Cuboid syndrome refers to a subluxation of the cuboid or calcaneo-cuboid joint dysfunction. Cuboid syndrome only accounts for 4% of sports-related foot injuries, but represents 17% of foot injuries among ballet dancers. The purpose of this report is to present an effective management strategy for cuboid syndrome.

The stability of the articulation between the cuboid and the distal portion of the calcaneus is maintained by a number of ligaments and a joint capsule. The peroneus longus tendon runs through the peroneal groove on the plantar aspect of the cuboid. The line of pull on the peroneal longus produces medial and inferior rotation of the cuboid around the oblique axis of the transverse tarsal joint, which is an important aspect of foot function during gait. At heel-strike, the subtalar joint is supinated and body weight is concentrated on the lateral aspect of the heel. During the transition from heel-strike to midstance, the subtalar joint pronates and the body weight is shifted to the medial aspect of the foot. The cuboid is most susceptible to displacement when tension within the peroneus longus tendon exerts more force than the passive stabilizers of the calcaneo-cuboid joint. Any joint that primarily relies on passive stabilizers is predisposed to hypermobility. Newell and Woodle reported that nearly all cases of cuboid syndrome were associated with pes planus. Pronation of the subtalar joint provides the peroneal longus muscle with a greater mechanical advantage. The intrinsic foot muscles, predominantly the flexors, are believed to play an important role in stabilizing the transverse tarsal joint during gait.

Current conservative management of cuboid syndrome includes manual therapy, taping, padding, and use of an orthosis. Newell and Woodle described a cuboid manipulation technique that was later referred to as the “black snake heel whip.” The patient stands with the affected leg in a knee-flexed, non-weight-bearing position. The clinician grasps the forefoot, placing the thumbs on the plantar aspect of the cuboid and wrapping the fingers around to the dorsal aspect of the midfoot. The clinician applies a quick plantar flexion force to the ankle as the thumbs push the cuboid in a dorsal direction. This technique was modified by Jennings and Davies, who placed the patient in a prone position on a plinth with the knee of the affected leg flexed to approximately 90 degrees. The clinician extends the patient’s knee while plantar-flexing the affected foot. A self-mobilization technique was described by Marshall.

Mobilization techniques are widely advocated for treatment of cuboid subluxation, but other conservative measures have also been suggested. There is no widely recognized procedure for cuboid taping. Marshall described a J-strapping technique that...
has been found to be very beneficial. Other researchers have suggested using a “low-dye” taping technique to both support the joints of the midfoot that form the medial longitudinal arch.\textsuperscript{10} Newell and Woodle\textsuperscript{3} suggested the use of a cuboid pad, or wedge, to add stability to the lateral column of foot joints. This pad is typically constructed from one-fourth inch closed-cell foam or felt and incorporated with a taping technique.\textsuperscript{3} Some clinicians advocate long-term utilization of an orthosis to foot in a neutral position, thereby decreasing the amount of tension generated by the peroneus longus tendon.\textsuperscript{1,3,10}

Other conservative treatment options mentioned in the literature include massage, cryotherapy, and therapeutic exercise.\textsuperscript{5-10} Although outcome studies have not been conducted to document the effectiveness of any of these management strategies, they may decrease pain and inflammation within the calcaneo-cuboid joint. Lacking a widely-recognized standard for conservative management, clinicians may be forced to take a “trial and error” approach to treatment. Assuming that laxity develops in the passive stabilizers of the calcaneo-cuboid joint in dancers and runners, it is logical to hypothesize that taping of the mid-foot and strengthening of the intrinsic foot muscles and extrinsic lower leg muscles may help to prevent recurrent subluxations of the cuboid.

Case Presentations

Athlete 1

This case series reports the evaluation and management of two female distance runners with differing presentations of cuboid subluxation. During the 2007 spring track season, a 22-year-old female collegiate cross country and 1500-meter runner (mass = 52.27 kg, height = 162.6 cm) presented lateral ankle pain at the base of her fifth metatarsal and extending to the lateral aspect of the distal one-third of the lower leg. Her pain was exacerbated by walking, after running on uneven surfaces, and with extreme ankle inversion.

Athlete 2

During the 2008 summer training camp, a 21-year-old female cross country runner (mass = 59.09 kg, height = 160 cm), presented pain in the Achilles tendon approximately 5 cm superior to its insertion, the inferior aspect of the lateral malleolus, and along the middle one-third of the plantar surface of the foot. She exhibited reduced plantar-flexion and dorsiflexion, due to pain and muscle tightness.

Differential Diagnosis

Possible conditions included extensor digitorum brevis or peroneus brevis tendinopathy, fifth metatarsal ligament injury, sinus tarsai syndrome, stress fracture, malalignment of the talocrural and subtalar joints, meniscoid lesion of the ankle, Jones fracture, subluxating peroneal tendons, lateral plantar nerve entrapment, and Lisfranc sprain.

Treatment

Palpation revealed grinding and hypermobility of the left cubo-metatarsal joint of the first athlete. The team physician recommended cross-training for several days to allow pain to subside, tape application to immobilize the cuboid during activity, and a wedge-shaped orthotic to increase foot pronation. A J-strapping technique was utilized on the first day, but it was not successful. Low-dye taping with a cuboid wedge was then used. The athlete reported increased pain after one day with the wedge, so its use was discontinued. Her foot was then taped for activity utilizing a “four mini-stirrup” method (Figure 1). The taping procedure utilized one strip of moleskin as a stirrup that was pulled laterally from the medial malleolus. Then three strips of Leukotape\textsuperscript{®} (BSN Medical, Hamburg, Germany) were used to secure the subtalar joint and transverse tarsal joint. Along with taping, the athlete participated in a daily ankle strengthening program (Table 1), followed by cold whirlpool submersion for pain control. Periodic petrissage was administered to relieve tightness in the gastrocnemius, soleus, and peroneal muscles.

For the second athlete, palpation revealed point tenderness over the calcaneal fat pad, medial longitudinal arch, and along the peroneal tendons of the foot. Pain was elicited by resisted eversion, and the amplitude of subtalar motion was less than that of the uninvolved extremity. The fourth metatarsal head was depressed and the cuboid was subluxated. The team physician used the “cuboid whip” mobilization method (Figure 2) to reduce the cuboid. Taping was recommended for weight-bearing activities until custom orthotics could be fabricated. Low-dye taping was initially utilized with poor results, and the foot was subsequently taped using the “four mini-stirrup” method. The athlete received custom orthotics two
days later. She cross-trained for two days, and then returned to normal training. Continuous ultrasound (1.2 MHz, 8 min) was administered before practice, and electrical stimulation (pre-modulated, 15 min) combined with ice was administered for three days to control pain. After training with both tape and orthotics for one session, the athlete chose to use only orthotics. Seven days after the cuboid reduction, the athlete

**Table 1. Rehabilitation Protocol for Cuboid Syndrome**

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Duration</th>
<th>Exercises</th>
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</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>Maximum stretch</td>
<td>3 × 30 sec</td>
</tr>
<tr>
<td>Strength</td>
<td>Maximum controlled contractions</td>
<td>3 × 10</td>
</tr>
<tr>
<td>Balance and Coordination</td>
<td>3 × 10</td>
<td>Squats (single leg, double leg), Lunges, Side to side hopping</td>
</tr>
<tr>
<td></td>
<td>3 × 30 sec</td>
<td>BOSU ball single leg balance</td>
</tr>
<tr>
<td></td>
<td>5 × 2 legs</td>
<td>6 point touch, 6 point hop</td>
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</table>
began a daily ankle strengthening program (Table 1), followed by cryotherapy for pain control. Both athletes performed the daily ankle strengthening program for four weeks. Each day, pain perception, activity level, and treatment were recorded (Table 2). After four weeks, both athletes reported a decrease in pain and increase in range of motion. We believe that a combination of therapeutic modalities, a rehabilitation strengthening program that is focused on the dynamic stabilization of the foot and ankle, and our “four mini stirrup” taping can help manage cuboid syndrome effectively.

**Conclusion**

Although relatively rare, cuboid syndrome may be responsible for midfoot discomfort among athletes. Treatment options for this condition include manual therapy techniques, therapeutic modalities, taping and padding, and the use of an orthosis. Lacking research evidence for the effectiveness of these therapeutic measures, clinicians must rely on the anecdotal experiences of other clinicians.

**References**


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