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Case report

Snapping knee caused by the gracilis tendon: A case report with an anatomical study

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Abstract

We report the case of a patient exhibiting the snapping phenomenon during flexion/extension motion caused by the gracilis tendon flipping over the posteromedial corner of the medial femoral condyle. A 30-year-old woman presented with a 2-year history of pain accompanied by snapping over the medial aspect of the left knee. Snapping was observed at the posteromedial corner of the medial femoral condyle at around 30° of flexion during active and passive flexion/extension. Imaging examination, including radiography, magnetic resonance imaging (MRI), and computed tomography, revealed no abnormalities. Considering the persistent discomfort and disability associated with the snapping, surgery was indicated. During surgery, the gracilis tendon was observed to move over the posterior edge of the medial femoral condyle during flexion/extension of the knee. The gracilis tendon was transected and the proximal cut end was sutured to the neighboring semitendinosus tendon in a proximally retracted position. After the surgery, the snapping symptom was resolved. We hypothesized that the anteriorly deviated location of the gracilis tendon in relation to the medial femoral condyle was a causative factor for the snapping phenomenon in this patient. In order to investigate whether the gracilis tendon of this patient passes along the aberrant route, the location of the gracilis tendon in our patient population with knee injuries (26 patients) was examined on axial MRI. In this study population, the gracilis tendon was located posterior to the medial femoral condyle in 21 of the 26 knees (81%), and at the posteromedial corner of the medial femoral condyle in 5 of the 26 knees (19%). However, passage of the gracilis tendon anterior to the posterior edge of the medial femoral condyle was not observed in any of the cases in this population. Based on this investigation, the aberrant route of the gracilis tendon was thought to be a primary factor for snapping observed in this patient.

Keywords: Extra-articular factor; Gracilis tendon; Snapping knee

Introduction

Snapping of the knee is generally caused by intra-articular factors such as meniscal injury, synovial plicae, and loose bodies.[1] However, snapping caused by extra-articular structures is also occasionally encountered. In previously published literature, there have been reports of cases showing a snapping phenomenon caused by surrounding soft tissues such as the iliotibial band and the hamstring tendon.[2−5]

In this article, we report the case of a patient exhibiting the snapping phenomenon during flexion/extension motion caused by the gracilis tendon flipping over the posteromedial corner of the medial femoral condyle. Additionally, the aetiology of the snapping in this patient is discussed based on the results of an anatomical study with magnetic resonance imaging (MRI).

Case report

A 30-year-old woman presented with a 2-year history of pain accompanied by snapping over the medial aspect of the left knee without preceding injury. Although she had undergone an arthroscopy at another clinic prior to the initial visit

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with a suspected diagnosis of meniscal injury, the arthroscopic examination did not reveal any significant injury to the meniscus. Upon physical examination, snapping was observed at the posteromedial corner of the medial femoral condyle at around 30° of flexion during active and passive flexion/extension (Fig. 1). The snapping was palpable and visible as a flipping motion of the tendon shifting posteriorly on flexion and anteriorly on extension over the medial femoral condyle. No other remarkable findings indicating meniscal and ligamentous injuries were detected. Regarding the imaging examinations, the anterior–posterior weight-bearing radiograph showed normal coronal alignment and computed tomography (CT) of the limb did not show any abnormal findings or change in contour of the flexor tendon and the bone as a cause of snapping. Route sagittal and coronal MRIs of the knee demonstrated no detectable changes. Based on the results of the physical and imaging examinations, it was thought that snapping of the medial hamstring tendon at the posteromedial corner of the medial femoral condyle was the principal cause of the symptom. On macroscopic observation of the gracilis tendon at surgery, no abnormal findings such as tendon damage, thinning, hypertrophy, or scar formation were identified.

Considering the persistent discomfort and disability associated with the snapping, surgery was indicated. During surgery under general anesthesia, the snapping phenomenon could not be reproduced. However, the gracilis tendon was observed to move over the posterior edge of the medial femoral condyle during flexion/extension of the knee (Fig. 2). No bony abnormalities such as local prominences or bumps were identified. Based on these intraoperative findings, flipping of the gracilis tendon at the posteromedial corner of the femoral condyle was thought to be a source of the symptom. The gracilis tendon was transected at the level of the medial femoral epicondyle and the proximal cut end was sutured to the neighboring semitendinosus tendon in a proximally retracted position.

After the surgery, the snapping symptom was resolved; however, although less distinct compared to the preoperative condition, snapping recurred at 5 months.

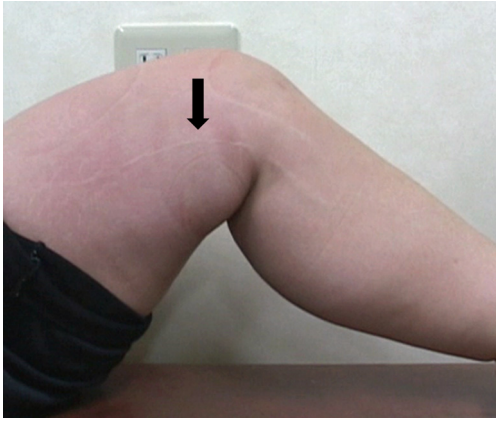

Fig. 1. Snapping is observed at 30° of knee flexion during active and passive flexion/extension at the posteromedial corner of the medial femoral condyle (black arrow).

MRI study on the route of the gracilis tendon

Because no pathologic factors related to the bony alignment and configuration could be identified in this patient, the non-physiological passage route of the gracilis tendon was suspected as a factor causing the snapping. We hypothesized that the anteriorly deviated location of the gracilis tendon in relation to the medial femoral condyle was a causative factor for the snapping phenomenon in this patient. To investigate whether the gracilis tendon of this patient passes along the aberrant route, the location of the gracilis tendon at the femoral epicondyle level in our patient population was examined on axial MRI. The MRIs of 26 patients were examined for tendon anatomy. MRI was indicated for these patients with a suspected diagnosis of ligamentous or meniscal injuries. There were 16 women and 10 men, with the age ranging from 15 years to 36 years (mean: 24.6 years).

In this study population, the gracilis tendon was located posterior to the medial femoral condyle in 21 of the 26 knees (81%), and at the posteromedial corner of the medial femoral condyle in five of the 26 knees (19%) (Fig. 3A and B). However, passage of the gracilis tendon anterior to the posterior edge of the medial femoral condyle was not observed in any of the cases in this population except for the current patient (Fig. 3C).

Discussion

Snapping syndrome is a fairly common phenomenon occurring in multiple regions such as the shoulder,[6] elbow,[7] wrist,[8] hip,[9] ankle,[10] and knee.[11] Among these, snapping of the knee is mostly caused by meniscal injuries, and snapping because of other etiologies is rather rare. Several reports have documented snapping of the knee with a discussion of the causative factors. Various conditions such as intra-articular tumors, synovial plicae, friction of the iliotibial band, and subluxation of the tendon have been raised as factors inducing

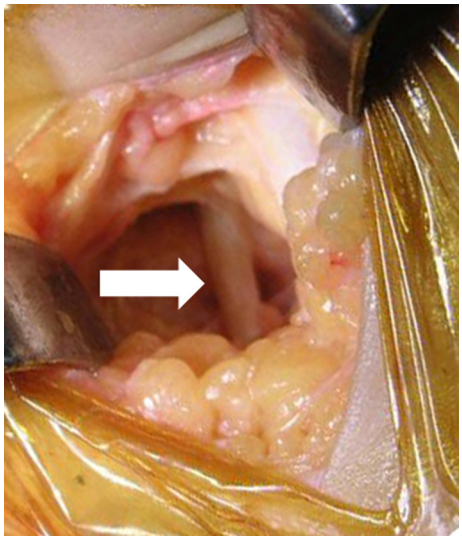

Fig. 2. Intraoperative photograph showing the passage of the tendon.

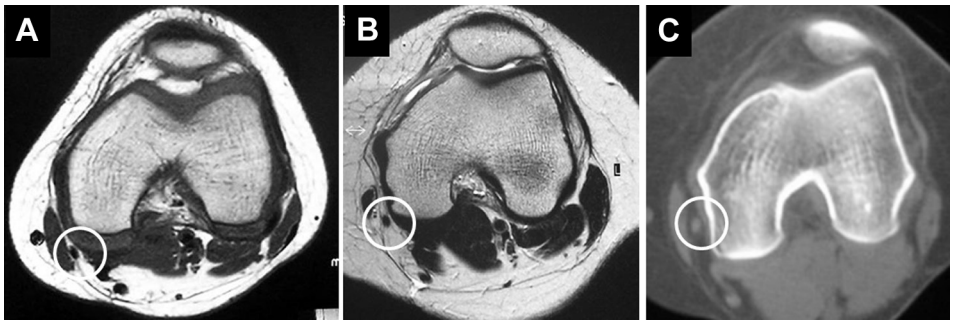

Fig. 3. (A, B) Axial magnetic resonance imaging at the level of the femoral epicondyle. The gracilis tendon (white circle) was identified posterior to the medial femoral condyle (A) in 21 of the 26 cases (81%), and at the posteromedial corner of the femoral condyle (B) in five of the 26 cases (19%). (C) Axial computed tomography at the corresponding level in this patient. The gracilis tendon (white circle) is located anterior to the posteromedial corner of the femoral condyle.

this phenomenon in the literature. Among these conditions, snapping of the hamstring tendon has been documented sporadically as a case report. Snapping of the biceps tendon can be caused by sliding motion of the tendon over the fibular head. On the medial side, there also have been some studies reporting snapping of the semitendinosus or gracilis tendon at the posteromedial aspect of the knee.

Lyu and Wu[5] investigated the anatomical factors related to this phenomenon in a cadaver dissection study. They stated that change in tension of the fanned-out fibres of the semitendinosus tendon was a critical factor for this phenomenon. Their speculation regarding the sequential process leading to snapping is as follows: The fanned-out fibre is stretched by injury concomitant with a scissoring gait, forcing internal rotation of the tibia and excessive contraction of the semitendinosus muscle. Repetitive tension applied to the semitendinosus tendon induces a gradual anterior slip of the tendon onto the medial tibial condyle. Thereafter, displacement of the semitendinosus tendon becomes more prominent, eventually leading to subluxation of the tendon over the medial tibial condyle.

Karataglis et al[12] reported a case of a high-demand volleyball player presenting symptomatic subluxation of the semitendinosus and gracilis tendons over the posteromedial corner of the tibia manifesting as snapping. Their speculation regarding its aetiology is as follows: Repetitive static vertical jumping and landing during volleyball play applies overloading to the anterior portion of the knees, especially when combined with hyperextension of the knee. This excessive loading induces distal displacement or attenuation of the accessory tendinous bands and subsequent gradual forward subluxation of the semitendinosus and gracilis tendons out of their shallow groove. As these structures slip forward, peritendinitis develops and causes increased muscle spasm, resulting in progression of the symptoms.

In the current case, snapping was caused by a flipping motion of the gracilis tendon over the posteromedial corner of the medial femoral condyle. Although the relevant aetiology was unclear, the gracilis tendon was located anterior to the posterior edge of the medial femoral condyle in this patient whereas this tendon passed behind the femoral condyle in all of our patient population. Therefore, this aberrant passage of the gracilis tendon was thought to be a primary factor causing snapping in this patient. Although the contributing aetiology is unclear, a gradual stretch of the supporting structures by repetitive overloading or subtle anatomical factor such as rotational bony malalignment may have been a factor leading to the unusual passage of the gracilis tendon.

Regarding the surgical procedure for the snapping of the medial hamstring tendon, Bae and Kwon[13] resected the gracilis and semitendinosus at 1 cm below the musculotendinous junction then sutured them to the sartorius and semimembranosus, which resulted in a satisfactory outcome. Bollen and Arvinte[14] described a series of four patients with snapping by a flicking of the semitendinosus and gracilis tendons over the muscle belly of the semimembranosus and performed an excision of the semitendinosus or gracilis tendon using a tendon harvester with resolution of snapping in all patients. Geeslin and Laprade[15] described a series of three patients in whom both semitendinosus tendon harvest and release of the tibial attachments of the hamstring tendons yielded satisfactory outcomes. In the current case, we transected the gracilis tendon at this level of snapping and sutured the cut end to the neighboring semitendinosus tendon. This procedure was selected with the intent of preserving the flexor function while reducing the tension of the corresponding tendon. Snapping was resolved after the surgery; however, it recurred after 5 months. Regeneration of the transected gracilis tendon along the same passage, as reported after tendon harvest in anterior cruciate ligament reconstruction,[16] was thought to induce this recurrence. Although regeneration of the tendon along its original passage may not be completely evitable, total excision of the tendinous portion with its insertion would have reduced the chance of subsequent recurrence.

Conflicts of interest

The authors declare that they have no conflicts of interests.

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