



Arthroscopic Reduction and Internal Fixation for Fracture of the Lateral Process of the Talus

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Abstract: Fractures of the lateral process of the talus (LPT) are relatively rare. We describe arthroscopic reduction and internal fixation for a type I fracture of the LPT according to the Hawkins classification. Preoperative computed tomography is necessary to evaluate the type and displacement of the LPT fracture because this type of fracture is often overlooked on a plain radiograph. The ankle is approached through a standard medial portal as the working portal and an anterolateral portal as the viewing portal. A 2.7-mm-diameter 30° arthroscope is used. Hematoma and soft tissues around the talus are cleared with a motorized shaver, and the anterior and lateral aspects of the talar process are visualized. Fracture reduction is obtained by pushing the lateral fragment of the lateral process medially and is fixed temporally with a 1.1-mm guidewire from the medial portal under both arthroscopy and fluoroscopy. A headless compression screw is inserted through the guidewire. Arthroscopic reduction and internal fixation for a type I LPT fracture can be easily accomplished, and return to daily and sports activities can be achieved in a relatively short time.

As snowboarding increased in popularity in the past decade, the frequency of associated injuries has been growing accordingly.^{1,2} Although fractures of the lateral process of the talus (LPT) typically occur in snowboarders, they still are relatively rare.¹⁻⁴ The LPT fracture is commonly misdiagnosed on the initial radiographs, and when overlooked, it can lead to subtalar osteoarthritis.^{1,2,4-6} In the case of a type I fracture, classified by Hawkins⁴ with more than 2 mm of displacement, open reduction–internal fixation (ORIF) is generally recommended.⁷⁻¹⁰ We present a less invasive arthroscopic reduction–internal fixation technique for a type I LPT fracture.

Preoperative Evaluation

Although the clinical findings of an LPT fracture are similar to those of an ankle sprain (inversion injury), local tenderness is present 1 cm distal to the tip of the

lateral malleolus. Preoperative examination includes plain anterolateral and lateral radiographs of the ankle joint (Fig 1). In addition, computed tomography (CT) is mandatory to further evaluate the diagnosis, and CT assessment should include the fracture type, degree of displacement, and size of the fracture fragment(s) (Fig 2).

Surgical Technique

The operation is performed with the patient under general anesthesia in the supine position (Table 1). After attachment of a pneumatic cuff, 5 mL of normal saline solution is injected into the sinus tarsi. The anterolateral portal is first inserted 2 cm anterior and 1 cm distal to the tip of the lateral malleolus, the location equivalent to the position of the sinus tarsi. This anterolateral portal is used as the visualization portal. A 2.7-mm-diameter 30° arthroscope is used. Next, a medial portal is established just distal and anterior to the tip of the lateral malleolus and is used as the working portal. Hematoma, soft tissues around the talus, cartilaginous flakes, and small osteochondral fragments are removed with a motorized shaver (3.5-mm cutter; Stryker, Kalamazoo, MI) (Fig 3, Video 1), and synovitis-affected tissue is shaved with a radiofrequency system (VAPR; DePuy Mitek, Raynham, MA). The anterior and lateral aspects of the LPT are then visualized (Fig 4A). The degree of fracture displacement is measured, and other potentially

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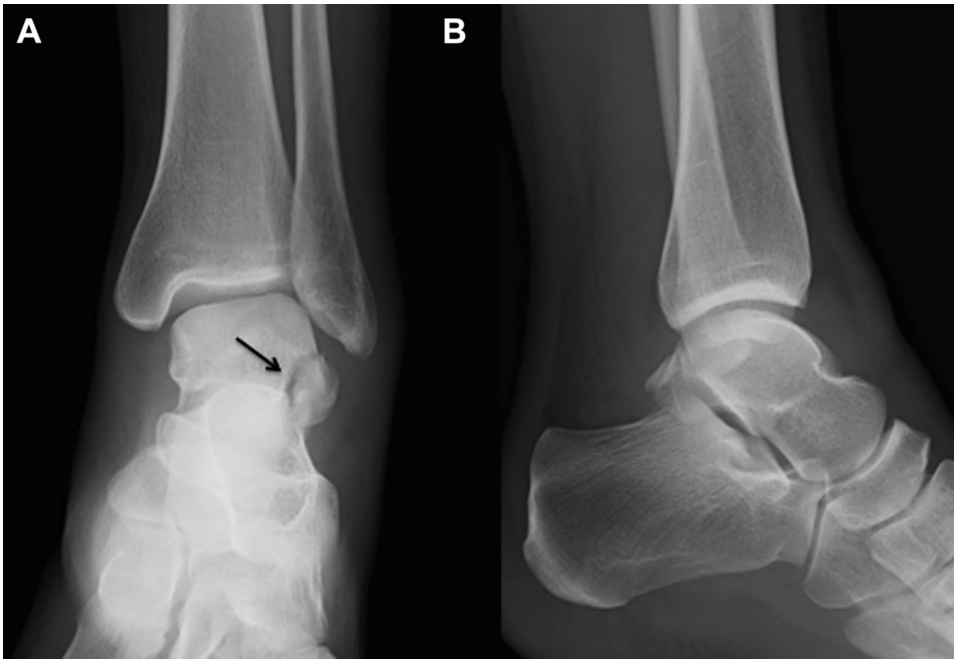


Fig 1. (A) Anteroposterior radiograph of the left ankle joint of a 22-year-old female snowboarder taken during the initial visit (the day after injury, in which she twisted the ankle during snowboarding) showing a displaced type I fracture of the lateral process of the talus according to the Hawkins classification (arrow). (B) The fracture was not evident on a lateral radiograph.

significant injuries such as cortical bone defects, ligament ruptures, or loose intra-articular bone fragments are also inspected (Fig 4B). If remarkable displacement is observed at the talofibular articular surface, the viewing portal can be switched to the anterolateral portal of the ankle joint. The lateral fragment of the

LPT is pushed medially with a small mosquito clamp from the medial portal. While the surgeon is confirming correct reduction alignment under both arthroscopy (Fig 5A) and fluoroscopy, a 1.1-mm guidewire is used for temporal fixation from the lateral side of the lateral process into the body directed

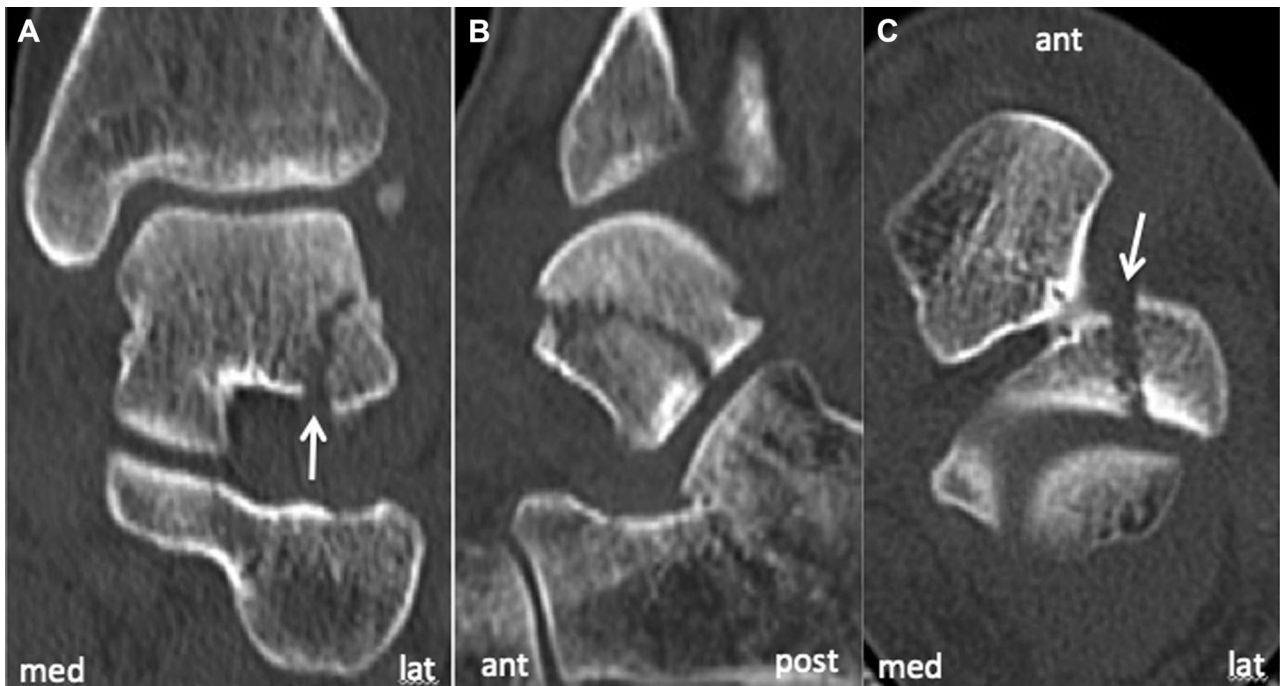


Fig 2. (A) Coronal, (B) sagittal, and (C) axial reconstructed computed tomography images confirm 3 mm of displacement at the anteroinferior aspect of the fracture (arrows) indicating the necessity for surgical reduction and internal fixation. (ant, anterior; lat, lateral; med, medial; post, posterior.)

Table 1. Surgical Steps and Technical Tips

Surgical Step	Technical Tips
Preparation	A 2.7-mm-diameter 30° arthroscope and a fluoroscope are used. Saline solution is injected into the sinus tarsi to facilitate insertion of the arthroscope into the lateral talar space.
Arthroscopic LPT examination	An anterolateral portal is used as the viewing portal and a medial portal as the working portal. Hematoma, soft tissues around the talus, cartilaginous flakes, and small osteochondral fragments are removed.
Reduction of fragment	The lateral fragment of the LPT is pushed medially with a small mosquito clamp from the medial portal. Correct reduction alignment is confirmed under both arthroscopy and fluoroscopy. In case the displacement of the superior aspect and/or posterior aspect is large, an additional superior portal (an anterolateral portal in the ankle joint) and/or a posterolateral subtalar portal may be needed.
Insertion of guidewire and screw	A 1.1-mm guidewire is used for temporal fixation from the lateral side of the lateral process into the body directed 45° superior and parallel to the fibula with the ankle in neutral position. When it is difficult to determine whether the guidewire is correctly inserted, the position and direction of the guidewire should be confirmed under both arthroscopy and fluoroscopy. A headless compression screw is inserted through the guidewire to the measured depth.

LPT, lateral process of talus.

45° superior and parallel to the fibula with the ankle in neutral position (Fig 5B). After the guidewire measurement for the screw depth, the bone is drilled to the measured depth. A headless compression screw (Acutrak Standard with 3.3-mm diameter at top and 4.2 mm at bottom; Acumed, Hillsboro, OR) is inserted through the guidewire (Fig 5C). The intra-articular space is irrigated, and the portals are sutured.

Postoperative Treatment

The ankle is immobilized with a plaster splint with partial weight bearing (10 kg) for 4 weeks. Although inversion and eversion of the hindfoot are prohibited during this period, the patient is allowed range-of-motion movements from 1 week after the operation. Full weight-bearing exercises and return to regular daily activities are allowed after confirmation of fracture healing on radiographs taken 4 weeks after the operation. CT scans are also recommended to confirm complete bone union (Fig 6).

Discussion

Although fractures of the LPT are infrequently encountered, they account for 26% of all talar fractures⁴ and 0.4% to 1% of all ankle injuries^{3,6,7} and typically occur in snowboarders.^{1-3,6,8} The pathomechanism of LPT fractures is multifactorial and not fully explained. LPT fractures are commonly divided into 3 types according to the Hawkins classification⁴: A type I fracture is a simple fracture that extends from the talofibular articular surface down to the posterior talocalcaneal articular surface of the subtalar joint;

type II is a comminuted fracture that involves both the fibular and posterior calcaneal articular surfaces of the talus and the entire lateral process; and a type III fracture is a chip fracture of the anterior and inferior portions of the posterior articular process of the talus. This fracture does not extend to the talofibular articulation.

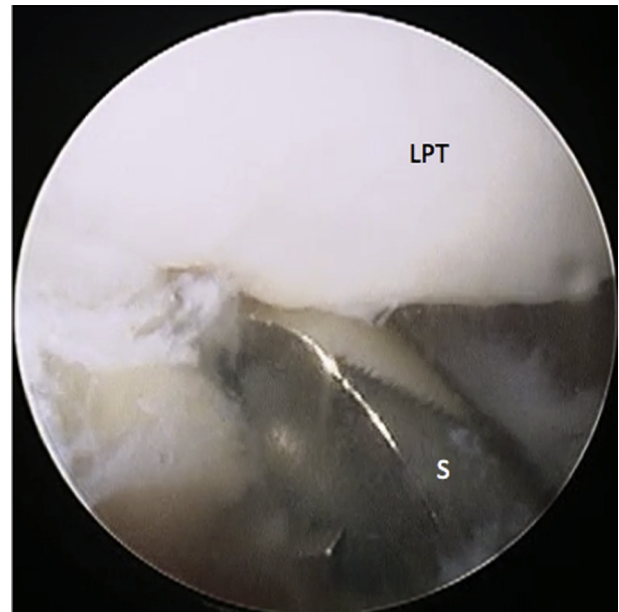


Fig 3. Arthroscopic examination of anterior aspect of lateral process of talus (LPT) (supine position, left ankle; arthroscopic view from anterolateral portal). A 2.7-mm-diameter 30° arthroscope is inserted from the anterolateral portal, and the synovia are shaved through the medial portal. (S, shaver.)

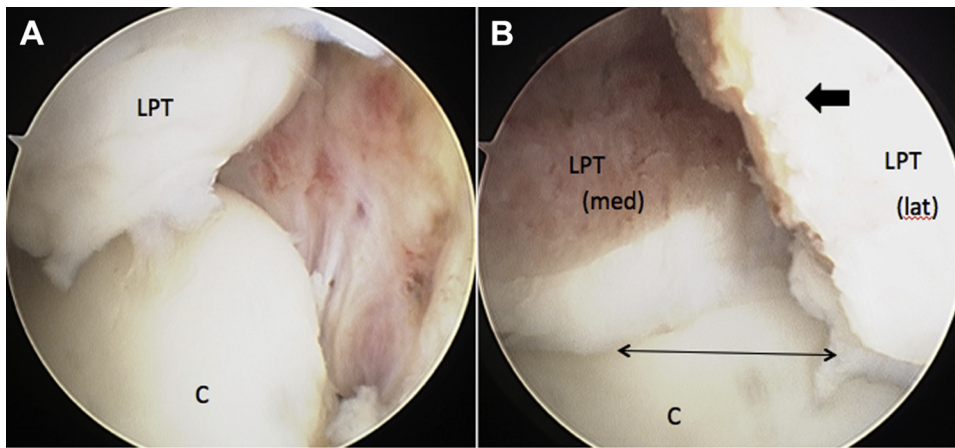


Fig 4. Arthroscopic examination of fracture of lateral process of talus (LPT) (supine position, left ankle; arthroscopic view from anterolateral portal). (A) The lateral aspect of the talar process is visualized after removal of the soft tissues around the talus. (B) Displacement of the fracture is measured. In this case it was 3 mm at the anteroinferior aspect of the fracture (double-headed arrow). The cortical defect is found at the anterior aspect of the fracture (arrow). (C, calcaneus; lat, lateral fragment; med, medial fragment.)

Selection of the treatment method depends on the fracture type, degree of displacement, size of the fragment(s), and duration from the injury.¹⁻¹⁰ Successful conservative treatment by immobilization with a plaster splint for nondisplaced fractures has been reported.¹⁻¹⁰ All displaced fractures, fractures with small intra-articular fragments, severely comminuted fractures, and fractures with nonunion or delayed nonunion necessitate surgical treatment.¹⁻¹⁰ Surgery consists of 2 methods: ORIF and excision of the fragments. Previously, we reported successful arthroscopic excision of the bone fragment and a loose body in a neglected fracture of the LPT.¹¹

There have been several reports of ORIF for LPT displaced fractures.^{1,4,8,10,12} In most reported cases, 1 or 2 cancellous bone screws (2.0 or 2.7 mm in diameter) were used for internal fixation. If the bony fragment is relatively large, we use 1 headless compression screw,

which has been widely used in recent years and has been reported to provide a good grip and compression of the fragment. A minimally invasive ORIF approach for an LPT fracture has also been reported.¹² In that case the reduction and internal fixation were performed by a small incision under fluoroscopy. The advantage of arthroscopic surgery, as presented in this report, is a good direct and dynamic method of visualization of the LPT fracture and associated injuries such as cortical bone defects, ligament ruptures, and loose intra-articular bone fragments. Because the technique is minimally invasive, no damage to the anterior talofibular, calcaneofibular, and talocalcaneal ligaments occurs with surgical manipulation (Table 2). The procedure can be quickly and safely performed if the surgeon is familiar with arthroscopic visualization. In type I fractures, the articular surface of the fracture consists of superior (talofibular joint), inferior (subtalar

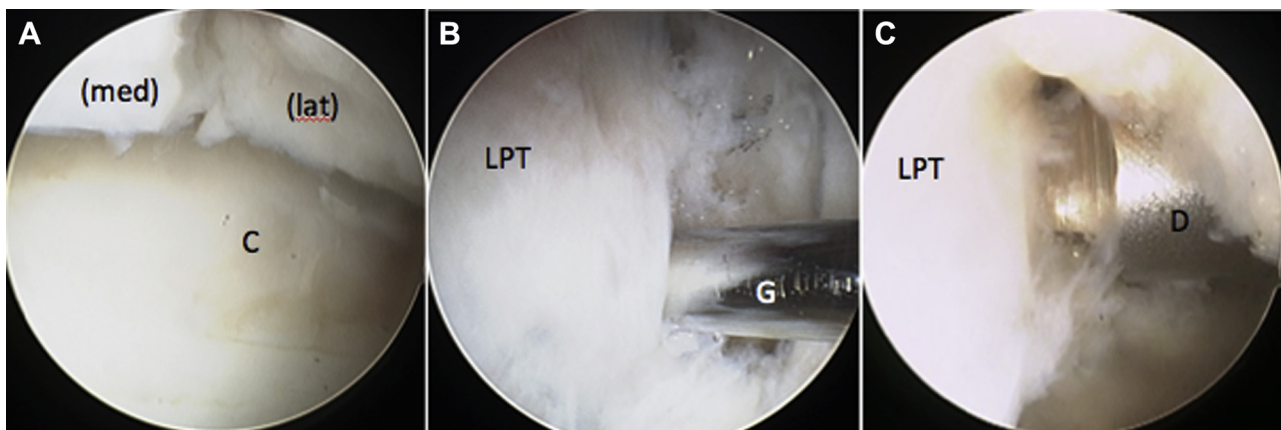


Fig 5. Arthroscopic view after insertion of guidewire and screw, as well as reduction of fracture (supine position, left ankle; arthroscopic view from anterolateral portal). (A) The fracture is reduced with a small mosquito clamp by pushing the lateral side of the fragment medially. (B) A 1.1-mm guidewire is inserted from the lateral aspect of the lateral process of the talus (LPT) under both arthroscopy and fluoroscopy. (C) After the measurement of the guidewire for the screw depth, the bone is drilled to the measured depth. A headless compression screw is inserted through the guidewire. (C, calcaneus; D, screwdriver; G, guidewire; lat, lateral fragment; med, medial fragment.)

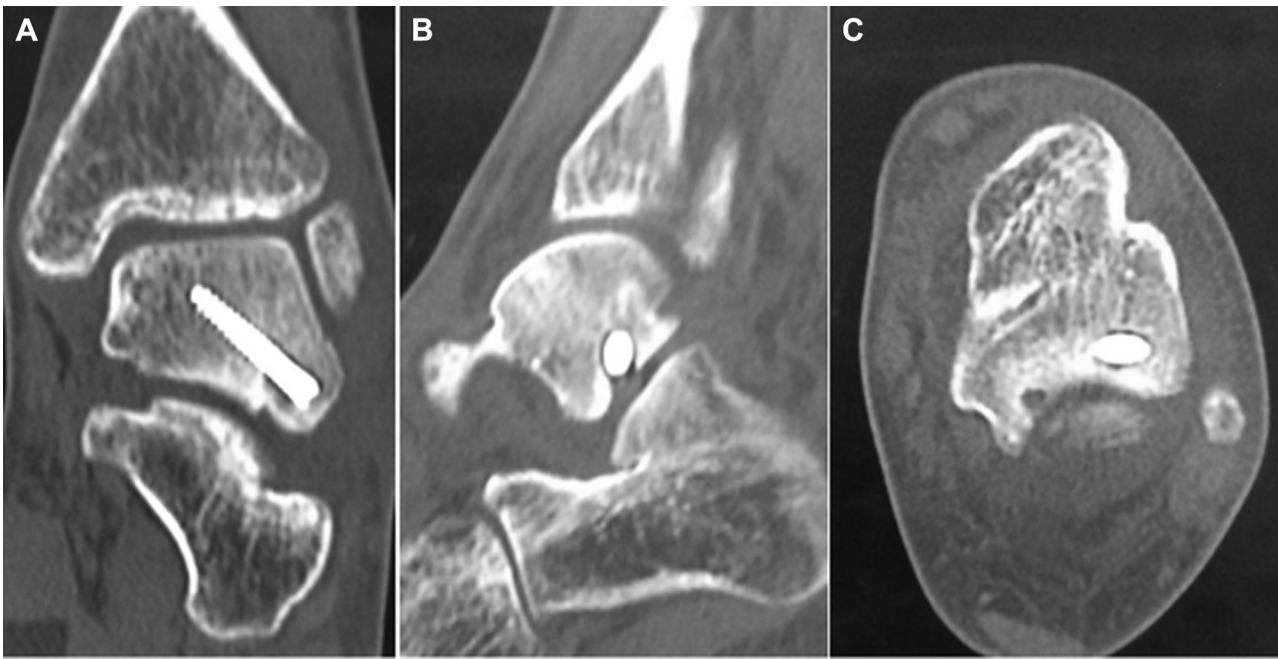


Fig 6. (A) Coronal, (B) sagittal, and (C) axial reconstructed computed tomography images taken 8 weeks after surgery confirm complete bone union.

joint), anterior, and posterior aspects. It is important to confirm accurate reduction in at least 2 dimensions during reduction of the fragment. We confirm the anterior and inferior aspects in addition to the superior aspect of the fracture by making another portal in the ankle joint. In case of significant displacement at the posterior aspect of the fracture, though rare, another posterolateral portal can be inserted.

Notwithstanding the aforementioned advantages, there are potential limitations and complications associated with the arthroscopic approach. It can be difficult to determine whether the fragment has been reduced and whether the guidewire has been inserted correctly. On reduction of the fragment, the position and direction of the guidewire therefore must be confirmed

under both arthroscopy and fluoroscopy. In addition, it can be difficult to achieve arthroscopic reduction and fixation with comminuted fragments. The indication for arthroscopic reduction and fixation for LPT fractures is limited to type I fractures. Another potential risk is damage to the superficial peroneal nerve and the sural nerve. With careful palpation of the lateral malleolus and sinus tarsi before insertion of the portal, the risk of serious complications can be reduced.¹¹

Arthroscopic reduction and internal fixation for a type I fracture of the LPT can be easily accomplished, and precise anatomic reduction can be obtained. With an early diagnosis and prompt treatment, the best possible results—an early return to preinjury daily and sporting activities—may be achieved.

Table 2. Indications, Pitfalls, Risks, and Benefits of Arthroscopic Reduction and Fixation for LPT Fracture

Indications	
	Displaced type I LPT fracture
	Excision of bone fragments of LPT fracture
Pitfalls	
	When the fracture fragment is small, a small-diameter (2.0- or 2.7-mm) screw is recommended.
	If there are multiple fragments, an arthroscopic surgical procedure should be carefully considered.
Risks	
	Damage to superficial peroneal and sural nerves
Benefits	
	Precise anatomic reduction with good direct and dynamic visualization of the LPT fracture can be obtained.
	Associated injuries such as ligament ruptures, cartilage damage, and loose intra-articular bone fragments can be observed.
LPT, lateral process of talus.	

References

1. Valderrabano V, Perren T, Ryf C, Rillmann P, Hintermann B. Snowboarder's talus fracture: Treatment outcome of 20 cases after 3.5 years. *Am J Sports Med* 2005;33:871-880.
2. Kirkpatrick DP, Hunter RE, Janes PC, Mastrangelo J, Nicholas RA. The snowboarder's foot and ankle. *Am J Sports Med* 1998;26:271-277.
3. Bladin C, McCrory P. Snowboarding injuries. An overview. *Sports Med* 1995;19:358-364.
4. Hawkins LG. Fracture of the lateral process of the talus. A review of thirteen cases. *J Bone Joint Surg Am* 1965;47:1170-1175.
5. Perera A, Baker JF, Lui DF, Stephens MM. The management and outcome of lateral process fracture of the talus. *Foot Ankle Surg* 2010;16:15-20.

6. McCrory P, Bladin C. Fractures of the lateral process of the talus: A clinical review. *Clin J Sport Med* 1996;6:124-128.
7. Boack DH, Manegold S. Peripheral talar fractures. *Injury* 2004;35:SB23-SB25.
8. von Knoch F, Reckord U, von Knoch M, Sommer C. Fracture of the lateral process of the talus in snowboarders. *J Bone Joint Surg Br* 2007;89:772-777.
9. Parsons SJ. Relation between the occurrence of bony union and outcome for fractures of the lateral process of the talus: A case report and analysis of published reports. *Br J Sports Med* 2003;37:274-276.
10. Lunebourg A, Zermatten P. Fracture of the lateral process of the talus: A report of two cases. *J Foot Ankle Surg* 2014;53:316-319.
11. Funasaki H, Kato S, Hayashi H, Marumo K. Arthroscopic excision of bone fragments in a neglected fracture of the lateral process of the talus in a junior soccer player. *Arthrosc Tech* 2014;3:e331-e334.
12. Tezval M, Schmoz S, Dumont C. Minimally invasive osteosynthesis. Even in talus fractures? *Oper Orthop Traumatol* 2012;24:396-402 [in German].