JKFAS Journal of Korean Foot and Ankle Society
Technical Report
pISSN 1738-3757 eISSN 2288-8551
J Korean Foot Ankle Soc 2020;24(4):165-167
https://doi.org/10.14193/jkfas.2020.24.4.165

Check for updates

리스프랑 관절 손상 수술 중 시행하는 프리어 검사법

양기원, 이홍섭, 박성철, 정구민

노원을지대학교병원 족부족관절 정형외과

Freer Test for an Intraoperative Evaluation of a Lisfranc Joint Injury: A Technical Report

Ki Won Young, Hong Seop Lee, Seongcheol Park, Gu Min Jeong

Department of Foot and Ankle Surgery, Nowon Eulji Medical Center, Eulji University, Seoul, Korea

Failure to achieve stable fixation during surgery for a Lisfranc joint injury leads to subtle instability that causes dysfunction and posttraumatic osteoarthritis. Therefore, it is important to check for appropriate fixation during surgery. This paper reports a test that evaluates the joint instability dynamically during the open reduction of the Lisfranc joint and checks the stability after fixation. a Freer elevator was inserted into the interosseous area between the medial cuneiform and second metatarsal base, and a twisting force was applied to evaluate the dynamic instability of the Lisfranc joint. After fixation of the Lisfranc joint, the stability of the fixation could be tested by trying this maneuver with the Freer elevator. Overall, the Freer test can be considered a valuable test in open surgery for a Lisfranc joint injury.

Key Words: Metatarsus, Metatarsal bones, Surgery

A Lisfranc joint injury is defined as a bony or ligamentous injury which involves the tarsometatarsal joint of the midfoot. Failure to achieve stable fixation during surgery for a Lisfranc joint injury leads to subtle instability that causes dysfunction and posttraumatic osteoarthritis.[1,2] Most authors agree that fracture or dislocation of the Lisfranc joint causes midfoot instability, which requires surgical treatment involving open reduction and internal fixation.[3] Before surgery, instability can be confirmed through weight bearing radiograph and abduction stress radiograph. When instability is unclear, tests such as magnetic resonance imaging may be helpful for diagnosis. However, there is no reported method to check if the instability has been resolved through proper fixation during the surgery. The purpose of the present report was to introduce a test that evaluates joint instability dynamically during open reduction of the Lisfranc joint and checks the stability after fixation.

TECHNIQUE

The protocol of this study was reviewed and approved by the Institutional Review Board. The patient was placed in the supine position and the Esmarch tourniquet was placed above ankle level. We made a dorsomedial incision between the first and the second metatarsals. The medial dorsal cutaneous branch of the superficial peroneal nerve was identified and protected. This incision allows visualization, debridement, reduction, and stabilization of the Lisfranc joint. The Freer test suggested by us uses a Freer elevator (width 5 mm,

Received July 3, 2020 **Revised** September 21, 2020 **Accepted** September 22, 2020
Corresponding Author: Hong Seop Lee
Department of Foot and Ankle Surgery, Nowon Eulji Medical Center, Eulji University, 68 Hangeulbiseok-ro, Nowon-gu, Seoul 01830, Korea
Tel: 82-2-970-8259, Fax: 82-2-973-3024, E-mail: sup4036@naver.com
ORCID: https://orcid.org/0000-0002-3589-314X

Financial support: None.
Conflict of interest: None.

thickness 1 mm) that is inserted into the interosseous area between the medial cuneiform and the second metatarsal base (Fig. 1). The surgeon applies a twisting force to the Freer elevator to widen the space between the medial cuneiform and second metatarsal base. The twisting motion applies a distraction force on the Lisfranc joint, directly stressing the Lisfranc ligament. It can be considered as instability of Lisfranc joint when the Freer elevator in the thin side is twisted more than 90 degree on the wide side. It allows the determination of the necessity of fixation by immediately checking the dynamic instability caused by rupture of the Lisfranc ligamentous complex (Fig. 2). After removing the fibrous tissues that interfere with reduction, anatomic reduction can be performed by percutaneously inserted large bone reduction forceps. Subsequently, the Freer elevator can be inserted into the space between the medial cuneiform and second metatarsal base, and twisted to confirm stable reduction (Fig. 3). In the present case, A 4.0 mm cannulated screw was inserted from the medial cuneiform into the second metatarsal base to hold the Lisfranc ligament in an anatomic position for healing. This screw effectively secured the keystone of the arch. After fixation of the Lisfranc joint, the stability of

Figure 1. The Freer elevator is inserted into the interosseous area between the medial cuneiform and the second metatarsal.

Figure 3. A twisting force is applied to the Freer elevator to check for stability after redudction with bone reduction forceps.

Figure 2. A twisting force is applied to the Freer elevator, attempting to separate the first and second metatarsals.

Figure 4. After fixation of the Lisfranc joint, the stability of the fixation can be tested by trying the twisting motion with the inserted Freer elevator.

the fixation could be tested by twisting motion with the freer elevator (Fig. 4). A 2-mm thick Freer elevator easily enters the space between the medial cuneiform and second metatarsal base. Inability to twist the Freer elevator denotes firm fixation.

After the surgery, the patient was instructed to perform non-weight bearing activities for 2 weeks while wearing a short leg splint. After 2 weeks, sutures were removed and a short leg cast could be worn. Non-weight bearing activities were advised for another 2 weeks. Short leg cast can be replaced with postoperative shoes, and tolerable weight bearing can be started 4 weeks after the surgery. Full weight bearing was started at 6 weeks after the surgery, and postoperative shoes were worn until 8 weeks after the surgery.

DISCUSSION

The Lisfranc joint complex is a very elaborate structure. The proximal part of the metatarsal bone and the cross-section of the cuneiform have an inverted triangular shape, forming a Roman arch with inherent stability that prevents the collapse of the structure.[4] Particularly, the base of the second metatarsal bone is sandwiched between the medial and the lateral cuneiform bones, and is located at the top of the Roman arch, functioning as a keystone. It serves as a reference point for treatment of all Lisfranc joint injuries.[5]

The complexity of the Lisfranc joint complex results in limitations in the diagnosis of Lisfranc joint injuries through physical examinations and simple radiographs. The probability of improper diagnosis at the first radiographic examination is approximately 20%.[6] Inadequate diagnosis and treatment lead to foot deformity, persistent instability, degenerative arthritis, and dysfunction including limping gait.[1] For displaced or unstable Lisfranc injuries, recently reported series support the importance of achieving and maintaining anatomic reduction. Routine direct joint visualization allows for a more reliable reduction and anatomic internal fixation of larger osteochondral fragments, or excision of smaller interposed fragments. It is critical to ensure that there is no instability during the surgery after adequate reduction and fixation between the second metatarsal base and the medial cuneiform. If proper stability is not achieved, long-term discomfort and functional deterioration may result after the surgery.[7,8] We developed the Freer test to check for instability dynamically during open surgery and to check whether stability was maintained after fixation. The Freer test has the advantage of an easy approach with or without the C-arm and dynamic visualization of the Lisfranc joint.

Nevertheless, our test also has some limitations. Iatrogenic injury could occur during the twisting motion of the Freer elevator inserted into the joint. No comparison was performed with the findings in the preoperative examination. Thus, prospective studies regarding the accuracy of this test are needed.

In conclusion, the Freer test could be considered a valuable test in open surgery for the a Lisfranc joint injury.

ORCID

Ki Won Young, https://orcid.org/0000-0001-9654-0041
Seongcheol Park, https://orcid.org/0000-0002-8454-515X
Gu Min Jeong, https://orcid.org/0000-0002-8279-3125

REFERENCES

1. **Curtis MJ, Myerson M, Szura B.** *Tarsometatarsal joint injuries in the athlete. Am J Sports Med. 1993;21:497-502. doi: 10.1177/036354659302100403.*
2. **Raikin SM, Elias I, Dheer S, Besser MP, Morrison WB, Zoga AC.** *Prediction of midfoot instability in the subtle Lisfranc injury. Comparison of magnetic resonance imaging with intraoperative findings. J Bone Joint Surg Am. 2009;91:892-9. doi: 10.2106/JBJS.H.01075.*
3. **Nunley JA, Vertullo CJ.** *Classification, investigation, and management of midfoot sprains: Lisfranc injuries in the athlete. Am J Sports Med. 2002;30:871-8. doi: 10.1177/03635465020300061901.*
4. **Lenczner EM, Waddell JP, Graham JD.** *Tarsal-metatarsal (Lisfranc) dislocation. J Trauma. 1974;14:1012-20. doi: 10.1097/00005373-197412000-00003.*
5. **Cain PR, Seligson D.** *Lisfranc's fracture-dislocation with intercuneiform dislocation: presentation of two cases and a plan for treatment. Foot Ankle. 1981;2:156-60. doi: 10.1177/107110078100200307.*
6. **Trevino SG, Kodros S.** *Controversies in tarsometatarsal injuries. Orthop Clin North Am. 1995;26:229-38.*
7. **Faciszewski T, Burks RT, Manaster BJ.** *Subtle injuries of the Lisfranc joint. J Bone Joint Surg Am. 1990;72:1519-22.*
8. **Ly TV, Coetzee JC.** *Treatment of primarily ligamentous Lisfranc joint injuries: primary arthrodesis compared with open reduction and internal fixation. A prospective, randomized study. J Bone Joint Surg Am. 2006;88:514-20. doi: 10.2106/JBJS.E.00228.*