CASE STUDY:

Ice Skating

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INTRODUCTION

Ice-skating provides a unique challenge to the foot care practitioner. The skate boot design and skating movement pattern are unique and require an understanding and appropriate intervention when dealing with lower extremity biomechanical problems. Balance and control of the subtalar and midtarsal joints within the boot can improve performance and reduce injury patterns. Also, the skate boot has a unique interface with the ice surface that provides a small balance point and a second point of potential intervention.

Overuse foot and ankle injury patterns secondary to biomechanical factors can clearly be identified in ice-skating. The narrow blade or balance point in skating requires strenuous eccentric muscle control and proprioceptive skills to assist in balance. As a result, general foot fatigue from strain of the small intrinsic muscles of the foot is common. Along with muscle strains, there are the extrinsic tendinopathies that can occur in the posterior tibialis and peroneal tendons as a reaction to compensatory balance. Overuse injuries of the groin or low back may also present. It is plausible that this may be due to the inherent requirement of the skate and skater to move in opposite directions as propulsion occurs in the typical skate cut. By effectively balancing the foot-boot, boot-blade and blade-skate interactions, performance may be improved and overuse injuries reduced.

CLINICAL BIOMECHANICAL BALANCE:

There are two steps in the process of assisting a skater from a biomechanical perspective. The first is to position the foot within the boot according to standard podiatric biomechanical principles. The second is to balance the blade with respect to the boot.

Step 1: Foot Balance Within Boot: Custom Foot Orthoses

A clinician can be confident when dealing with the first step of biomechanical control that involves positioning the foot properly within the boot. A complete lower extremity exam should be performed and a decision on foot orthotic prescription can be made using Root biomechanical principles. Orthotic design for skating (Figure 1):

1. Neutral suspension cast impression
2. Intrinsically post casts to 10° inversion
3. Medial heel skive (3-4 mm)

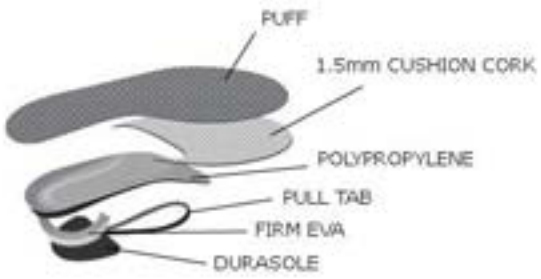

Figure 1: Prescription Skate Orthosis

4. Polypropylene shells
5. Extrinsic rearfoot posts (no motion)
6. Full-length Puff top cover with cushion cork extension to toe
7. Trace, photocopy or send skate insoles with casts for precise fit

Step 2: Blade Balance

The second step in skate intervention involves blade balance. Blade balance is accomplished using three different techniques:

1. Sagittal plane rocker,
2. Medial-lateral position of blade, and
3. Varus/valgus wedging of the blade which can also incorporate limb lifts.

These interventions are usually best performed by a professional skate technician after podiatric advice is given.

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The sagittal plane rocker of the blade allows for easy response to the center of gravity changes in the sagittal plane. Typically, the rocker is in the centre of the blade with only one inch of the blade in contact with the ice. Some skaters will increase the rocker (decrease contact with ice) in order to improve their maneuverability. Others will decrease the rocker to increase blade contact with the ice. This will increase speed but decrease turning capabilities. Adjustments of the blade rocker are more a matter of individual preference for performance, and should only be done in the hands of a skilled skate technician.

The medial-lateral position of the blade on the boot has a significant effect on skating posture and balance. The standard blade placement courses longitudinally from heel center to the second metatarsal head. This blade position should provide an inherently stable platform for the foot with pure sagittal plane rocking. A medially deviated subtalar joint axis will influence the default contact portion of the standard placed blade. Shifting the blade medially will place the default contact portion of the blade in a more functional position with respect to the medially deviated axis. In extremely rigid inverted feet, moving the blade lateral on the boot will help to improve balance.

Balancing the blade with wedging is the final blade adjustment technique. Once appropriate foot orthoses have been prescribed, the blade rocker has been checked and the blade has been moved medial or lateral as required, a decision on using a wedge can be made by evaluating the position of the blade edges relative to the weight-bearing surface. A wedge can assist in balancing the blade to the boot and upper body so that in static stance each edge of the blade balances on the ice surface, equally. Contrary to what you may think, a supinated foot may require a medial wedge to bring the medial blade edge evenly to the ground. Conversely, a pronated foot may require a lateral wedge to bring the lateral blade edge to the ground. The management of the skater can be best shown through two contrasting case examples. Each of these cases depicts the contrasting management of two complex cases involving both foot to boot balance and blade to boot balancing techniques, in a pronated and supinated foot type.

CASE #1 – Moderate to Severe Pronation:

A 12-year old male suffers from medial ankle and knee pain while playing hockey. He is otherwise fit and healthy. After a complete history and physical examination a diagnosis of posterior tibial tendon strain and patellofemoral pain syndrome was made. Excessive foot pronation was identified as a contributing factor. He functions maximally pronated due to a fully compensated forefoot and rearfoot varus deformity bilaterally of approximately 4 degrees for both.

Custom foot orthoses were manufactured from casts corrected to 25° of inversion using the Blake inversion technique and a 4 mm medial heel skive was added (Figure 2). The forefoot to rearfoot was posted a further 4° of varus and a balancing post was placed on the rearfoot also in 4° of varus. A further mechanical intervention was required and the blades were moved medially on the skates. The final solution for this patient was a good quality skate boot appropriately fitted, an aggressive custom foot orthotic and a blade balancing adjustment (Figure 3). Con't.....

Figure 2: Prescription Skate Orthosis (Case 1)

CASE #2 – Supinated Pes Cavus Foot Type:

An 18-year old hockey player suffers from lateral leg and ankle pain as well as skate balance

Conferences & Events:

Pedorthic Association of Canada
April 7-9, 2006, Winnipeg, MB

Canadian Orthopaedic Foot & Ankle Symposium
April 8 & 9, 2006, Toronto, ON

BC Assoc.of Podiatrists Annual Scientific Seminar
April 28, 2006, Whistler, BC

Ontario Society of Chiropodists
May 4-6, 2006, Toronto, ON

Figure 3: Medial Blade Adjustment (Case 1)

problems. History and physical exam finds him otherwise fit and healthy. A diagnosis of peroneal tendonitis was made due to a rigid forefoot valgus and a limb length discrepancy.

The mechanical solution to this patient's problem was a custom-made extra depth skate boot to accommodate an orthoses with an extrinsic forefoot valgus post to the sulcus. Standard Root-inspired biomechanical principles where employed to make this orthotic and no newer inversion techniques were utilized (Figure 4). Several skate blade adjustments where required to enhance skating performance. A full-length leg length accommodation

Figure 4: Prescription Skate Orthosis (Case 2)

was incorporated, blades were moved laterally (Figure 5) on the boots and a medial wedge was inserted to assist further in bringing the medial edge of the skate blade down to the ground (Figure 6).

Figure 5: Lateral Blade Adjustment (Case 2)

Figure 6: Meidal Wedge and Leg Length Accommodation (Case 2)

CONCLUSION

Ice-skating is increasing in popularity throughout North America. Podiatric practitioners can expect to see ice skaters in their offices. Podiatric biomechanical management using both traditional and newer techniques used in other athletic populations can be modified to work in the athletic skating population. The sound use of biomechanical intervention can assist in the pleasure and performance of this unique activity.

For references please visit www.parisorthotics.com

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