Lisfranc Ligament Injuries in Windsurfers

ABSTRACT: Recently, due to evolution of equipment and techniques, ordinary-level windsurfers can attempt acrobatic activities that previously only high-level windsurfers could perform in stormy conditions. Moreover, many difficult aerial tricks have been developed by high-level windsurfers. Synchronously, “foot strap injuries” have increased, which affect the knee, ankle, and foot by twisting loads because the foot is unable to be released from the foot strap. Here we report three Lisfranc ligament injuries in windsurfers that had not been diagnosed appropriately at another medical institution. The cases of two professional, and one amateur windsurfer, all of whom sustained a sprain to the anterior foot when they failed to land properly following an aerial trick or during wave riding, are reported in this publication. Weightbearing anterior to posterior (AP) view radiographs were an important tool for the diagnosis of these Lisfranc ligament injuries which can easily be missed on non-weightbearing films. Surgical treatment was chosen for two cases and conservative treatment was chosen for the other. To allow the windsurfers to return successfully to competition, we devised a special cork insole inside a marine boot called the “Ninja.” Lisfranc Ligament injuries should be suspected as there are frequent foot injuries in windsurfers, and adequate treatment can enable the patients to return to competition successfully.

KEYWORDS: Lisfranc ligament injury, windsurfing, foot strap injury

Introduction

Windsurfing is a relatively new sport, born in 1967. Though most people have an image of a windsurfer cruising slowly on flat water, it actually enables the participant to glide over 50 m/h, to ride a wave like a surfer, and to perform aerial tricks similar to those seen in snowboarding. In addition, recently, due to the evolution of equipment and technique, ordinary-level windsurfers can attempt acrobatic activities that previously only high-level windsurfers could perform during stormy conditions.

Moreover, many difficult aerial tricks have been developed by high-level windsurfers and a new competition category, termed “Free Style,” has been established. Thus, not surprisingly, high energy injuries have increased in frequency. “Foot strap injuries” are also very common. Moreover, Lisfranc ligament injury, which can be a subtle injury to the tarsometatarsal complex, is relatively uncommon in other sports injuries. It is notoriously difficult to diagnose, both clinically and radiographically. It causes persistent foot pain if it is overlooked.

Here we report three Lisfranc ligament injuries caused by the non-releasable foot strap in windsurfers who had not been diagnosed properly at another medical institution.

Case 1: 23 year Old Male, Professional Windsurfer

The patient sprained his left forefoot when he was unable to free his foot from the foot strap during a landing following a forward loop (Fig. 1). Only his injured foot was fixed in a foot strap when he landed. Immediately he felt severe pain and had swelling in his anterior foot. On the same day, he went to...
neighboring medical institution and was diagnosed as having a sprain of his foot. He was presented to us on the next day. He could not weight bear because of anterior foot pain, and on examination was found to have point tenderness between the first and second metatarsal bases. A nonweightbearing radiograph suggested a small amount of diastasis between the first and second metatarsal bases, but was not convincing (Fig. 2). A weightbearing AP view radiograph showed greater than 3 mm of definite diastasis between first and second metatarsal bases, and a fleck sign was found (Fig. 3). With the diagnosis of an acute Lisfranc ligament injury, he underwent closed reduction and internal fixation with partially threaded 4 mm cannulated screws under fluoroscopic visualization (Fig. 4). Postoperatively, he remained totally non-weightbearing for two weeks. Between two and four weeks, partial weightbearing was instituted, increasing to full weightbearing with a custom hard insole for longitudinal and lateral arch support. Screw removal occurred at 12 weeks. Return to windsurfing occurred 16 weeks after the athlete had a sports specific functional rehabilitation program using a special cork insole in a marine boot.

Case 2: 35 year Old Female, Amateur Windsurfer

The patient sprained her left forefoot when she could not release from her foot strap when she failed to land properly after a normal jump. The next day, she went to a neighboring medical institution and was diagnosed as having “just” a foot sprain. After ten days she able to walk unaided, but she continued to experience pain, and she was unable to perform any sports activities. She was presented to us two months

FIG. 1—Forward loop.

FIG. 2—Case 1: Nonweightbearing radiographs.

affected side unaffected side

FIG. 3—Case 1: AP Radiographs with weightbearing.
after the injury with no significant improvement. On examination, she had anterior foot pain on weight-bearing and point tenderness was found between the first and second metatarsal bases. Non-weightbearing radiographs were reported to be normal. A weightbearing AP radiograph showed greater than 3 mm of diastasis between the first and second metatarsal bases (Fig. 5). With diagnosis of an old Lisfranc ligament injury, she underwent open reduction and internal fixation with partially threaded 4 mm cannulated screws under fluoroscopic control (Fig. 6). To reduce the displacement, scar tissue, including a portion of the old Lisfranc ligament, was excised. Postoperative rehabilitation was performed as we had done in Case 1. She returned to windsurfing successfully at 20 weeks following the surgery.

**Case 3: 40 year Old Female, Professional Windsurfer**

The patient sprained her left foot when she dropped into the water during wave riding without release of her injured foot from the foot strap. The next day, she went to a neighboring medical institution and was diagnosed as having a foot sprain. After one week, she was able to walk unaided, but she experienced pain
afterward. She was not able to depress a board with her left foot placed in a foot strap during windsurfing. She was presented to us three months after the injury with no significant improvement in her symptoms.

Upon examination, anterior foot pain with weightbearing occurred and point tenderness was found between the first and second metatarsal bases. A weightbearing AP radiograph showed greater than 3 mm of definite diastasis between the first and second metatarsal bases. With the diagnosis of an old Lisfranc ligament injury, we first recommended surgical treatment. However, she strongly preferred nonsurgical treatment, and thus we consented to use conservative therapy. She is now successfully back to competition wearing a special cork insole. She decided to concentrate on racing, giving up wave riding and free-style competition.

Discussion

A foot strap injury is a relatively common lower extremity injury that affects the knee, ankle, or foot by loads transmitted proximally from the foot strap, which does not release from the foot when a windsurfer is rolled over by a wave or fails to properly land after a jump. It was described by Ullis et al. as “Wave Jumpers and Wave Sailor’s Knee and Ankle.” A foot strap fixes the foot to the board to allow the windsurfers to control the board. It is generally worn barefoot and designed to make it easy to remove. Quite a few windsurfers prefer to set the foot strap loose, but when it is too loose, the foot tends to be placed too deeply into the strap, which in turn makes it difficult to remove. This may lead to a foot strap injury. As has been previously described, from the perspective of preventing foot strap injuries, it is advisable to set the foot strap properly tight which prevents the foot from going into the strap further than the metatarsophalangeal (MTP) joint.

The Lisfranc ligament extends from the medial cuneiform to the base of the second metatarsal bone. Lisfranc ligament injury causes persistent foot pain with weightbearing due to instability between the first and second metatarsal bases. It is thought to be a relatively uncommon sports injury, because in many cases it is overlooked since the nonweightbearing radiographs often do not provide clear evidence of its presence.

In the case of soccer or American football players, it generally occurs when the anterior foot bears the athlete’s weight when it is forced into external rotation and pronation. In the case of windsurfers, it occurs when landing from a jump or wave riding. Immediately prior to the injury, the unaffected-side foot becomes free from its foot strap causing the athlete to lose his/her balance, and then the affected-side foot, which is fixed to the board, becomes acutely pronated.

Nunley et al. classified this injury based on clinical findings, weightbearing radiographs, and bone scintigram results. The patients with Stage 1 injuries were unable to play sports and had pain at the region of the Lisfranc ligament complex; however, weightbearing radiographs demonstrated no abnormal displacement, but there were positive results on bone scintigrams. Patients with Stage 2 injuries had diastasis of the first and second metatarsal bones of 1 to 5 mm on the AP weightbearing radiographs, but no evidence of loss of midfoot arch on lateral weightbearing radiographs. Patients with Stage 3 injuries had first to second metatarsal bone diastasis greater than 5 mm on an AP weightbearing radiograph and loss of midfoot arch height (Fig. 8). Bone scintigrams should help in the case of Stage 1 injuries, in which displacement is not recognized on AP weightbearing radiographs. Since our three cases were Stage 2
lesions, in which instability was clearly present on weightbearing AP view radiographs, bone scintigrams were not performed.

Potter et al. [4] demonstrated the validity of MRI for this injury. We, however, found that although in the acute stage, signal changes that indicate the deterioration of the ligament and hemorrhage within it can be observed, the MRI usually can provide only poor reproducibility of the image of this notably thin ligament, especially in chronic cases. Additionally, it cannot provide the evidence of instability. Therefore, we believe it should be used only as an adjunct to the diagnosis.

Since CT scans did not provide more information than radiographs for all our cases, we believe it is not a valid screening method for most Lisfranc ligament injuries for which instability is not observed under nonweightbearing conditions. Therefore, a weightbearing AP radiograph is believed by us to be most cost-effective tool for the diagnosis of this condition.

Shapiro et al. [5] observed that, “A high index of suspicion based on history and physical examination is necessary.” Lisfranc ligament injuries should be ruled out as a possibly frequent foot injury in windsurfers.

Although Shapiro et al. [5] reported that conservative therapy resulted in good results, many authors, including Potter et al. [4], Davis et al. [6], and Nunley et al. [3], recommend surgical treatment when diastasis is observed on weightbearing AP radiographs. We concur; however, for Case 3, we decided on conservative therapy because the patient was 40 years of age and nearing the late stages as a professional windsurfer, and a thus long rest would have precipitated her retirement. Fortunately, her specialty was racing, in which weightbearing to her anterior foot in the foot strap occurred relatively infrequently. Thus, she decided to concentrate on racing, giving up wave-riding and free-style.

To enhance return to competition, we devised a special cork insole for all our cases. This was designed to have enough strength to support the longitudinal and lateral arch even under the stress of bearing weight with the anterior foot placed in the foot strap. To accommodate its use in the water, it was worn inside a marine boot called the “Ninja” (Fig. 9).
Conclusion

Lisfranc ligament injuries should be suspected as potentially frequent foot injuries in windsurfers. An AP view radiograph with weightbearing is useful for diagnosis in addition to normal AP and lateral non-weightbearing views. Adequate treatment enabled all our patients to return successfully to competition.

References


