Varus ankle arthritis: a modified operation with a novel osteotomy and lateral hinge plate fixation technique

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Ankle arthritis is a disease characterized by degeneration of articular cartilage, which is always accompanied with pain, decreased mobility, and varus deformity.

Supramalleolar osteotomy is a reliable techniques in the treatment of arthritis. It can correct deformities at the distal tibia and normalize the load-bearing axis, and thereby reduce the unusual compression to the articular cartilage, alleviate pain, and improve functionality. The shortcomings include the frequent intra-operative failure, delayed union even non-union of the osteotomy. In this study, we reported a modified osteotomy with a pre-shaped plate and novel osteotomy to overcome these shortcomings.

We retrospectively reviewed the patients admitted to the hospital for varus ankle arthritis in the past 4 years. Sixteen patients with an average age of 57.7 years and follow-up of 23 months met the selection criterion.

Ankle function was evaluated by the American Orthopaedic Foot and Ankle Society ankle-hindfoot score, and the degree of deformity was evaluated by tibial articular surface angle. The correction of deformity was measured and calculated as: the height of the wedge \( H = \tan \alpha \times W \), where \( \alpha \) was the degree of the deformity desired correction, and \( W \) was the diameter of the distal tibia.

All patients were under general anesthesia with a supine position.

Step 1: A 4 cm longitudinal incision was made at the anterolateral of the ankle. The lateral part of the ankle joint was exposed, followed by cleaning the anterior and lateral osteophyte and synovium in the articular cavity to reduce the impingement of bone and soft tissue so as to increase the range of motion.

Step 2: A three-hole plate which had been pre-shaped to \( \alpha \)-degree was placed close to the syndesmosis with the screws semi-tightened [Figure 1]. The osteotomy plane was then determined by positioning Kirschner wire from the central hole of the plate oriented to 4.5 cm proximal to the medial malleolar tip. According to the Kirschner wire, an 8 cm medial tibia skin was incised longitudinally and gradually separated into the periosteum. The medial part of the ankle was exposed, followed by cleaning articular cavity.

Step 3: The osteotomy was performed with a wide swing saw along the Kirschner wire. The osteotomy was stopped when the swing saw was about 5 mm to the lateral cortex under the direct observation through the anterolateral incision. Then the Kirschner wire was removed, the patient’s leg was tracked to the appropriate angle. After the osteotomy was opened, a wedge-shaped graft was inserted into the proper space. The screws of the lateral plate were tightened as the preliminary fixation. The alignment of the ankle was checked and adjusted to the desired position by

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fluoroscopy. Finally, the medial tibia was stabilized with a locking plate.

Note: Autograft came from the same side of the iliac crest in patients (surgeon should shape bone block to appropriate wedge with the cortex).

Compared with the traditional osteotomy, lateral hinge plate could effectively avoid separation of the lateral cortex and the structure of dual plate had better initial stability against separating and revolving movement. As a result, complications such as non-union and delayed union were uncommon.

In our procedure, surgeons determined the osteotomy position from the lateral side to the medial. The position and depth of osteotomy could be accurately observed through the anterolateral incision without frequent X-ray fluoroscopy.

In one word, the modified osteotomy made no additional incisions through the anterolateral incision because debridement of the joint was essential. Surgeons could expose and set the lateral plate under direct vision, and innovatively determine the osteotomy plane from lateral to the medial tibia with accurate location to reduce the use of fluoroscopy. Dual plates osteosynthesis provided better initial stability to avoiding complications. Moreover, the lateral plate used in this modified operation was an ordinary plate, which was available for most hospitals.

Compared with other new studies of supra-malleolar osteotomy, the follow-up showed that patients undergoing the modified osteotomy also had a good result in relieving pain, improving function, and restoring the proper weight-bearing alignment. This modified osteotomy technique achieved an excellent result according to our early follow-up, and might be worth for popularizing to more patients.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

None.

**References**

1. Takeuchi R, Ishikawa H, Kumagai K, Yamaguchi Y, Chiba N, Akamatsu Y, *et al*. Fractures around the lateral cortical hinge after a...
medial opening-wedge high tibial osteotomy: a new classification of lateral hinge fracture. Arthroscopy 2012;28:85–94. doi: 10.1016/j.arthro.2011.06.034.

2. Miller BS, Dorsey WO, Bryant CR, Austin JC. The effect of lateral cortex disruption and repair on the stability of the medial opening wedge high tibial osteotomy. Am J Sports Med 2005;33:1552–1557. doi: 10.1177/0363546505275488.

3. Barg A, Saltzman CL. Single-stage supramalleolar osteotomy for coronal plane deformity. Curr Rev Musculoskelet Med 2014;7:277–291. doi: 10.1007/s12178-014-9231-1.

4. Jung MK, Myoung JL. Supramalleolar osteotomy for moderate degenerative ankle osteoarthritis. J Korean Foot Ankle Soc 2017;21:122–127. doi: 10.14193/jkfas.2017.21.4.122.

5. Xu Y, Xu X. Medial open-wedge supramalleolar osteotomy for patients with Takakura 3B ankle osteoarthritis: a mid- to long-term study. Biomed Res Int 2019;2019:7630868. doi: 10.1155/2019/7630868.

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