



# Arthroscopic Treatment of Freiberg Disease – Case Report\*

## Tratamento artroscópico da doença de Freiberg – Relato de caso

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Rev Bras Ortop 2022;57(5):891–895.

### Abstract

Freiberg disease is a rare condition whose diagnosis requires a high clinical suspicion. Avascular necrosis of the metatarsal head progresses with articular collapse, leading to forefoot pain and limitation of the daily activities.

Several surgical techniques have been described to address the disease, and since it is usually diagnosed in later-stages, most of them include joint-destructive procedures. The use of arthroscopy on the small joint of the foot has arisen in the last few years, but its application in Freiberg disease is still scant. Joint-preserving procedures have been advocated for cases of early-stage disease, aiming to relieve symptoms while preventing the progression of the disease.

In the present report, we describe a successful treatment of a 12-year-old patient with early-stage Freiberg disease using core decompression and bone marrow graft through a minimally-invasive approach assisted by arthroscopy.

### Keywords

- ▶ foot
- ▶ metatarsal bones
- ▶ arthroscopy

### Resumo

A doença de Freiberg é rara, e seu diagnóstico requer alto grau de suspeita clínica. A necrose avascular da cabeça do metatarso progride com colapso articular, e causa dor no antepé e limitação da atividade.

Há diversas técnicas cirúrgicas para o tratamento da doença; como o diagnóstico geralmente é feito em estágios posteriores, a maioria dessas técnicas inclui procedimentos de destruição articular.

A artroscopia tem sido utilizada nas pequenas articulações do pé nos últimos anos, mas sua aplicação na doença de Freiberg ainda é escassa. Procedimentos de preservação articular têm sido preconizados na doença em estágio inicial, com o objetivo de aliviar os sintomas e impedir a progressão.

Neste relato, descrevemos o tratamento bem-sucedido de uma paciente de 12 anos de idade com doença de Freiberg em estágio inicial por meio de descompressão central e enxerto de medula óssea, por meio de abordagem minimamente invasiva assistida por artroscopia.

### Palavras-chave

- ▶ pé
- ▶ ossos do metatarso
- ▶ artroscopia

\* Work developed at Centro Hospitalar de Entre o Douro e Vouga, Santa Maria da Feira, Portugal.

received  
June 2, 2019  
accepted  
October 22, 2019  
published online  
March 16, 2020

DOI <https://doi.org/10.1055/s-0040-1701282>.  
ISSN 0102-3616.

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Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

## Introduction

With the improvement of technology and the availability of delicate instruments, arthroscopy for small joints has become a promising tool, showing a significant increase in indication for minimally-invasive surgery with the aim of decreasing surgical complications.<sup>1</sup>

Arthroscopy of the ankle, the subtalar joint and the first metatarsophalangeal joint is already well accepted and performed by orthopedic surgeons. However, arthroscopy of the lesser joints of the foot has barely been described in the literature regarding recommendations and surgical techniques.<sup>2</sup>

The usefulness of metatarsophalangeal joint arthroscopy has been shown in some case reports and small series for conditions affecting the lesser toes, such as rheumatoid or gout arthritis, infection and claw toes.<sup>3</sup> The first report of an arthroscopic technique for Freiberg disease was published in 1996 by Maresca et al,<sup>4</sup> and since then only 4 other papers have addressed this topic.<sup>3,5-7</sup>

Although described more than a century ago, the etiology and the most appropriate treatment of Freiberg disease remain controversial. Avascular necrosis of the metatarsal head is believed to be caused after trauma, circulatory impairment, or to have other idiopathic origins.<sup>8,9</sup>

It is a rare condition affecting mainly individuals in the second and third decades of life.<sup>9</sup> Early diagnosis and treatment are the keystone to achieve good results; however, this requires a high clinical suspicion, since imaging studies may be normal in the early stages of the disease.<sup>10</sup>

Conservative measures are the first line of treatment, but when they fail, a variety of surgical procedures are available. Smillie<sup>11</sup> divided the clinical progress of Freiberg disease in five stages.<sup>3,10,11</sup> For early stages (1-3), joint-sparing techniques are recommended to restore the normal articular surface. These include joint debridement, microfractures, dorsal wedge osteotomy of the metatarsal head, among others. For later stages (4-5), joint-destructive techniques are advised, such as interposition arthroplasty or metatarsal head resection.<sup>3,9,10</sup>

In the present report, we describe the surgical treatment of a 12-year-old patient with Freiberg disease using arthroscopic debridement followed by open autografting of the subchondral defect of the metatarsal head.

## Case Report

A 12-year old female patient was referred to an orthopedic consultation. Besides being asthmatic, she was otherwise healthy and had no relevant family history. The patient complained of forefoot pain affecting the third toe of her left foot. She presented local tenderness and motion-related pain on the third metatarsophalangeal joint.

No recent traumatic event was reported, but she recalled a minor trauma to her left foot about four months before the onset of pain. The pain had been increasing and was worse after a walk or a long period standing up. No inflammatory signs, callous formations or evident deformities were present. The foot radiographs showed no evidence of recent or old



**Fig. 1** Preoperative weight-bearing foot radiograph.

fractures, but a small radiolucent lesion could be spotted on the third metatarsal head (► **Fig. 1**).

Only after a magnetic resonance imaging (MRI) scan was performed, we found a well circumscribed medullary edema on the third metatarsal head, with an increased signal intensity on T2-weighted and short tau inversion recovery (STIR) images (► **Fig. 2**), suggestive of early Freiberg disease.

The patient was initially treated with conservative measures for six weeks. Anti-inflammatory medication was prescribed, and the patient (as well as her parents) was instructed to avoid high-impact activities, such as running or jumping. A stiff soled shoe with rocker bottom was also used to unload the metatarsal head during walking.

Although the patient was committed to the instituted treatment, these conservative measures failed to relieve the symptoms. Therefore, we decided to proceed to surgical treatment.

After an evaluation of the clinical and imaging findings, we planned to perform a metatarsophalangeal arthroscopy for joint inspection and then curettage of the necrotic area with bone grafting to fulfil the subchondral defect.

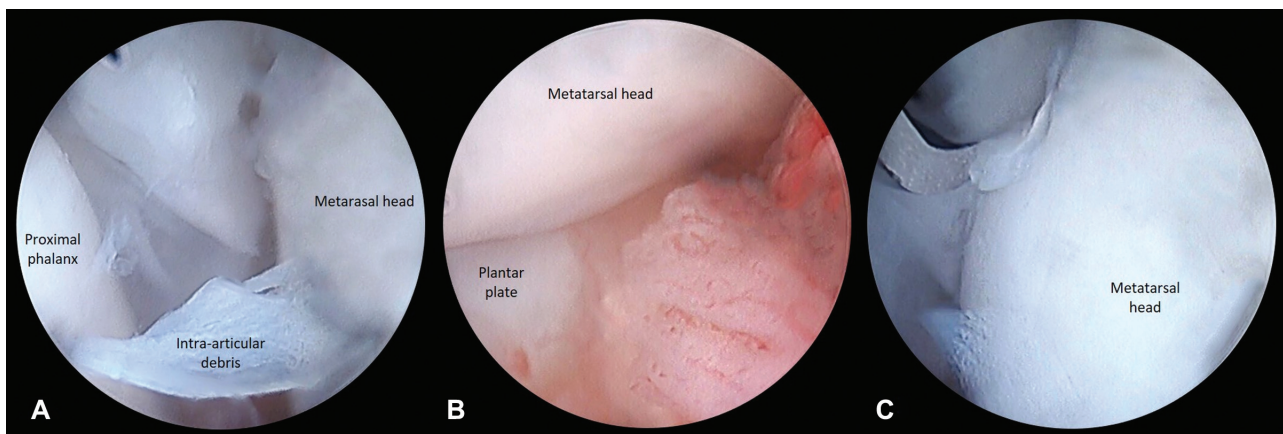
A 2.5-mm arthroscope was used with dorsomedial and dorsolateral portals.

We inspected the joint for the presence of debris (► **Fig. 3A**), and performed a synovectomy. After articular debridement, we could identify the uninjured plantar plate (► **Fig. 3B**) and collateral ligaments. A grade-I chondral lesion was identified in the upper part of the metatarsal head (► **Fig. 3C**).

Then, we used a mini-open extra-articular dorsal approach to the metatarsal head to perform core decompression with curettage of the subchondral necrotic bone. Bone grafting from the proximal tibial metaphysis was used to fulfil the defect and restore the normal anatomy of the metatarsal head. Care was taken when harvesting the bone graft to ensure a safe distance from the proximal tibial physis.



**Fig. 2** Preoperative magnetic resonance imaging (MRI) scan.



**Fig. 3** Arthroscopic images of the procedure: (A) intra-articular debris; (B) uninjured plantar plate; (C) chondral lesion on the upper part of the metatarsal head.

The postoperative radiograph showed correct autograft placement and no deformities of the normal anatomy of the metatarsal head (►**Fig. 4**). The patient was discharged the day after surgery using a Barouk inverted bottom shoe for four weeks.

### Outcome and Follow-Up

The patient was evaluated every two weeks for the first two months after surgery. In the first postoperative consultation, she reported only mild pain in the operative wound, which had no complications. Four weeks after surgery, we allowed full weight-bearing when comfortable, and at six weeks, she was walking with no pain or discomfort. The patient returned to unrestricted activities two months after surgery, and has not had complaints so far, with a 1-year follow-up period.

To confirm the successful interruption of the pathological process of Freiberg disease, an MRI was performed 6 months

after surgery, and it showed restoration of the normal anatomy of the metatarsal head without evidence of the disease (►**Fig. 5**).

### Discussion

Freiberg disease is a rare condition of difficult diagnosis. Maybe that is the main reason why there are still no consensus guidelines about its treatment, mainly in early stages.

It is known that early diagnosis enables the management of the disease with conservative measures with good results or, at least, to perform less aggressive procedures that enables the preservation of the original anatomy of the metatarsophalangeal joint. This is an important point, since individuals affected are usually in their second or third decades of life, and joint-destructive procedures in such a young age could lead to further complications.



**Fig. 4** Postoperative radiograph.

In this patient, we have successfully treated a case of stage-2 Freiberg disease according to the classification of Smillie.<sup>11</sup>

Metatarsophalangeal arthroscopy enabled a better inspection of the joint and related structures than any imaging study. Besides, debridement and synovectomy can be easily performed arthroscopically, as well as the evaluation of cartilage lesions without the need of a more invasive arthrotomy.

Just as in cases of femoral head avascular necrosis or osteochondral knee lesions, we have performed core decompression augmented with bone marrow graft. By removing the necrotic subchondral bone, the increased intraosseous pressure associated with avascular necrosis is relieved, thus enabling the revascularization of the necrotic area. Additionally, filling the defect with a bone marrow graft prevents cartilage collapse and serves as an adjuvant therapy to core decompression, as it provides osteoprogenitor cells to support the repair of the necrotic bone.<sup>12,13</sup>

The use of arthroscopy on Freiberg disease was reported by other authors: Maresca et al<sup>4</sup> and Hayashi et al<sup>7</sup> reported similar procedures, with arthroscopic debridement and drilling; Carro et al<sup>5</sup> reported an arthroscopic Keller resection for a late-stage lesion; and Lui<sup>6</sup> reported an arthroscopic interpositional arthroplasty technique using the extensor digitorum brevis tendon. All of these techniques were applied on late-stage diseases (grade III or higher in the Smillie<sup>11</sup> classification); therefore, they required a more aggressive surgical treatment, with the need of more extensive dissection and where the original structure of metatarsal head was, at variable extent, altered.

We believe our technique is a good and innovative option for early-stage Freiberg disease, when the metatarsal head is not yet deformed, emphasizing the importance of early diagnosis.

The use of arthroscopy of the metatarsophalangeal joint enables a good inspection and debridement. Therefore, core decompression and bone graft may be performed with a minimally-invasive and extra-articular approach.



**Fig. 5** Postoperative (six months) MRI.

As it has happened in the past with other joints, namely the knee and the shoulder, arthroscopy is putting into perspective the way orthopedic surgeons approach articular lesions and providing new elaborate ways of treating them.

From simpler to more complex techniques, progression is being made regarding the treatment of Freiberg disease and the role of arthroscopy of the lesser joints of the foot.

Further investigation is needed to provide clear indications and safe and effective procedures. We believe arthroscopic surgery for Freiberg disease is a safe and useful procedure, which can lead to symptomatic relief without significant iatrogenic damage.

#### Financial Support

There was no financial support from public, commercial, or non-profit sources.

#### Conflict of Interests

The authors have no conflict of interests to declare.

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