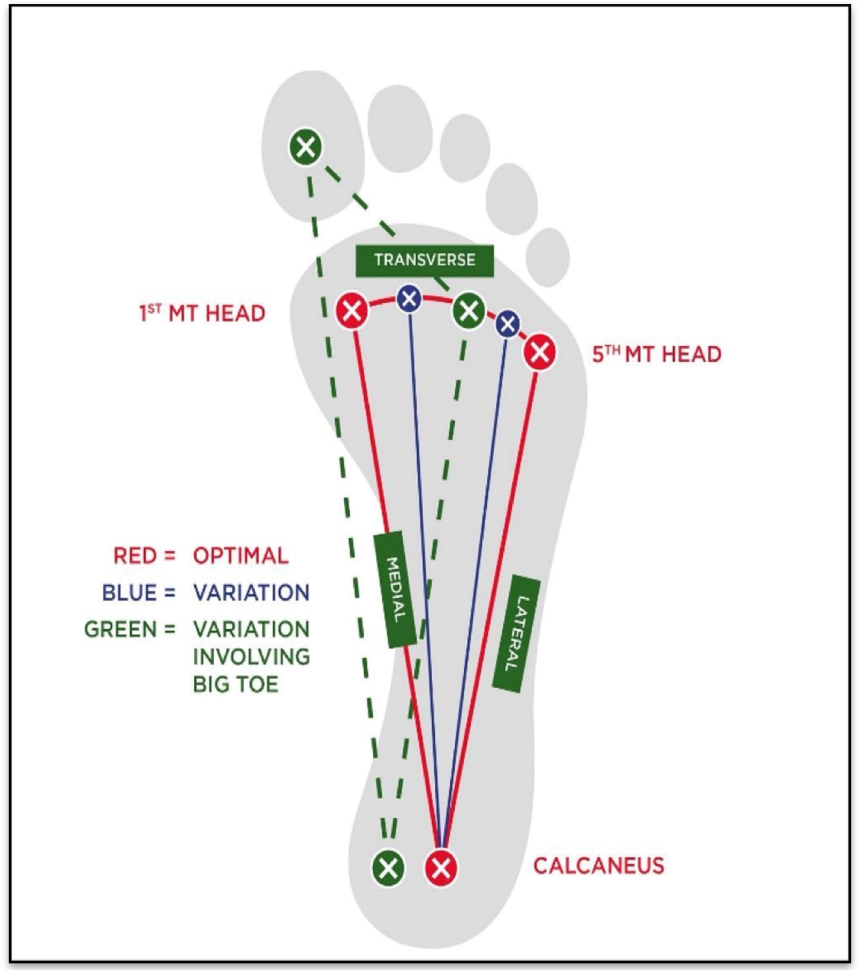


The Kinetic chain begins at the big toe joint.

The foot has 26 bones, 33 joints.

What Is it that the foot can do, and when its does that, what's the impact on everything else?

The ski boot environment can dictate your anatomy and structure, determining your balance point and range of balance.



Efficient skiing is the goal

- Skiing from the snow up
- Edging sensitivity
- Kinesthetic awareness to balance against the force with a platform. (Inclination)
- Independent edge control of all 4 edges with micro pronation and supination movements
- Weight distribution and pressure control
- Relax muscle tension when appropriate and ski with structure

Finding Neutral - The optimal tripod for efficient skiing.

Elements of posture and balance:

- Neutral Position
- Ankle engagement
- Weight transfer & Platform
- Squared
- Upper body control

SETTING THE FOUNDATION

- Establish a more neutral foundation where the foot can both lengthen and contract.
- Organize the bones in the confined ski boot environment.
- A pronated foot lengthens and widens
- A supinated foot shortens and narrows
- Insoles will help manage this relationship inside the boot.

- Rigid feet vs loose feet
  - Finding the appropriate level of correction and compliance. For the bones of the leg to rotate internally, the foot has to pronate.
  - Too much stability = reduced mobility
  - Too much mobility = reduced stability

Joints act, muscles react.

- Skiing happens in mid stance, so we use this technique when casting.

- We use the the windlass mechanism to evaluate as well as unweighted to weighted observation.

- Generally, we avoid adding ramp with the insole

Boot Board Height

- Relative to size: 22.5 vs 28.5
- Lowering = taking up range of dorsiflexion/increasing dorsiflexion
- Pressure becomes more direct, ligaments and tendons under more tension.
- Passive ankle range test and dryland screening to help determine which way to lean.
- Consider calf/cuff volume
- Finding the correct height for natural, balanced, neutral position.
- Best height for mass distribution on the tripod.


PORTER CABLE
MASTERFIT


PORTER CABLE
MASTERFIT
180
BEALL TOOL CO.
ON/OFF ABS
ZERO
HOLD

Stand height considerations

- Sole planing the boots
- Interfacing the insoles to the shell
- Choosing the appropriate stance and balance solution.

Emphasizing the foot in basic skiing

- Transferring balance from foot to foot
- Transfer weight from heel (in the release/transition) to the forefoot (initiation and apex)
- Using the the big toe joint to engage a strong kinetic chain.
- Moving weight forward through your feet and ankles as opposed to hip extension.

Posture and balance

- Neutral, relaxed stance.
- Tall stance, proud spine, relaxed shoulders, core engagement.
- Establish a platform and balancing against it.
- Appropriate position and separation for the context.
- Turn shape and pressure distribution to challenge the balance and position.
- Fluidity

Boot setup - Lateral setting

- Strong (aggressive) vs weak (less aggressive) canting.
- Sole canting and cuff canting
- Strive for a setting where the athlete can lean against the ski through the whole turn.
- Strive for a setting where the athlete can increase the angle through the turn and not be overwhelmed by the grip too early.
- Typically, canting is symmetrical between left and right
- Avoid compensating for technique

Finding neutral - Canting Angles

- Typically, within a tolerance of 1 degree. If I see more than that, review the foundation and ramp.
- There are always exceptions!
- Measuring the canting accurately so you can monitor and reproduce.

RELATIVE CONTRIBUTIONS OF LEG ANGLES TO SKI EDGING DURING A SLALOM SKI TURN

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KEY WORDS: alpine ski racing, angulation, edging

INTRODUCTION: Ski physical and geometrical properties are designed such that, when tipped onto "edge" on the snow surface, the ski will assume a deformed configuration causing it to turn as it glides forward. Skiers control how much the ski is edged, and thereby regulate ski turning radius, through a combination of center-of-mass (CoM) inclination with hip and knee angulations (shown in Figure 1). These frontal plane movements are essential to generate turning and for the skier to maintain a position of equilibrium throughout the turn. This study evaluated the time course of knee, hip and inclination angle contributions to edging in slalom turns.

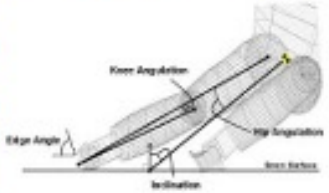


Figure 1. Edging angle of ski to snow surface is determined by the combination of Inclination angle along with Hip and Knee Angulation.

METHOD: Six Norwegian skiers of the men's Europa Cup team were analyzed through two turns during slalom race simulations on courses with 10 and 13 m linear distances between gates (Reid, 2010). Based on 3-dimensional data, lower body angle measurements were made in the plane which both passed through the outside ski middle point and was orthogonal to the outside ski longitudinal axis. CoM inclination was defined as the angle created between the local snow surface normal and a line projected from the skier's CoM to a point midway between skis on the snow. Hip angulation was the angle created between the constructed CoM inclination line and a line from the outside hip joint center to the middle point of the outside ski. Knee angulation was the angle created by the hip joint line and a similar line running from the ski middle point to the knee joint center. Positive angulation values indicated a contribution to increased, and negative values to decreased, overall edge angle. Angle-time data were computed for each turn and normalized across time.

RESULTS & DISCUSSION: Ensemble average angular contributions to edging on the 10 m course are shown in Figure 2. Ski edge angle was largely controlled by CoM inclination. Knee and hip angles each contributed approximately 5 to 10° to the edge angle until the final 25% of the turn. At that point, hip angulation increased and knee angulation decreased, reaching negative values as large as –20°. This unexpected pattern may be explained by the fact that during turn completion the skis turn in under the skier's body, resulting in a countered, angulated skier position referred to as "vissage" (Joubert, 1980). This increase in hip angulation was synchronized with reduction in knee angulation so that overall edge angle was reduced to terminate the turn.

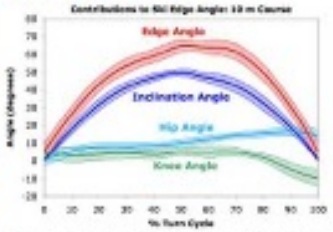


Figure 2. Ensemble averages with mean angle ± SD across 12 turns. Edge angle is Inclination + Hip + Knee angles

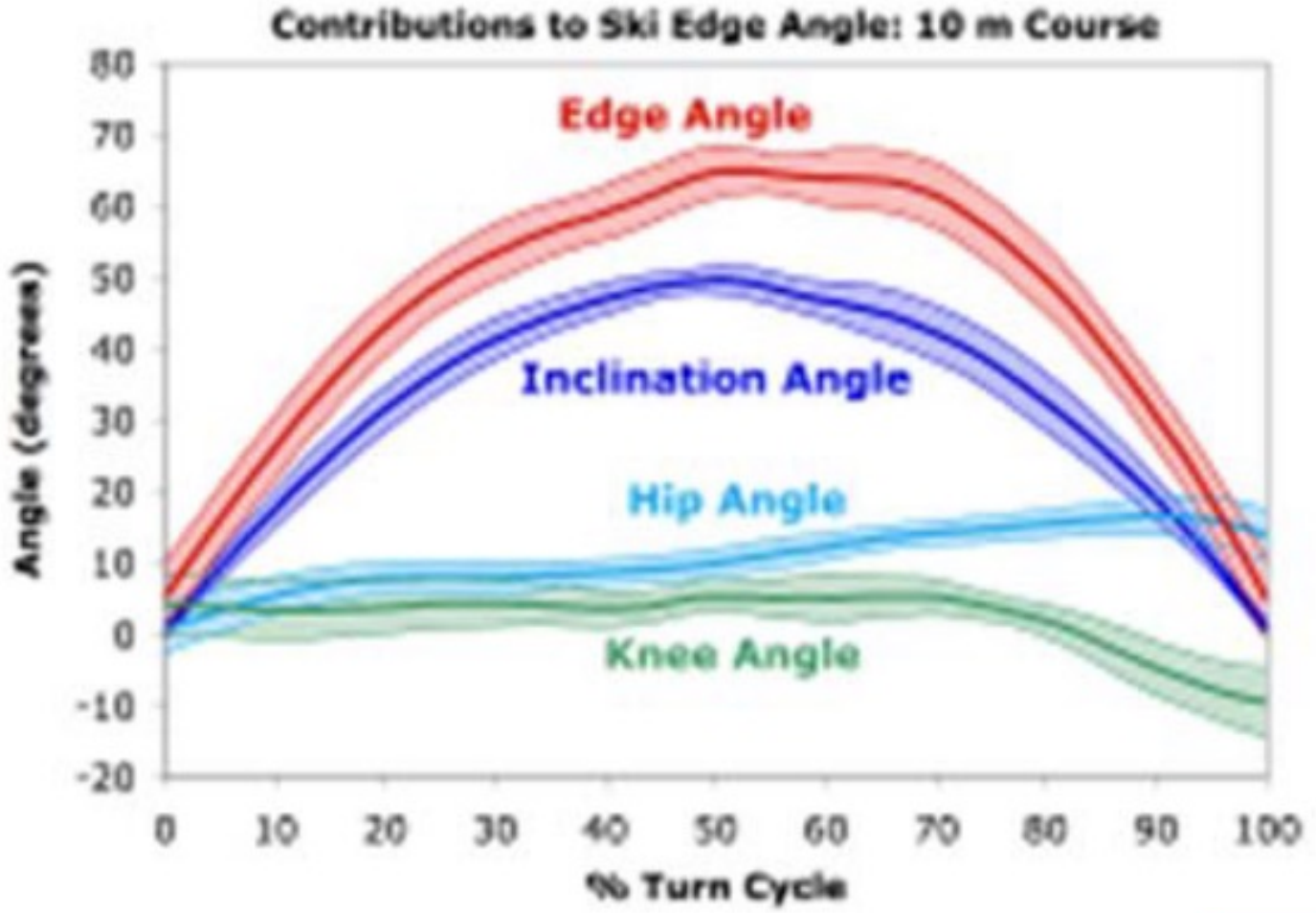
CONCLUSION: Ski edging created by lateral motion in a skier's frontal plane is dominated by CoM inclination. Hip and knee angulation serve to fine tune edging late in the turn cycle.

REFERENCES

Reid, R. (2010). A kinematic and kinetic study of alpine skiing technique in slalom. Unpublished doctoral dissertation, Norwegian School of Sport Sciences, Oslo, Norway.

Joubert, G. (1980). Skiing: An art, a technique. LaPorte, CO: Poudre Publishing Company.

Angulation and Inclination?

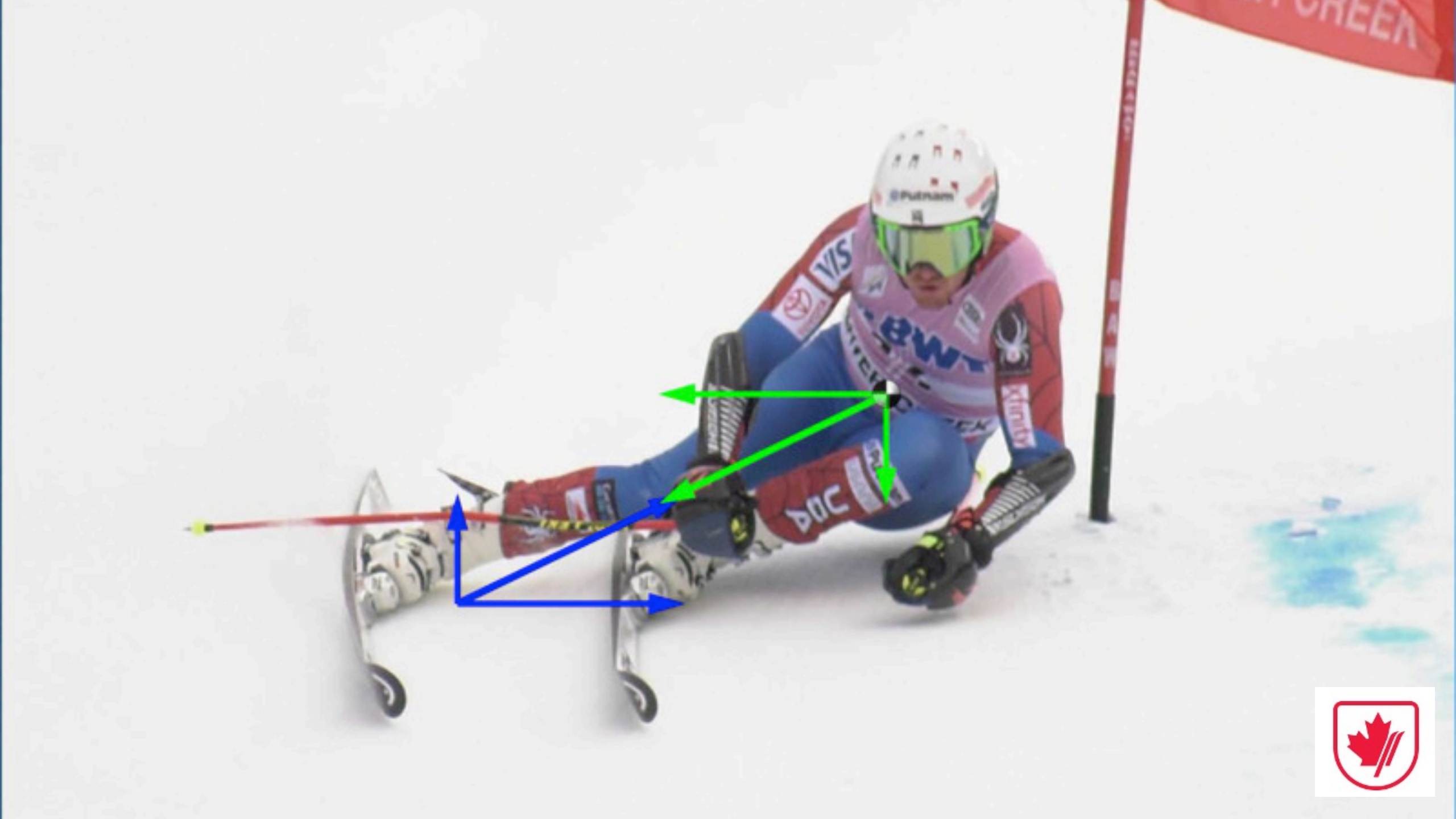


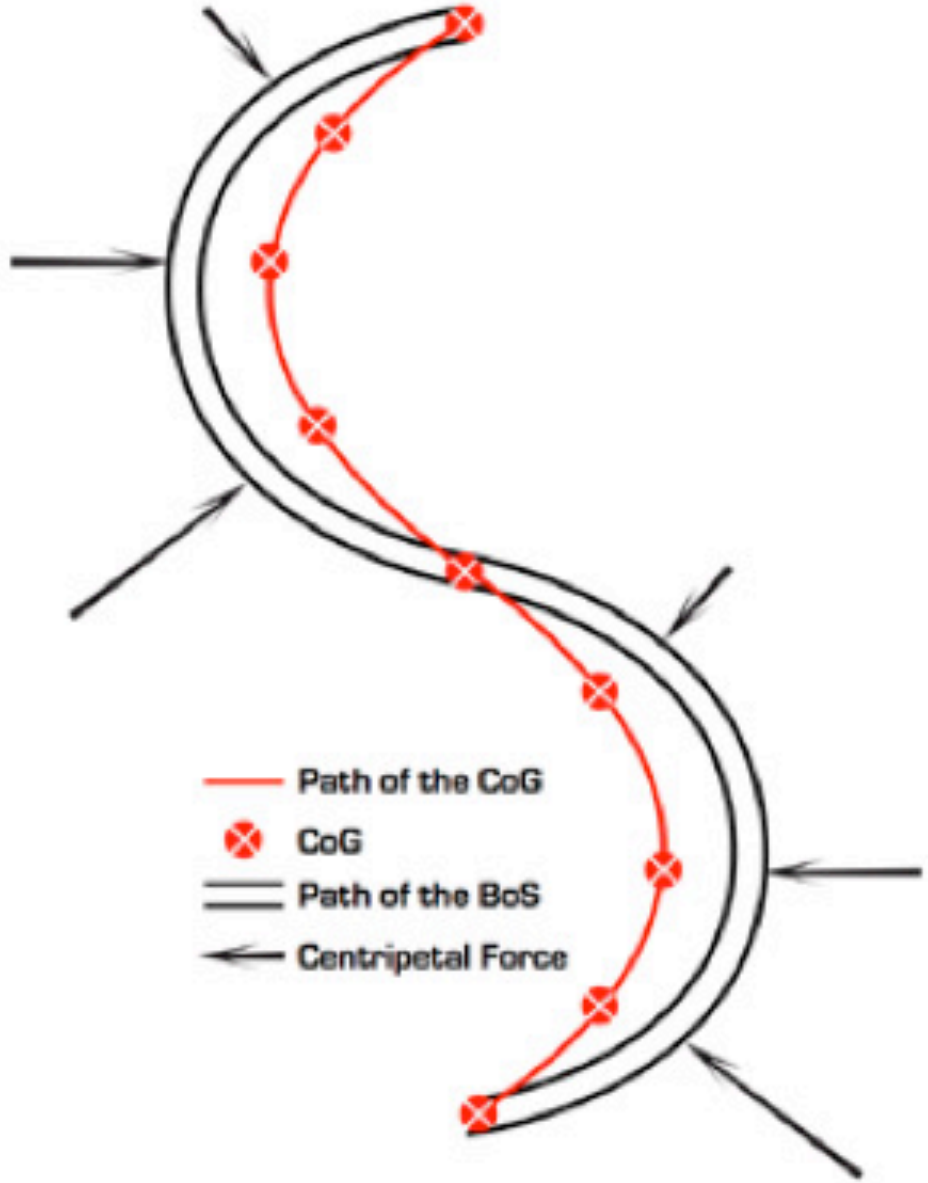
Leaning/Resisting against the platform

Increase edge angle through the turn, fine tuning with angulation through the completion

Hip can externally rotate and stay square to the force

Not overwhelmed with edge pressure


Putnam
BWT
Klotz


Path of the CoG
CoG
Path of the BoS
Centripetal Force

0/0 canting

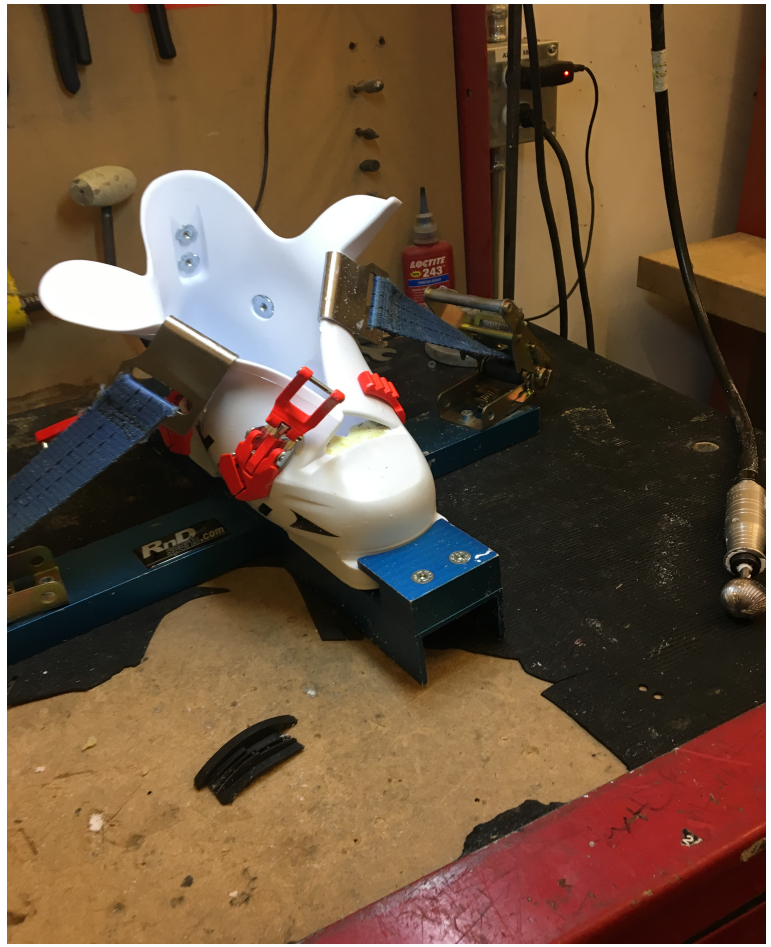
0.5/0.5 canting

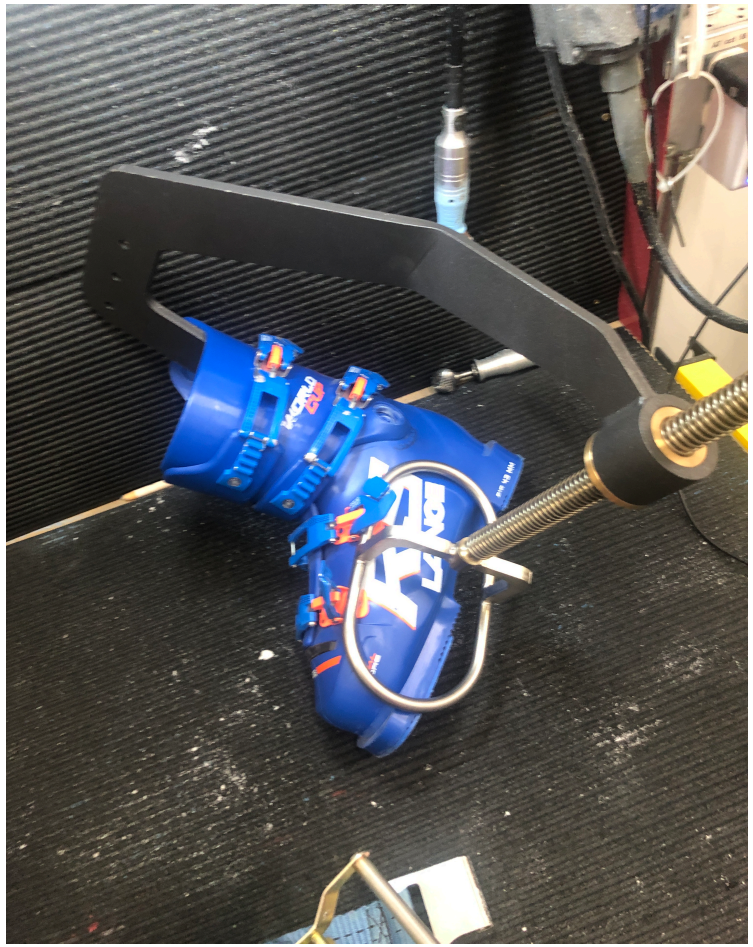

SEITERKAR
BAHN

U14-U16 considerations

- Volume between models is significantly different. Comfort oriented vs performance oriented.
- Foot length not balanced with leg volume and height.
- Manage leg volume with tongue shims, volume reducers, power straps to enhance the connection and leverage.
- Altering flex on lower shell v cuts as opposed to removing spine screws.
- Conservative approach to alignment, but good to know where you're at.
- Ramps from stock are decreasing across all brands, 1mm can change a lot.

Shell work





Rear support tuning

Toe punching

- The foot needs to pronate and will lengthen
- Binding compatibility
- Boot integrity