Technical Note

Arthroscopic Talonavicular Arthrodesis for the Management of Talonavicular Osteoarthritis

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Abstract: The talonavicular joint is a common site for osteoarthritis of the foot. Talonavicular arthrodesis is the surgical treatment for symptomatic talonavicular osteoarthritis. Classically, this is performed via an open approach and is associated with a rate of nonunion that ranges from 3% to 37%. Arthroscopic talonavicular arthrodesis has been proposed to provide better intra-articular visualization, conserve bone blood supply to improve the union rate, and reduce soft-tissue complications such as wound dehiscence, infection, and neurovascular injury. The purpose of this Technical Note is to describe the details of arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis.

Symptomatic radiographic foot osteoarthritis affects 17% of adults aged 50 years and older, with the first metatarsophalangeal joint being most commonly affected, followed by the second cuneometatarsal and talonavicular joints.[1] Isolated talonavicular arthrodesis is one of the surgical treatments for talonavicular osteoarthritis.[2] Classically, this is performed via an open approach and is associated with a rate of nonunion that ranges from 3% to 37%.[3]

Because of the recent advances in small joint arthroscopy, techniques of talonavicular arthroscopy have been introduced for the management of various pathologies of the joint, for example, osteochondral lesions, osteoarthritis, arthrofibrosis, and spring ligament tears.[4-13] Arthroscopic talonavicular arthrodesis has been proposed to provide better intra-articular visualization, conserve bone blood supply to improve the union rate, and reduce soft-tissue complications such as wound dehiscence, infection, and neurovascular injury.[5,11] The purpose of this Technical Note is to describe the details of arthroscopic talonavicular arthrodesis for the management of talonavicular osteoarthritis. It is indicated in cases of symptomatic talonavicular osteoarthritis recalcitrant to conservative management. It is contraindicated if the pain is not arising from the talonavicular joint; there is significant distortion of local anatomy (e.g., previous unreduced fracture dislocation of the navicular); there is the presence of chronic osteomyelitis involving the navicular or talar head requires bone resection; or there is significant foot deformity requiring open correction (Table 1).

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Received February 12, 2024; accepted March 13, 2024.

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2212-6287/24249
https://doi.org/10.1016/j.eats.2024.103006

Surgical Technique

Preoperative Assessment and Patient Positioning

Clinical palpation of the tender spot is important to differentiate the pain arising from the talonavicular joint from adjacent structures, for example, accessory navicular synchondrosis, posterior tibial tendon insertion, talar head, or navicular bone. Standing radiographs are useful to detect any significant foot deformity (Fig 1). The presence of navicular bone cyst is detected in this illustrated case, and computed tomography scan is useful to study the anatomy of the cyst and to detect any subchondral bone defect communicating the cyst with the talonavicular joint proper (Fig 2).

The patient is placed in the supine position with the legs spread. A thigh tourniquet is applied to provide a bloodless operative field. A 2.7-mm 30° arthroscope (Henke Sass Wolf GmbH, Tuttlingen, Germany) is used

Table 1. Indications and Contraindications of Arthroscopic Talonavicular Arthrodesis for Management of Talonavicular Osteoarthritis

Indications	Contraindications
1. Symptomatic talonavicular osteoarthritis recalcitrant to conservative management.	1. The pain is not arising from the talonavicular joint 2. There is significant distortion of local anatomy (e.g., previous unreduced fracture dislocation of the navicular) 3. Presence of chronic osteomyelitis involving the navicular or talar head requires bone resection 4. There is significant foot deformity requiring open correction

for this procedure. Fluid inflow is driven by gravity, and no fluid inflow is required.

Portal Placement

The midtarsal arthroscopy portals are used for this procedure.[11,14] Midtarsal arthroscopy portals include the medial, dorsomedial, dorsolateral, and lateral portals.[11,14] The medial, dorsomedial, and dorsolateral portals are used for arthroscopic talonavicular arthrodesis. The medial portal is at the medial corner of the talonavicular joint just dorsal to the posterior tibial tendon. The dorsolateral portal is at the junction point between the talonavicular and calcaneocuboid joints. The dorsomedial portal is at the talonavicular joint midpoint between the medial and dorsolateral portals (Fig 3). This portal can be identified with a needle under arthroscopic visualization via the medial portal. Sometimes, fluoroscopy is needed to identify the dorsomedial portal, especially if there is dorsal osteophyte obscuring the joint line. The lateral portal that is not used for this procedure is at the plantar lateral corner of the calcaneocuboid joint.

Cartilage Removal of the Talonavicular Joint

The medial portal is the viewing portal and the dorsomedial portal is the working portal. The cartilage of the dorsal part of the talonavicular joint is removed by an arthroscopic shaver (DYONICS; Smith & Nephew,

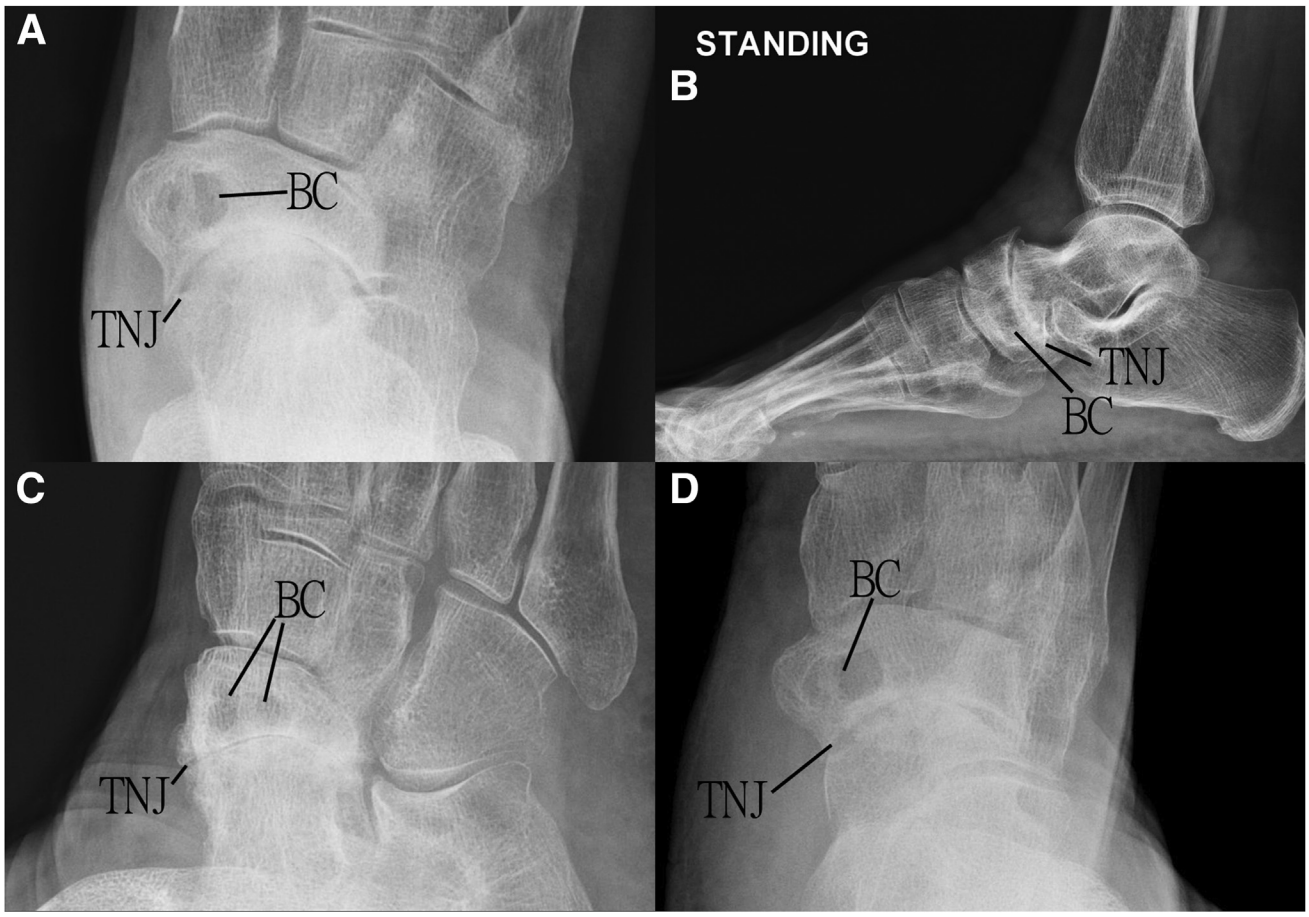

Fig 1. Arthroscopic talonavicular arthrodesis for the management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. Foot radiographs of this illustrated case show the presence of talonavicular osteoarthritis and navicular bone cyst. (A) Dorsoplantar view; (B) standing lateral view; (C) lateral oblique view; and (D) medial oblique view. (BC, bone cyst; TNJ, talonavicular joint.)

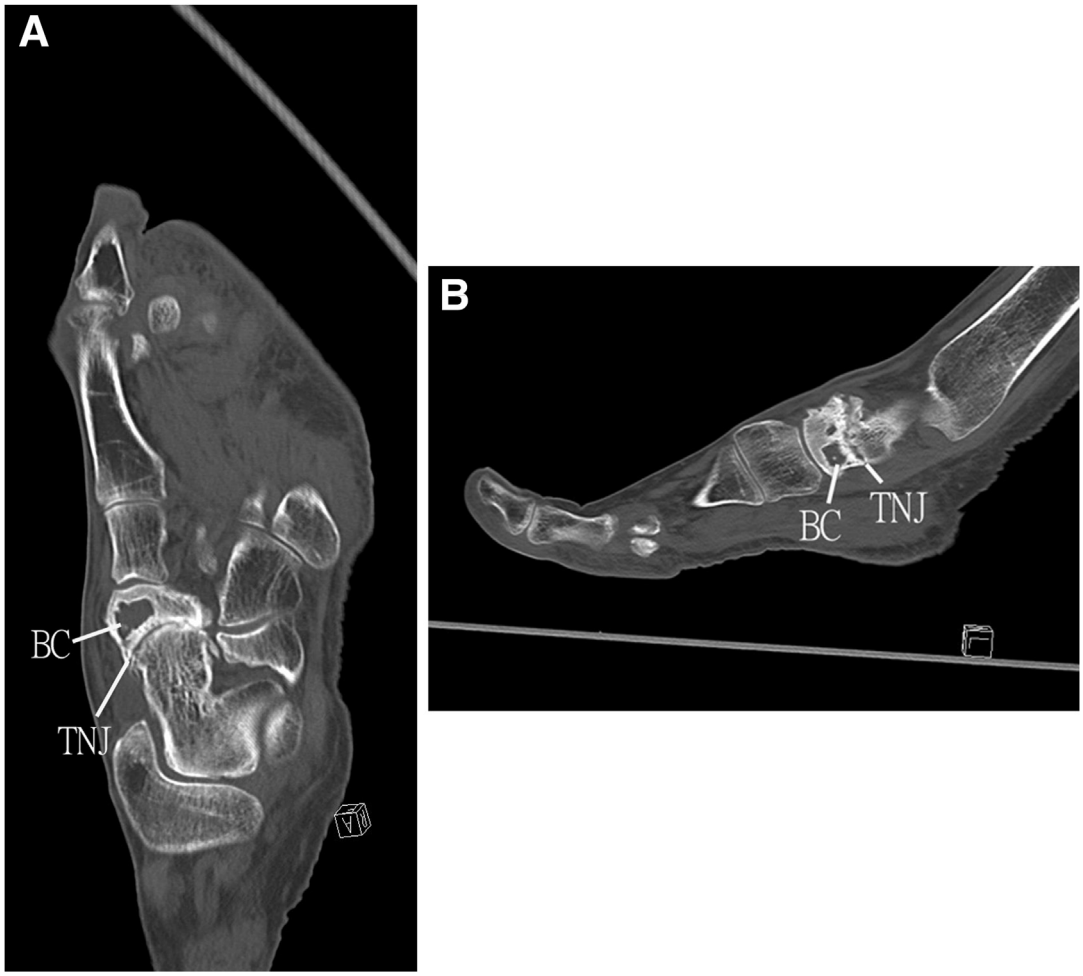

Fig 2. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. Computed tomography scan of this illustrated case shows no subchondral bone defect communicating the navicular bone cyst and the talonavicular joint proper. (A) transverse image; (B) sagittal image. (BC, bone cyst; TNJ, talonavicular joint.)

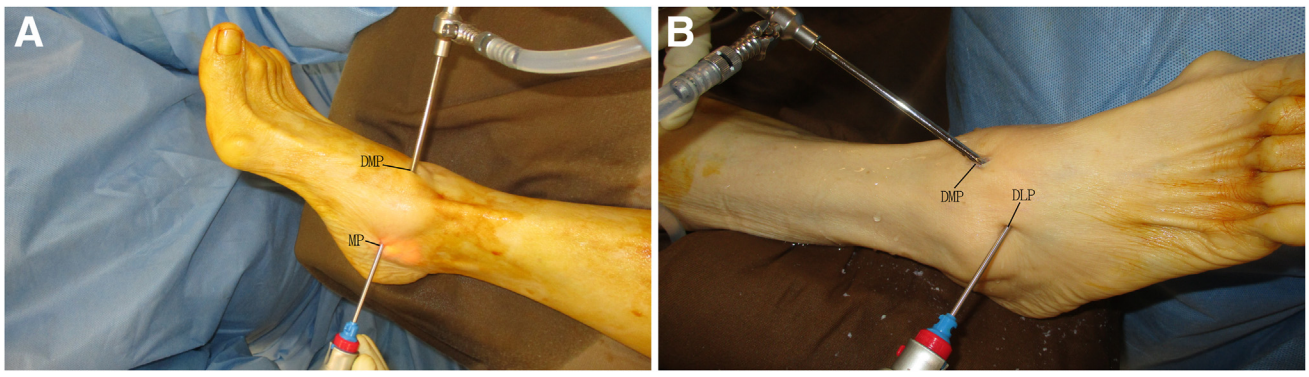

Fig 3. Arthroscopic talonavicular arthrodesis for the management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The medial, dorsomedial, and dorsolateral portals of midtarsal arthroscopy are used for arthroscopic talonavicular arthrodesis. The medial portal is at the medial corner of the talonavicular joint just dorsal to the posterior tibial tendon. The dorsolateral portal is at the junction point between the talonavicular and calcaneocuboid joints. The dorsomedial portal is at the talonavicular joint midpoint between the medial and dorsolateral portals. (A) Dorsomedial view of the foot; (B) dorsolateral view of the foot. (DLP, dorsolateral portal of midtarsal arthroscopy; DMP, dorsomedial portal of midtarsal arthroscopy; MP, medial portal of midtarsal arthroscopy.)

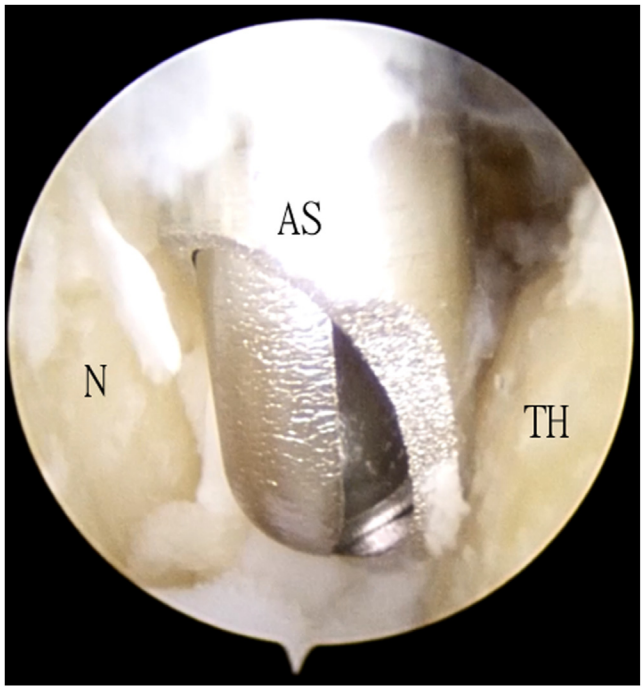

Fig 4. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The medial portal is the viewing portal and the dorsomedial portal is the working portal. The cartilage of the dorsal part of the talonavicular joint is removed by an arthroscopic shaver with preservation of the subchondral bone. (AS, arthroscopic shaver; N, navicular; TH, talar head.)

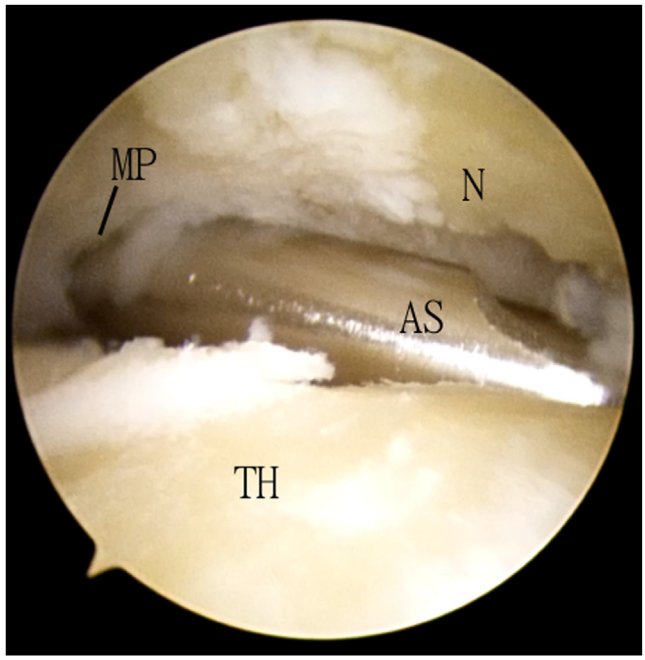

Fig 5. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The dorsomedial portal is the viewing portal and the medial portal is the working portal. The cartilage of the medial and plantar medial parts of the talonavicular joint is removed by an arthroscopic shaver with preservation of the subchondral bone. (AS, arthroscopic shaver; MP, medial portal; N, navicular; TH, talar head.)

Andover, MA) and an arthroscopic osteotome (ACUFEX, Smith & Nephew) with preservation of the subchondral bone (Fig 4).

The dorsomedial portal is the viewing portal and the medial portal is the working portal. The cartilage of the medial and plantar medial parts of the talonavicular joint is removed by the arthroscopic shaver and arthroscopic osteotome with preservation of the subchondral bone (Fig 5).

The dorsomedial portal is the viewing portal and the dorsolateral portal is the working portal. The cartilage of the lateral and plantar lateral parts of the talonavicular joint is removed by the arthroscopic shaver and arthroscopic osteotome with preservation of the subchondral bone (Fig 6).

Microfracture of the Subchondral Bone

The medial portal is the viewing portal and the dorsomedial portal is the working portal. The subchondral bone of the dorsal part of the talonavicular joint is microfractured with an arthroscopic awl (Smith & Nephew) (Fig 7).

The dorsomedial portal is the viewing portal and the medial portal is the working portal. The subchondral bone of the medial and plantar medial parts of the talonavicular joint is microfractured with the arthroscopic awl (Fig 8). The dorsomedial portal is the viewing portal and the dorsolateral portal is the working portal. The subchondral bone of the lateral and plantar lateral parts of the talonavicular joint is microfractured with the arthroscopic awl (Fig 9).

Cannulated Screws Insertion

After preparation of the fusion surfaces, the talonavicular joint is put into desired position and transfixed with two 4.0-mm cannulated screws (Fig 10, Table 2, Video 1). Postoperatively, the foot is immobilized in a short leg cast for 6 weeks, and weight-bearing walking as pain tolerates with an arch support is allowed.

Discussion

The efficacy and safety of the talonavicular joint arthroscopic portals are well studied.[14-16] The portals have a good to acceptable safety margin for the foot neurovascular structures and most of the talar and navicular fusion surfaces can be prepared without the need of excessive bone removal.[14-16] However, caution should still be paid to the establishment of the portals, especially the dorsomedial portal. The dorsolateral portal of midtarsal arthroscopy is actually

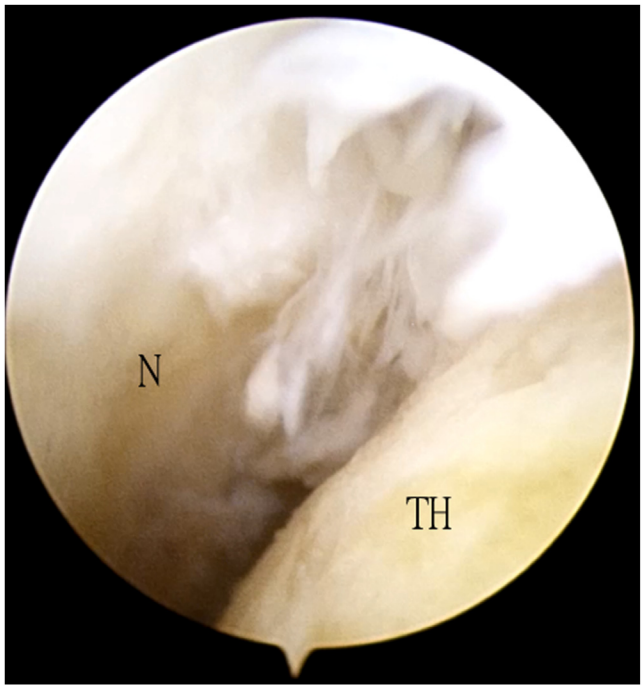

Fig 6. Arthroscopic talonavicular arthrodesis for the management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The dorsomedial portal is the viewing portal and the dorsolateral portal is the working portal. The cartilage of the lateral and plantar lateral parts of the talonavicular joint is removed the arthroscopic shaver and arthroscopic osteotome with preservation of the subchondral bone. (N, navicular; TH, talar head.)

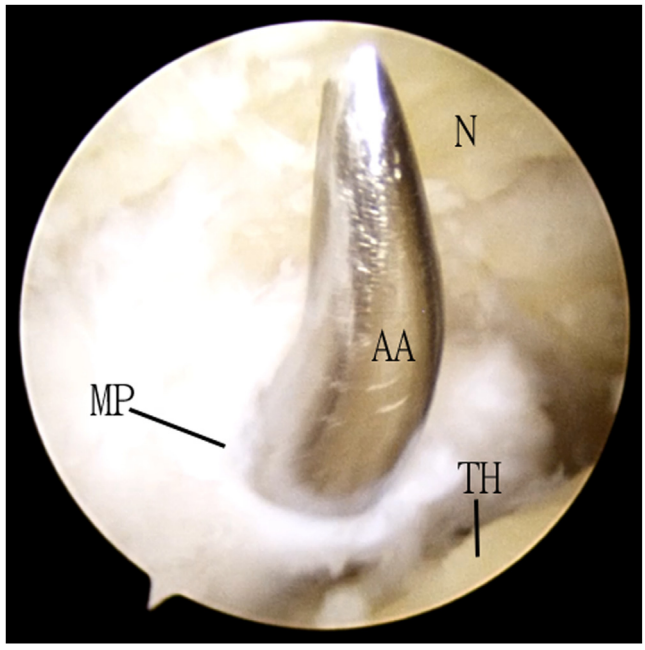

Fig 8. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The dorsomedial portal is the viewing portal and the medial portal is the working portal. The subchondral bone of the medial and plantar medial parts of the talonavicular joint is microfractured with an arthroscopic awl. (AA, arthroscopic awl; MP, medial portal; N, navicular; TH, talar head.)

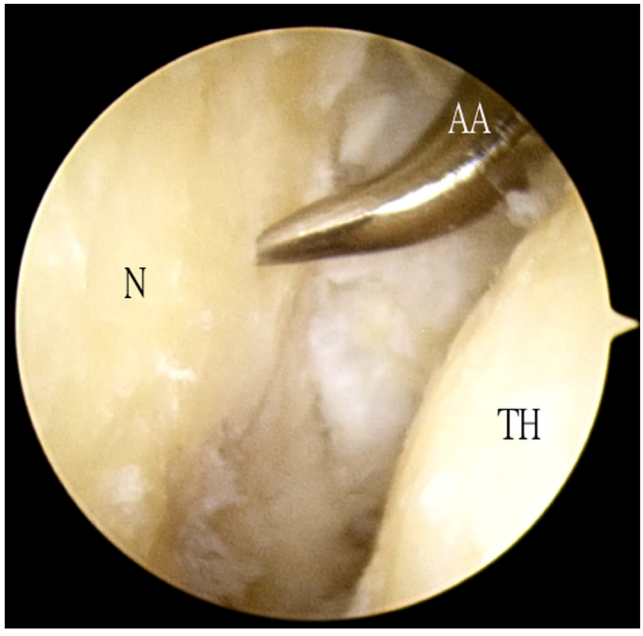

Fig 7. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The medial portal is the viewing portal and the dorsomedial portal is the working portal. The subchondral bone of the dorsal part of the talonavicular joint is microfractured with an arthroscopic awl. (AA, arthroscopic awl; N, navicular; TH, talar head.)

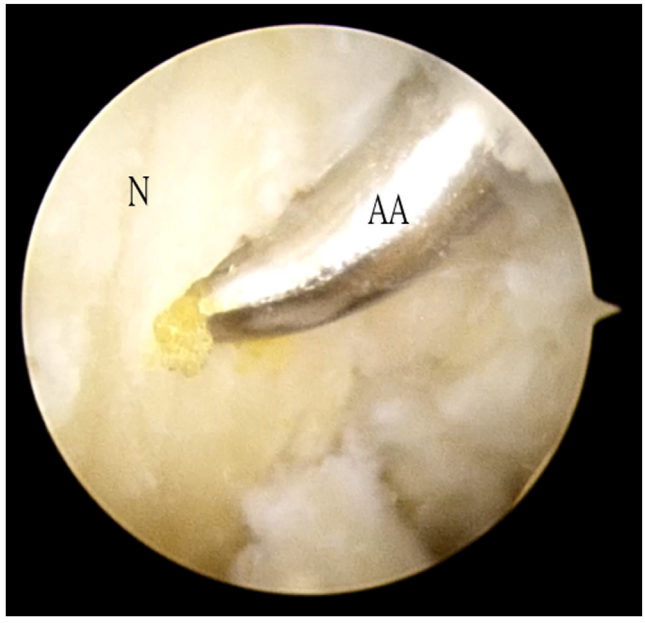

Fig 9. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. The dorsomedial portal is the viewing portal and the dorsolateral portal is the working portal. The subchondral bone of the lateral and plantar lateral parts of the talonavicular joint is microfractured with an arthroscopic awl. (AA, arthroscopic awl; N, navicular.)

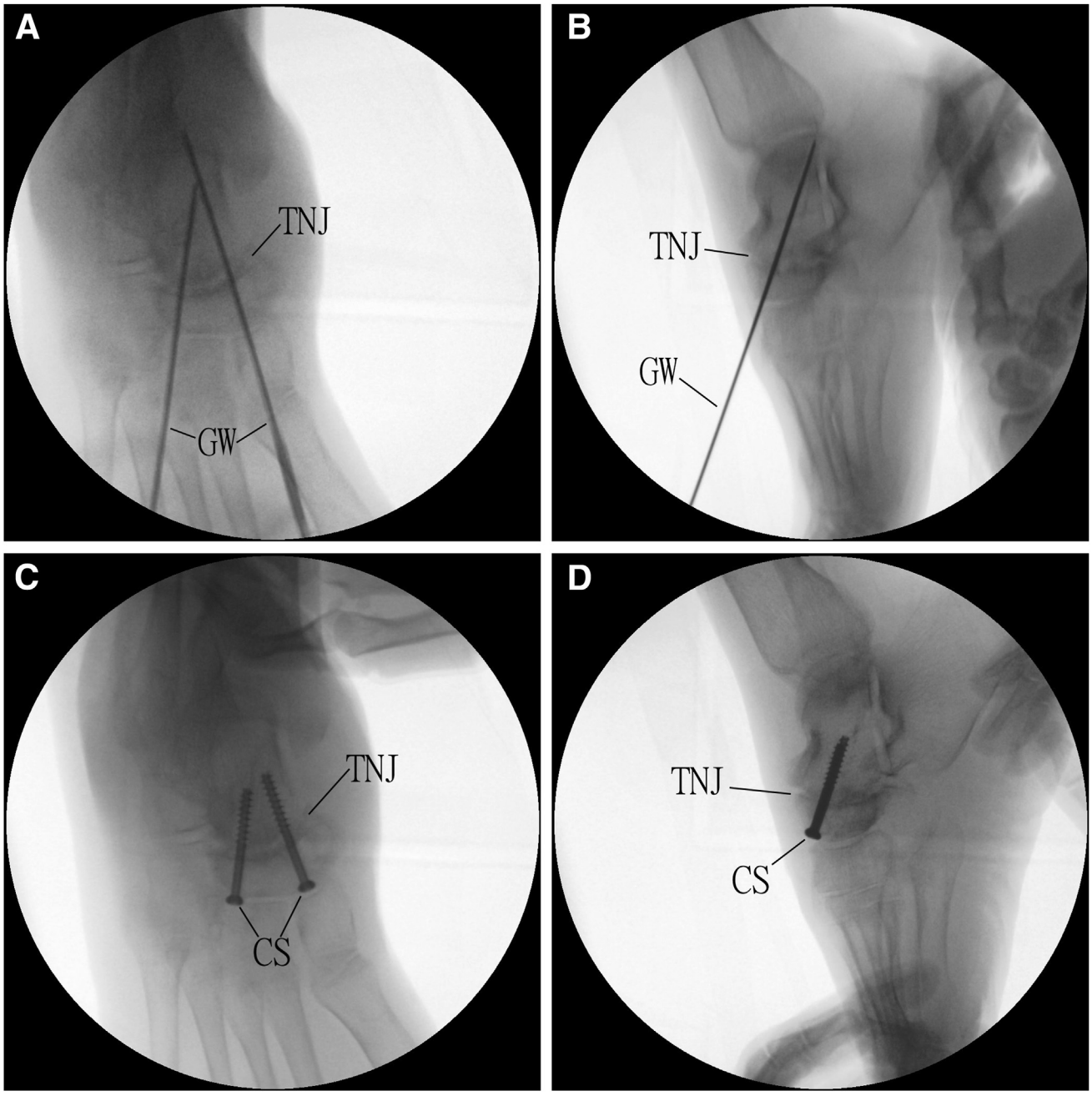

Fig 10. Arthroscopic talonavicular arthrodesis for management of talonavicular osteoarthritis of the right foot. The patient is in the supine position with the legs spread. (A) Dorsoplantar fluoroscopic image; (B) lateral fluoroscopic image. Two guidewires are inserted across the talonavicular joint. (C) Dorsoplantar fluoroscopic image; (D) lateral fluoroscopic image. The talonavicular joint is transfixed with two 4-mm cannulated screws. (CS, cannulated screw; GW, guidewire; TNJ, talonavicular joint.)

located at the plantar lateral side of the talonavicular joint and is a good working portal for the lateral and plantar lateral parts of the joint.

If sizable navicular bone cyst is present with talonavicular osteoarthritis, talonavicular arthroscopy can detect any subchondral cortical defect communicating the bone cyst and the joint proper. It also can detect the presence of any pathologic fracture through the bone cyst. These arthroscopic findings determine the subsequent management plan. Debridement of the bone cyst is not necessary in arthroscopic talonavicular arthrodesis if the subchondral bone is intact, as the subchondral bone is preserved for subsequent fusion. Debridement and bone grafting of the bone cyst is indicated if there is a large osteochondral defect of the navicular communicating the bone cyst and the talonavicular joint

Table 2. Pearls and Pitfalls of Arthroscopic Talonavicular Arthrodesis for the Management of Talonavicular Osteoarthritis

Pearls	Pitfalls
1. Fluoroscopy can be used to identify the dorsomedial portal if in doubt. 2. The dorsomedial joint capsule can be stripped percutaneously via the medial and dorsomedial portals. This can help to identify the dorsomedial joint line arthroscopically. 3. The medial, dorsal, plantar, and lateral joint capsule should be seen to ensure thorough removal of the articular cartilage	1. Excessive bone removal at the dorsal side of the joint to access the plantar side of the joint may induce dorsiflexion malunion of the fusion site. 2. Excessive advancement of the screws may cause migration of the screw head into the navicular bone cyst or migration of the screw tips into the ankle or subtalar joint.

Table 3. Advantages and Risks of Arthroscopic Talonavicular Arthrodesis for the Management of Talonavicular Osteoarthritis

Advantages	Risks
1. Small incisions and better cosmetic outcome 2. Minimal soft-tissue trauma 3. Better intra-articular visualization to avoid of excessive bone resection and malunion 4. Conservation of bone blood supply to improve the union rate.	1. Injury to the saphenous vein and nerve 2. Injury to the deep peroneal nerve and dorsalis pedis artery 3. Injury to the medial dorsal cutaneous branch of the superficial peroneal nerve and the intermediate dorsal cutaneous branch of the superficial peroneal nerve 4. Nonunion or malunion of the fusion site 5. Implant failure

proper. In this case, the cyst can be debrided via the osteochondral defect by talonavicular arthroscopy. If there is significant tenderness at the navicular bone and no pathologic fracture is present, the bone cyst can be debrided and bone grafted via a uni-osseous portal endoscopic approach in the same setting of arthroscopic talonavicular arthrodesis.[17] This single-portal approach reduces the risk of iatrogenic fracture of the navicular bone.[17]

Various fixation devices have been reported for talonavicular arthrodesis, including screws, staples, plates, K-wires, and intraosseous fixation systems; however, the best fixation technique of talonavicular fusion is still inconclusive.[3] In our experience, percutaneous screw fixation together with a short period of cast immobilization is good enough to ensure successful fusion of the joint.

The advantages of this technique include small incisions and better cosmetic outcome, minimal soft-tissue trauma, better intra-articular visualization to avoid of excessive bone resection and malunion, and conservation of bone blood supply to improve the union rate. The potential risks of this technique include injury to the saphenous vein and nerve, the deep peroneal nerve and dorsalis pedis artery, the medial dorsal cutaneous branch of the superficial peroneal nerve, and the intermediate dorsal cutaneous branch of the superficial peroneal nerve, nonunion or malunion of the fusion site, and implant failure (Table 3).[14-16] This procedure is technically not difficult and can be attempted by foot arthroscopists with average experience.

Disclosures

All authors (W.K. and T. H.L.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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