

C A S E R E P O R T

Grice subtalar arthrodesis of bilateral adult flatfoot in a professional dancer: a case report

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Abstract. *Background and aim:* Adult acquired flatfoot deformity (AAFD) is a common pathology and an important cause of pain and disability. This deformity causes a progressive flattening of the foot arch which has traditionally been associated with posterior tibialis tendon (PTT) dysfunction. Operative treatment is indicated after the failure of conservative management aiming to achieve proper alignment of the hindfoot and to maintain as much flexibility as possible. If subtalar osteoarthritis is present, subtalar arthrodesis is usually the best therapeutic option. Grice-Green subtalar arthrodesis is a widely used procedure. *Methods:* This report describes a case of bilateral painful AAFD in a 39-years old female professional dancer treated with Grice-Green subtalar arthrodesis with an autologous corticocancellous graft harvested from the ipsilateral proximal tibia. Surgeries were performed 3 years apart from each other. *Results:* The patient had good clinical and radiological outcomes. She returned to dance 4 months after surgery with no referred pain or limitations. *Conclusions:* Due to its versatility and capability to restore the shape and thickness of the hindfoot Grice-Green procedure is a simple and effective technique for the treatment of AAFD with subtalar osteoarthritis and a valid option to solve professional disabilities as it happened in this case with a professional dancer. (www.actabiomedica.it)

Key words: flatfoot, subtalar arthrodesis, bone graft, adult

Introduction

Adult acquired flatfoot deformity (AAFD) is a common pathology observed by foot and ankle surgeons and it is an important cause of pain and disability. This deformity is characterized by flattening of the medial longitudinal arch, valgus of the calcaneus, abduction of the forefoot, and modifications of the posteromedial soft tissues of the ankle (1,2). This malalignment results from a complex three-dimensional deformity of the subtalar joint and the spectrum may range from a subtle, easily correctable foot to a rigid, uncorrectable plano-valgus deformity (3,4). Several factors have been proposed in the etiology of AAFD including arthritic, neuromuscular, and traumatic diseases all associated to posterior tibial tendon dysfunction (5-8). Operative treatment is indicated after the failure of conservative management aiming to achieve proper alignment of the

hindfoot and to maintain as much flexibility as possible in the foot. A wide variety of surgical procedures have been reported; the choice depends on tibialis posterior lesion stage, localization and degree of deformity, and whether the deformity is flexible or rigid (9,10). In those cases of rigid deformity associated with subtalar osteoarthritis, arthrodesis is considered the gold standard (4,6,11,12). Grice-Green subtalar arthrodesis with insertion of an autologous bone graft is a widely used procedure (13). Since the first description by Grice, several modifications have been applied to the original technique (14-17). Due to its versatility and capability to restore the shape and thickness of the hindfoot it has been used more and more frequently for adult flatfoot correction, where subtalar joint osteoarthritis is present and the damage to the tibialis posterior requires an associated procedure of tendon augmentation with considerable invasivity (18). This report describes a case of

bilateral painful adult flatfoot in a professional dancer treated with Grice-Green subtalar arthrodesis and her clinical outcome.

Case Report

L.S., a 39 years-old female professional dancer, came to visit 4 years ago reporting bilateral swelling and pain on the medial part of the hindfoot along the posterior tibial tendon and on the lateral sides of the ankle joints. It was impossible for her to dance because of these symptoms. At the clinical examination she presented with bilateral rigid deformity of the hindfoot, calcaneus valgus, forefoot abduction, and medial arch disappearance (Fig.1).

Heel lifting experiment was positive. Routine X-ray included the anterior-posterior and latero-lateral films of the feet, assessing the severity of flat foot, osteoarthropathy and checking for other deformities and abnormalities. Radiological measurement of Meary angle, Kite angle and Pitch angle were altered (Fig.2).

AAFD was classified as type III according to Johnson and Strom classification (11) modified by Myerson.

MRI examination was performed in order to understand the condition of posterior tibial tendon. After clinical and instrumental evaluation, the patient underwent Grice subtalar arthrodesis. Surgery was firstly performed on the left foot (the most symptomatic side) in December 2017. After spinal anesthesia and antibiotic prophylaxis with cefazoline, a thigh tourniquet was applied and regular iodine alcohol disinfection was used. A lateral incision was performed over the sinus tarsi: synovitis and severe cartilage degeneration were seen. After debridement and decortication of the articular surfaces, an autologous corticocancellous graft was harvested from the ipsilateral proximal tibia. The graft was prepared to appear suitable, positioned in a slightly vertical position into the sinus tarsi and then stabilized with 2 k-wires under fluoroscopic control (Fig. 3 and 4).

Surgery lasted 90 minutes (tourniquet has been maintained for 74 minutes) and the patient was discharged 2 days later. The limb was immobilized in a plaster cast and weight bearing was not allowed on the affected foot for 50 days. The cast and k-wires were removed 40 days after surgery and progressive weight



Figure 1. Preoperative images showing the anterior (A) and posterior (B) standing views of the feet with a bilateral hindfoot valgus deformity, a concomitant abducted forefoot deformity associated to medial arch disappearance.



Figure 2. Standing preoperative radiographs of the left foot showing evidence of arch flattening with abduction of the mid-foot and subtalar osteoarthritis.

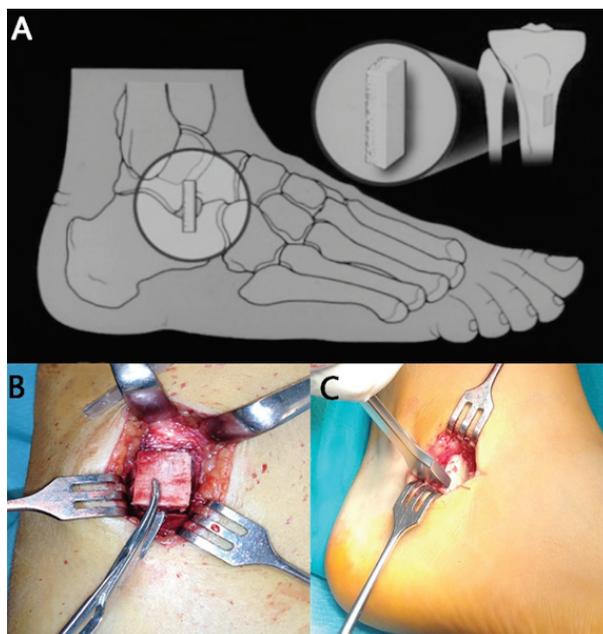


Figure 3. Illustration of the surgical procedure (A). Autologous corticocancellous is harvested from the ipsilateral proximal tibia (B) and then positioned in a slightly vertical position into the sinus tarsi (C).



Figure 4. Post-operative X-rays of the left foot. The graft was stabilized with 2 K-wires.

bearing was permitted 10 days later. The rehabilitation program started with active and passive mobilizations, progressive strengthening and resistive exercises, electrotherapy and pulsed electromagnetic field therapy. X-rays performed at 2 months showed articular fusion and good osteointegration of the graft into the subtalar joint. The patient was satisfied and returned to dance 5 months after surgery with no referred pain or limitations. Because of good functional and painless long-term results, Grice subtalar arthrodesis was performed with no complication on the contralateral foot in June 2020. The surgical procedure was identical to the first time. Through lateral incision over the sinus tarsi decortication of articular surface was performed in the same way. An autologous corticocancellous graft was harvested from the ipsilateral proximal tibia, positioned into the subtalar articulation and fixed with 2 k-wires (Fig.5).



Figure 5. Post-operative X-rays of the right foot.

The patient followed the same postoperative protocol (plaster cast and no weight bearing for 50 days) and follow-up. The results have been comparable with those obtained after the first intervention and finally the patient fully resumed her work 3 months after surgery. Follow-up at 8 months from second surgical procedure showed good radiological and functional outcomes (Fig. 6 and 7).



Figure 6. 8 months follow-up (from second surgery) standing anterior (A) and posterior (B) views.



Figure 7. A long-term follow-up weight bearing radiographs highlights bilateral subtalar arthrodesis consolidation and the maintenance of the corrected angles.

Nowadays there are no limitations of strength and of range of motion on both sides and no pain has been reported.

Hindfoot valgus deformity and abduction of the forefoot have been reduced and the patient returned to dance with no referred pain or limitations.

Discussion

AAFD causes a progressive flattening of the foot arch, which has traditionally been associated with tibialis posterior tendon (PTT) dysfunction (1,10,19,20).

The clinical presentation can vary widely depending on the stage of the deformity. In the early onset of the disease, the patient will frequently complain of pain over the medial aspect of the foot along the PTT. As the disease progresses, they commonly complain of arch collapse and forefoot abduction. In AAFD not rarely is present the “too-manytoes” sign due to forefoot abduction and an inability to perform a single-heel rise (21).

AAFD was originally divided in three distinctive stages by Johnson and Strom (11); Myerson added a fourth type in 1997 (22).

Stage I consists of PTT tenosynovitis without evidence of arch collapse. By stage II, the tendon has failed, with the patient developing a flexible flatfoot deformity and is unable to accomplish a single leg heel rise. This stage has been further classified as either IIa in which the patient has hindfoot valgus with arch collapse, however, no midfoot abduction, or IIb in which there is midfoot abduction. In stage III, the patient has a fixed deformity with uncorrectable hindfoot valgus and forefoot abduction. Lastly, stage IV of AAFD includes deformity of the ankle with evidence of lateral talar tilt due to insufficiency of the deltoid ligament (23).

The first line of treatment of symptomatic AAFD is nonoperative. This is traditionally performed with immobilization through a removable boot or cast in association with nonsteroidal anti-inflammatory medications. If a period of immobilization is successful, the patient is then transitioned to a customized orthosis providing mechanical support.

Once the conservative treatment fails surgery may vary depending on the stage of AAFD (23).

In the early stages of the disease (Stages I, IIa and IIb), surgical options focus on strengthening the PTT in isolation or combined with osteotomies in order to rebalance the foot structure. However, when the flat-foot deformity is rigid (stage III or IV), surgeons need to use more restrictive treatments such as arthrodesis of the hindfoot joints (subtalar, talonavicular and calcaneocuboid) in isolation or combined (triple arthrodesis or other procedures) (5,24,25).

The goal of surgical treatment is to achieve proper alignment of the hindfoot and to maintain as much flexibility as possible in the foot and ankle complex; nevertheless, if subtalar osteoarthritis is present, subtalar arthrodesis is usually mandatory (18).

Grice procedure has been initially used in its original description and with different modifications in young patients affected by neurological foot deformities and without subtalar arthritis (17, 26-28). Due to its versatility and capability to restore the shape and thickness of the hindfoot it has been used more and more frequently for adult flatfoot correction. This procedure presents the benefit of correcting hindfoot malalignment by restoring the correct relationship of the talus with the calcaneus and navicular, without the need for internal screw fixation. The stability of the arthrodesis is guaranteed by a bone block graft of autologous bone which allows a good correction and higher of successful fusions as reported by Chahal et al. (29,30). In the Grice-Green procedure the bone graft is a small, autologous, cortical-shaped dowel that is inserted in a groove created between talus and calcaneus. The graft is harvested from the proximal ipsilateral tibia in the same operative field and this considerably reduces the morbidity of this procedure (6).

According to Grice, the use of a bone graft as a bridge between the talus and calcaneus prevents the latter from rotating posterolateral and thus blocks the heel and foot from shifting into valgus, resulting in an extremely stable arthrodesis (29). Union takes place very rapidly and the graft is solidly incorporated into the talus and calcaneus within 8 to 10 weeks after operation (31).

Besides, the use of autologous bone, compared with allograft, reduces the costs and the risk of infection, and there are no risks of induction of an immune response, which could further delay the osteoinductive

phase of graft incorporation (32-34). Furthermore, the extension of the lateral subtalar approach and the surgical trauma is minimal and, as consequence, this technique could be considered a minimally invasive arthrodesis.

For all these reasons Grice technique has replaced subtalar arthrodesis without graft insertion, which usually require extensive cartilage removal from the articular surfaces, a more extensive surgical approach, and the need of a fixation by screws (11).

Literature reports confirm these assumptions and the validity of this technique in AAFD.

Johansson et al. evaluated the effectiveness of the original procedure in the treatment of painful subtalar traumatic arthritis in 23 adult patients (average 43.3 years). The back-to-work time ranged from 2 weeks to 2 years (average 6.2 months). Eighteen patients (85.7%) were fully active, and only 3 (13.3%) changed to lighter work or activities. All fusions were solid clinically and radiologically (35).

A technique modification to the Grice-Green procedure, the mini bone block distraction subtalar arthrodesis (SAMBB), has been recently described by Mosca et al. to make it applicable to the acquired adult flatfoot (18).

In 2020 they performed a retrospective review of 62 patients affected by symptomatic adult flatfoot with subtalar osteoarthritis and treated SAMBB with a mean follow-up of 6.2 ± 4.2 years. The AOFAS score improved from a mean value of 48.1 ± 6.1 to a postoperative average score of 87.7 ± 5 . Calcaneal pitch angle, talar coverage angle, and Meary's angle showed a postoperative improvement to 17.7 ± 2.1 , 2.9 ± 0.7 , and 0.6 ± 0.6 degrees, respectively, at the final follow-up, and all deformities were corrected. No graft reabsorption, sural nerve neuralgia, or donor site morbidity was recorded (29), thus demonstrating its validity.

Conclusions

Grice-Green procedure is a simple and effective technique for the treatment of adult flatfoot with subtalar arthritis, allowing realignment of the calcaneus, restoring a satisfying orientation of the hindfoot, and resolving the painful symptoms due to degenerative ar-

thropathy. This procedure has also proved to be a valid option for solving important professional disabilities as it happened in this case with a professional dancer.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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