CLINICAL BIOMECHANICS:

Biomechanics of Ice Hockey Skating

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In order to fully understand the rational for the skate interventions described in the Case Study, a brief description of the fundamentals of forward power skating biomechanics will be discussed in the following section.

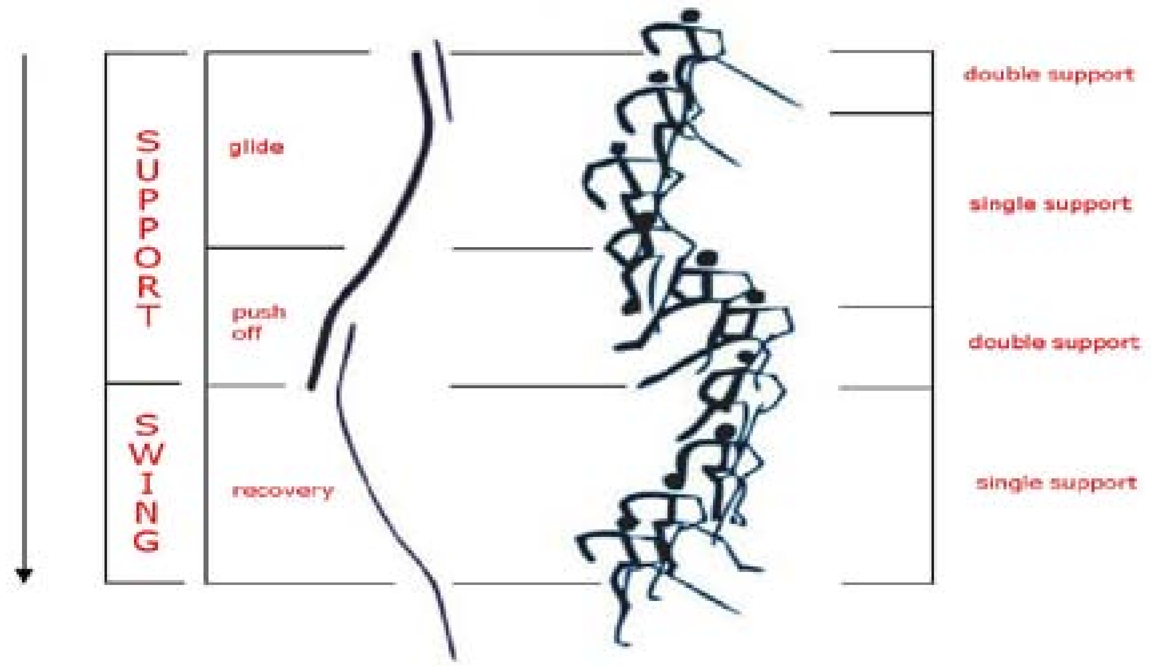

Figure 1

During a simple skating stride, the stride cycle is essentially biphasic including a *Support* and *Swing* phases (Figure 1). The support phase can be further broken down into the *Glide* and *Push-off* phases involving both periods of single and double support. As we will discuss later, it is during the *Glide* and *Push-off* phases that the foot and ankle are critical to maximizing optimal alignment and propulsive power.

During the *Glide* Phase the skate blade will tend to glide with either both edges in contact with the ice or only the medial edge (Figure 2). If the rearfoot is in an excessively everted or inverted position, the muscles acting to maintain stability could potentially suffer overuse strain. In particular, the peroneal muscle group has been reportedly strained in individuals who exhibit excessive inversion. With the excessive pronator, the tibialis posterior muscle tends to be at risk.

It is likely that the peroneals that are most strained in the individuals who maintain an inverted rearfoot position during the *Glide* Phase. The compensatory eccentric muscle action required by these muscles to maintain balance onathin blade is likely to be associated with the delayed muscle soreness that is often reported by skaters with uncompensated rearfoot varus, tibial varum and genu varum.

The same can be suggested for the over pronator whose everted rearfoot position through the *Support* Phase would likely explain the occurrence of tibialis posterior muscle strain, medial ankle ligamentous stress and general medial ankle instability. In cross section, the metal skate blade (Figure 2A) is designed with 2 edges separated by a hollow. The depth of this hollow varies given the method and degree of sharpening.

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The metal skate blade is fastened in a plastic blade housing (Figure 2B) that is riveted to the bottom of the skate boot (Figure 2C). There is a compromise that exists when considering edge sharpness or hollow depth. With a sharper blade edge, push off is optimized while smooth stops are compromised. The opposite is true with a lesser hollow.

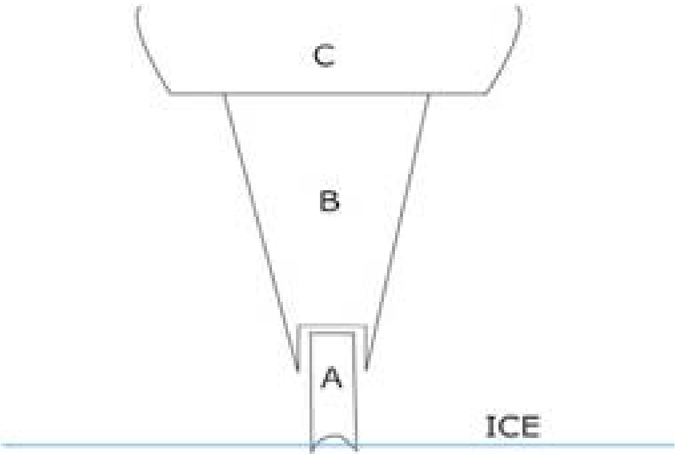

Figure 2

Another blade characteristic is the radius of curvature or, more simply put, the *blade rocker.* The blade rocker has reciprocal influences on stability and agility. It has been reported anecdotally by professional players that a greater rocker leads to increased agility and decreased stability. The opposite scenario exists with a lesser rocker. The amount of rocker selected to optimize both agility and stability is solely dependent on athlete preference. Propulsion generally occurs half way through the single support period of the *Support* phase with abduction of the hip and coincidental extension of the hip and knee. As the contralateral skate touches down, the propulsive limb pushes off through a summation of forces generated through coordinated:

- Hyperextension and abduction of the hip
- Extension of the knee
- Plantar flexion of the ankle

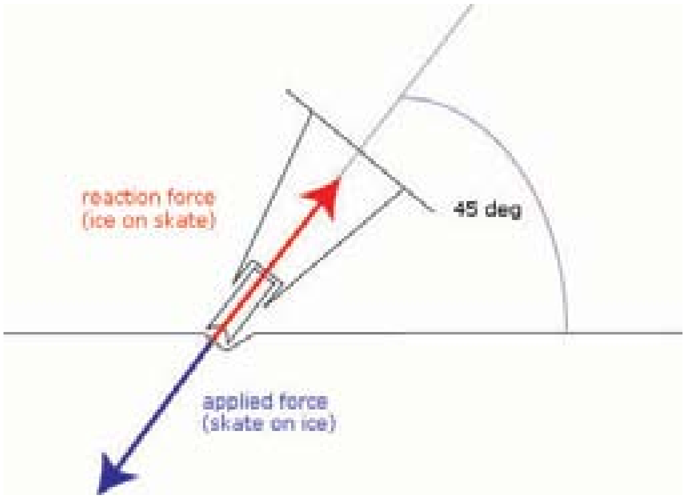

Figure 3

Researchers have suggested that the optimal skate-ice interface angle during forward Push-off phase should be approximately 45° (Figure 3). Thus, having the foot in either an excessively pronated or supinated position at push off could potentially influence this interface anyle. For example, if the foot is excessively everted at push off, this angle could be reduced to a degree <45°. Conversely, if rearfoot angle was excessively inverted, the angle could be possibly >45°.

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