



# Patella Baja Revisited: Interposition of a Pedunculated Flap of the Hoffa Fat Pad to Treat Adhesions Between the Tibia and Patellar Tendon and Restore the Functional Length of the Patellar Tendon

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**Abstract:** Adhesions in the deep infrapatellar region may occur as iatrogenic complications (e.g., after bone–patellar tendon–bone grafting), as part of arthrofibrosis or infrapatellar contracture syndrome, or owing to specific diseases such as Osgood-Schlatter disease. Described adhesions may limit the length of the functional portion of the patellar tendon and lead to patella baja with subsequent decreased range of motion and patellofemoral joint overload, with a risk of osteoarthritis development. The patellar tendon length is commonly within normal limits; however, only the free part of the patellar tendon is functionally active. The purpose of this article is to present a quick, simple, and cost-effective technique for the treatment of patella baja due to adhesions in the deep infrapatellar region. This technique consists of the removal of adhesions to free the whole length of the patellar tendon and the interposition of a Hoffa fat pad pedunculated flap between the patellar tendon and tibia to avoid the recurrent formation of adhesions. Only local tissues are used, allowing for the avoidance of donor-site morbidity. The technique restores the functional length of the patellar tendon and thus normalizes patellofemoral kinematics, increases range of motion, alleviates anterior knee pain, and decreases the risk of osteoarthritis development.

Adhesions in the deep infrapatellar region may occur as iatrogenic complications, for example, after bone–patellar tendon–bone grafting during anterior cruciate ligament reconstruction<sup>1-3</sup>; as part of

arthrofibrosis or infrapatellar contracture syndrome (Fig 1)<sup>4</sup>; or owing to specific diseases such as Osgood-Schlatter disease.<sup>2,5,6</sup> Nevertheless, such adhesions may limit the length of the functional portion of the patellar tendon and lead to patella baja with subsequent decreased range of motion<sup>1,3,7,8</sup> and patellofemoral joint overload, with a risk of osteoarthritis development.<sup>1,7-9</sup>

Many surgical treatment methods have been proposed for refractory patellofemoral pain syndrome due to patella baja, such as lengthening of the patellar tendon, proximalization of the tibial tuberosity, and reconstruction of the patellar tendon.<sup>8-10</sup> However, these techniques were developed for patella baja with shortening of the patellar tendon's fibers. In addition, they violate the continuity of the extensor mechanism, which is associated with a risk of loss of knee function in cases of failure or complications.<sup>8-10</sup> In cases of patella baja due to adhesions in the deep infrapatellar bursal region, the patellar tendon length is commonly within normal limits but only the free part of the patellar tendon is functionally active.<sup>1</sup>

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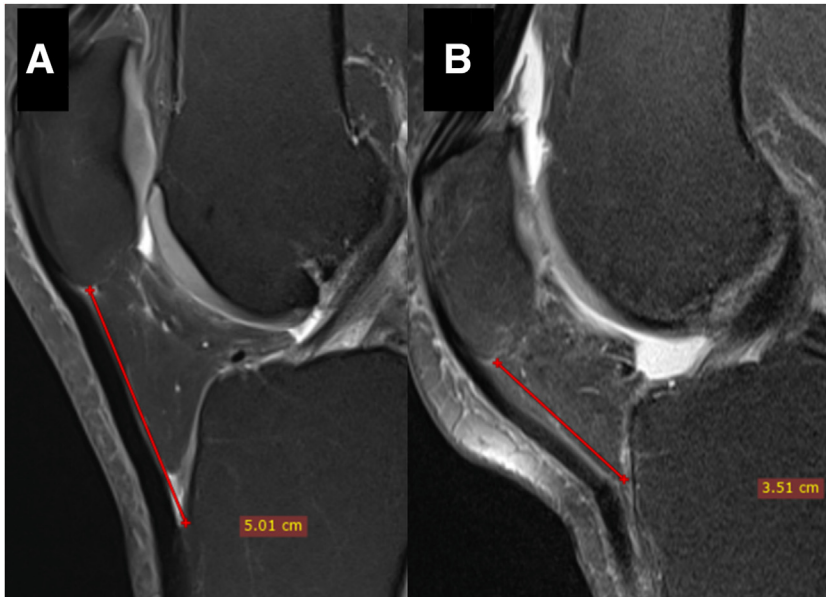
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**Fig 1.** (A) Sagittal magnetic resonance imaging scan of right knee before primary surgery owing to other intra-articular lesions. (B) Sagittal magnetic resonance imaging scan of right knee after knee arthroscopy complicated by adhesions in deep infrapatellar bursa with functional patella baja caused by adhesions between patellar tendon and tibia in deep infrapatellar bursal region, refractory to conservative management. The red line indicates functional length of the patella tendon.

The purpose of this article is to present a quick, simple, and cost-effective technique for the treatment of patella baja due to adhesions in the deep infrapatellar region (Video 1). This technique consists of the removal of adhesions to free the whole length of the patellar tendon and the interposition of a Hoffa fat pad pedunculated flap between the patellar tendon and tibia to avoid recurrent formation of adhesions. It allows for restoration of the natural height of the patella and thus normalizes patellofemoral kinematics, increases range of motion, alleviates pain, and decreases the risk of osteoarthritis development.

## Surgical Technique

### Indications

Our technique is indicated in patients with anterior knee pain or a flexion deficit due to patella baja caused by adhesions between the patellar tendon and tibia in the deep infrapatellar bursal region refractory to conservative management (Fig 1).

### Patient Positioning

The patient is positioned supine with the operative leg placed in a leg holder.

### Procedure

With the knee in 90° of flexion, a 4- to 5-cm-long sagittal incision is made 1 to 2 cm lateral to the patellar tendon, starting below the level of the patellar apex and proceeding distally. The skin and subcutaneous tissues are transected until free access between the patellar tendon and tibia is achieved. The patellar tendon is elevated bluntly with the surgeon's finger, and

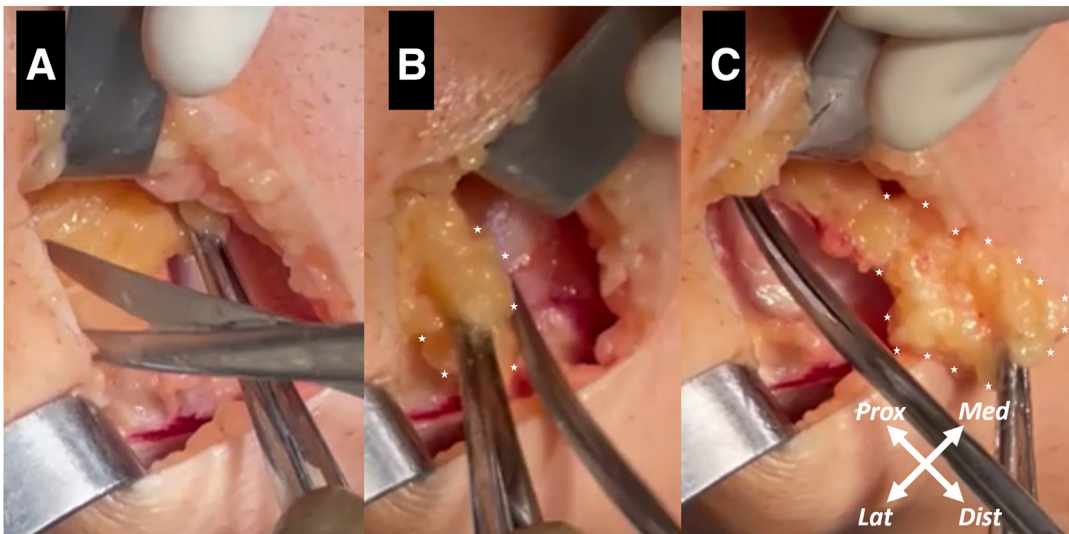
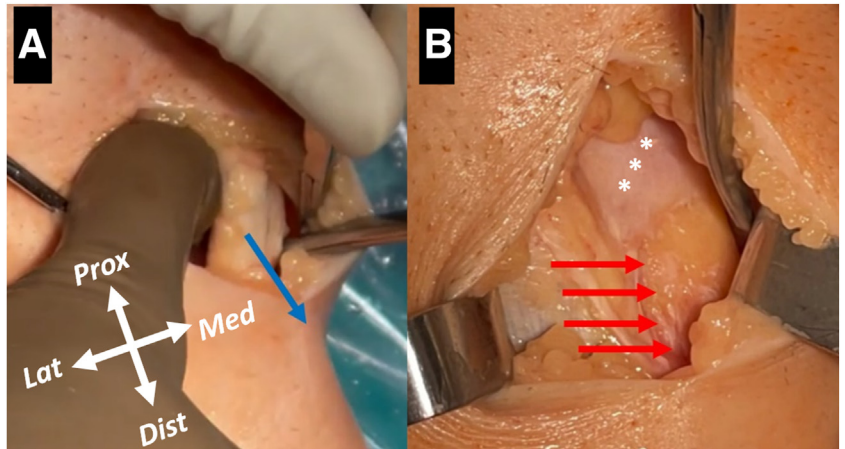
restricted motion of the patellar tendon is confirmed. The adhesions between the patellar tendon and tibia are transected with scissors on the lateral and medial sides of the tendon. Then, the patellar tendon is firmly tensioned with one's finger (Fig 2A) to break the bursal adhesions. The separation of the patellar tendon from the tibia in the deep infrapatellar bursal region is confirmed (Fig 2B).

The possibility of performing full knee flexion is assessed, with confirmation that the patellar tendon adhesions have been sufficiently released. In some cases, other procedures may be necessary as well.<sup>11</sup> The second part of the procedure is the creation and interposition of a Hoffa fat pad pedunculated flap between the separated patellar tendon and bare area of the tibia. The Hoffa fat pad is grasped with tweezers, and scissors are used to gradually create a pedunculated flap of fat tissue (Fig 3 A and B). The size and mobility of the pedunculated flap are checked every cut or two. The aim is to ensure it is possible to interpose a flap between the patellar tendon and bone in the deep infrapatellar bursal region without tension to minimize recurrence of adhesions (Fig 3C). The length of the flap has to allow for full knee flexion without excessive tension on the flap.

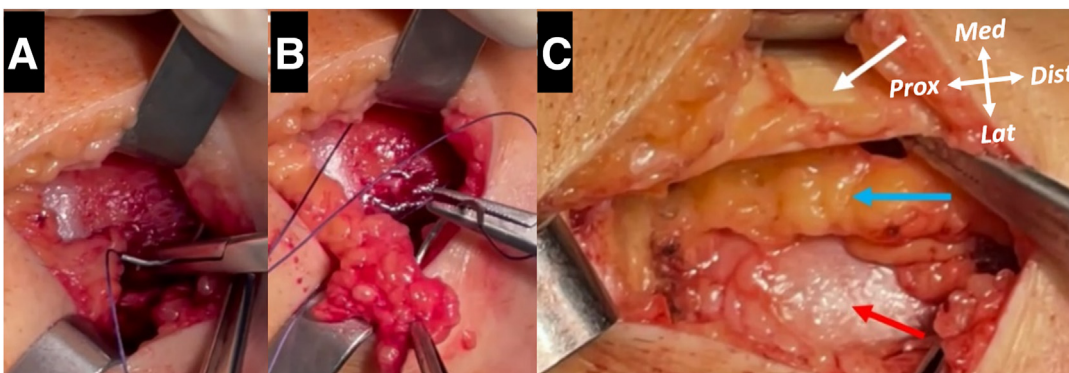
Then, the created flap is sutured to the periosteum remnants and surrounding soft tissues in the deep infrapatellar bursal region. If soft tissues are lacking or are poor quality, it is acceptable to suture the flap to the most distal dorsal portion of the patellar tendon or to use a suture anchor (Fig 4).

The subcutaneous tissues are closed with No. 1 and 0 Vicryl (Ethicon), and the skin is sutured with No. 3-0 Ethilon sutures (Ethicon). A photograph of achieved

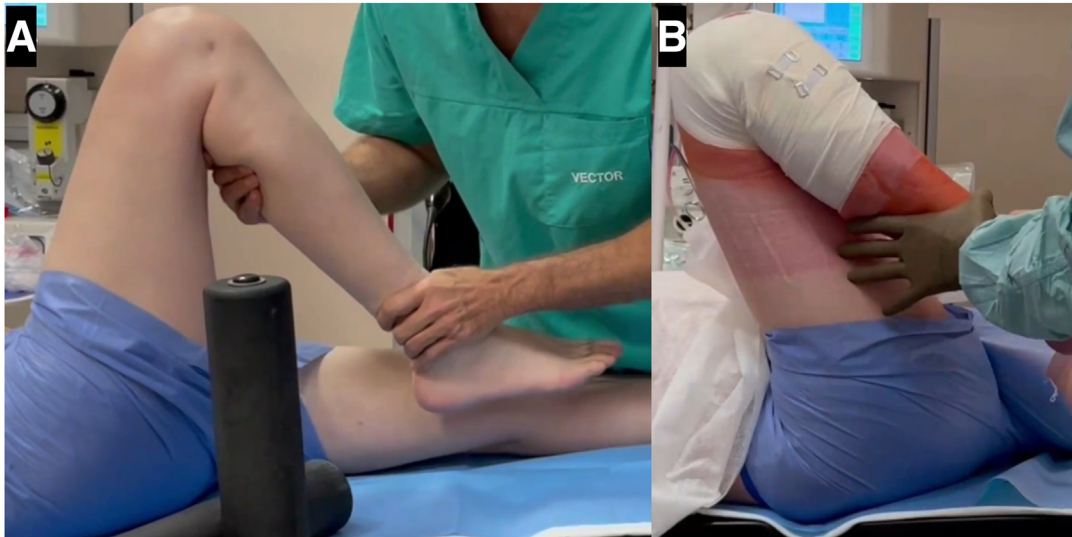
**Fig 2.** (A) Blunt separation of patellar tendon adhered to tibia in deep infrapatellar bursal region (lateral view, right knee). The blue arrow indicates the direction of tensioning to break the bursal adhesions. (B) The bare area of the tibia (red arrows) is visible after patellar tendon separation (lateral view, right knee). The white asterisks indicate the tibia covered by periosteum. (Dist, distal; Lat, lateral; Med, medial; Prox, proximal.)



**Fig 3.** Creation of pedunculated flap from Hoffa fat pad tissue (lateral view, right knee). The white asterisks delineate the pedunculated flap margins. (Dist, distal; Lat, lateral; Med, medial; Prox, proximal.)



**Fig 4.** Interposition and suturing of pedunculated flap between patellar tendon and tibia in deep infrapatellar region (lateral view, right knee). (A, B) Subsequent steps of suturing. (C) Interposed sutured pedunculated Hoffa fat pad flap (blue arrow). The white arrow indicates the patellar tendon, and the red arrow indicates the anterior tibia.



**Fig 5.** (A) Maximal knee flexion possible under anesthesia before described procedure, consisting of removal of adhesions to free whole length of patellar tendon and interposition of Hoffa fat pad pedunculated flap between patellar tendon and tibia (lateral view, right knee). (B) Restoration of full knee flexion at end of surgical procedure (lateral view, right knee).

possible flexion is presented in [Figure 5](#).<sup>12</sup> Additional outcomes are illustrated in [Figures 6](#) and [7](#).

Tips and tricks for the procedure are as follows: (1) The removal of adhesions between the dorsal surface of the patellar tendon and tibia has to be performed in a blunt manner with the surgeon's finger to avoid iatrogenic patellar tendon injury. (2) The obtained pedunculated flap has to be long enough that there is no excessive tension on it in deep knee flexion. (3) Meticulous hemostasis of the flap harvest site and deep infrapatellar bursa is necessary to reduce intra-articular

bleeding, which has been shown to increase joint fibrosis.<sup>13</sup>

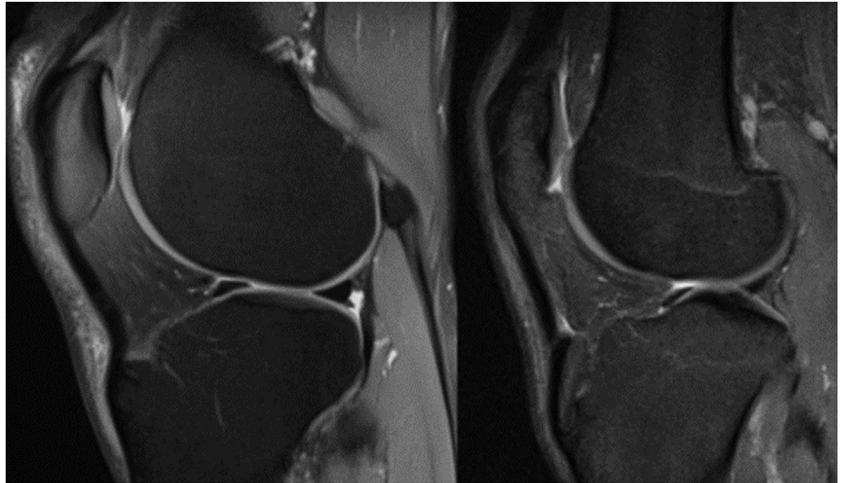
### Rehabilitation

Every 2 hours for the first 2 postoperative weeks, the patient performs gravitational hyperextension and maximum pain-free flexion for 5 minutes each. Ambulation using crutches with increasing weight bearing is allowed, dependent on tolerance; however, its volume is reduced. Guided physiotherapy is administered weekly after the first postoperative week,



**Fig 6.** Sagittal magnetic resonance imaging (MRI) scans of patient with recurrent adhesions after surgical treatment of Osgood-Schlatter disease and reoperation with presented technique (right knee): preoperative scan (A), 6-month follow-up scan (B), and 3-year follow-up scan (C). At 3 years after surgery, the patient reported no symptoms and full range of knee motion was possible. The length of the functionally active part of the patellar tendon increased significantly from before the procedure (A) to 3-year follow-up (C). The yellow arrows indicate adhesions between the patellar tendon and anterior part of the tibia, and the red and green arrows indicate the length of the functionally active part of the patellar tendon before the procedure compared with that at 3-year follow-up.

**Fig 7.** Sagittal magnetic resonance imaging scan of right knees of 2 different patients with patella baja due to adhesions between patellar tendon and anterior part of tibia as consequence of Osgood-Schlatter disease without surgery.



with manual mobilizations of the patella, patellar tendon, and Hoffa fat pad.

### Discussion

The presented technique allows for the treatment of patella baja due to adhesions between the patellar tendon and tibia in the deep infrapatellar region. The 2 main elements of the technique are blunt removal of adhesions and interposition of a pedunculated Hoffa fat pad flap.

Blunt removal of adhesions within the deep infrapatellar region is necessary to restore the natural length and movement of the patellar tendon. In a cadaveric biomechanical study by Ahmad et al.,<sup>1</sup> simulated adhesions between the patellar tendon and tibia contributed to a reduction in the length of the patellar tendon and to a medial and distal shift of the patella. In addition, extensor mechanism strength was reduced, and patellofemoral joint reactive forces were increased.

The second element of the technique is interposition of a pedunculated Hoffa fat pad flap between the freed patellar tendon and the tibia. Similar methods are used in talocalcaneal coalitions. After separation, the fat graft is interposed between the talus and calcaneus to reduce

the recurrence rate, improve functional scores, and decrease pain.<sup>14,15</sup> Abdominal non-pedunculated or buccal pedunculated fat pads are also used for interposition in temporomandibular joint ankylosis to minimize recurrent ankylosis by inhibition of osteogenesis. It is interesting to note that a buccal pedunculated fat pad has better long-term survival than an abdominal non-pedunculated fat pad, possibly owing to the blood supply through the peduncle.<sup>16,17</sup>

In summary, the described technique is a safe, cost-effective technique to treat and prevent recurrence of adhesions between the patellar tendon and tibia. It restores the functional length of the patellar tendon and thus normalizes patellofemoral kinematics, increases range of motion, alleviates anterior knee pain, and decreases the risk of osteoarthritis development.<sup>3,7-9</sup> The advantages and disadvantages of this technique are presented in [Table 1](#).

### Disclosures

All authors (K.M., K.S., P.A.P., R.F.L., M.M.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Table 1.** Advantages and Disadvantages of Hoffa Fat Pad Pedunculated Flap Interposition Technique

**Advantages**

- Adhesion recurrence is prevented.
- The natural functional length of the patellar tendon is restored.
- The healing process is safe and quick because of the solid and well-vascularized structure of a pedunculated flap.
- The Q angle is not changed, which is favorable for patellofemoral biomechanics.
- The technique uses local tissue reserves only, allowing for avoidance of additional donor-site morbidity.
- The technique allows for avoidance of tibial tuberosity osteotomy.
- The technique allows for avoidance of patellar tendon lengthening.

**Disadvantages**

- There is a possible risk of patellar tendon injury during surgery.
- Painful deep flexion restriction is possible if the created flap is too short and constricted.
- Intrabursal hematoma is possible.

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