Unsuccessful regeneration of the semitendinosus tendon harvested for anterior cruciate ligament reconstruction: Report of two cases

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Summary Recent magnetic resonance imaging (MRI) and three-dimensional (3D) computed tomography (CT) analyses have demonstrated that semitendinosus tendon can regenerate at a high rate following harvesting the tendon for anterior cruciate ligament (ACL) reconstruction. Although it is known that the regeneration of the semitendinosus tendon does not occur in all the patients, the reason for this unsuccessful regeneration of the tendon in certain patients remains unknown. We recently encountered two cases in which regeneration of the semitendinosus tendon was unsuccessful because of apparent reasons. These patients experienced a sudden sharp pain in the posterior aspect of their thighs when their hamstring muscles were subjected to aggressive load at 3 and 4 weeks after surgery. At the follow-up examination conducted after 12 months, 3D CT imaging revealed unsuccessful regeneration of the semitendinosus tendons in both cases. Severe proximal retraction of the semitendinosus muscle belly was also confirmed.

Introduction

In recent years, the use of autologous hamstring tendons (semitendinosus and/or gracilis) in anterior cruciate ligament (ACL) reconstruction has become increasingly popular. The regeneration potential of semitendinosus and gracilis tendons after harvesting has been demonstrated with magnetic resonance imaging (MRI) and three-dimensional (3D) computed tomography (CT) analyses (Fig. 1) [1–8]. Recent studies [5–8] demonstrated that semitendinosus tendon could regenerate at a high rate (91–100%) following harvesting the tendon for ACL reconstruction. Although it is known that the regeneration of the semitendinosus tendon does not occur in all the patients [9], the reason for this unsuccessful regeneration of the semitendinosus tendon in certain patients remains unknown. We present two cases in which regeneration of the semitendinosus tendon was unsuccessful because of apparent reasons.

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Case 1

A 22-year-old male college student sustained a partial rupture of the ACL in his right knee because of a traffic accident. The patient underwent an ACL augmentation procedure [10] by using an ipsilateral autogenous semitendinosus tendon. The immediate postoperative recovery was uneventful. However, 3 weeks after surgery, the patient experienced a sudden sharp pain in the posterior aspect of his right thigh while performing aggressive hamstring-strengthening exercises. Although the severity of pain in his posterior thigh decreased gradually within a week, he continued to experience mild pain in his right dorsal thigh even 6 months after the surgery. The patient’s right knee showed excellent stability. The side-to-side difference in anterior laxity measured with the KT-2000 knee arthrometer (MEDmetric, San Diego, California) was 0.4 mm at 133 N. At the 12 months follow-up, 3D CT imaging revealed unsuccessful regeneration of the semitendinosus tendon (Fig. 2), and the semitendinosus muscle was retracted proximally by 14 cm as compared to the contralateral side. The isokinetic measurements of the knee flexion showed deficits in knee flexor strength (70% and 71% of the contralateral knee at 60°/s and 180°/s, respectively). The patient continued to experience discomfort in his right dorsal thigh on flexing the knee even at 2 years after surgery.

Case 2

A 17-year-old female high school student was referred to our clinic; she had a history of an unsuccessful ACL reconstruction of her left knee with an ipsilateral semitendinosus tendon autograft. She underwent ACL revision surgery of the left knee, which was performed using the over-the-top femoral route. A semitendinosus tendon was harvested from the contralateral knee for use as the graft. The immediate postoperative recovery was uneventful. However, 4 weeks after surgery, the patient felt a sudden sharp pain in the posterior aspect of her right thigh when she hopped on her right foot. The pain persisted for 2 weeks, and she needed crutches while walking. The pain in her right thigh began to gradually subside eventually, and she did not experience any difficulty in her daily life thereafter. However, the discomfort in her right posterior thigh persisted even until 6 months after surgery. Evaluation of her left knee (subjected to revision ACL surgery) by the Lachman and pivot shift tests showed negative results. The side-to-side difference measured with the KT-2000 knee arthrometer was 1.7 mm. At the follow-up examination conducted after 12 months, no regeneration of the semitendinosus tendon was observed on 3D CT images (Fig. 3), and severe proximal retraction of the semitendinosus muscle was observed. The isokinetic measurements of knee flexion showed mild deficits in knee flexor strength (95% and 92% of the preoperative knee at 60°/s and 180°/s, respectively). The patient continued to experience discomfort in her right dorsal thigh.

Discussion

Since the first report by Cross et al. [1], several studies using MRI have shown regeneration of the semitendinosus tendon after harvest for ACL reconstruction, although tendon regeneration does not simply restore what was lost [11,12]. Recent studies [5–8] demonstrated that semitendinosus tendon could regenerate at a high rate following harvesting the tendon. Makihara et al. [6] reported that the
regeneration of the semitendinosus tendon was confirmed in all subjects (16 patients) using MRI. In 2012, Nakamae et al. [8] showed that the structure of regenerated tendons could be clearly identified in 38 of 39 cases (97.4%) after harvest of only semitendinosus tendon. In their study, 3D CT was used for evaluation of the semitendinosus tendon regeneration. It has been shown that 3D CT is useful in orthopedics for the diagnosis of soft tissue injury [13]. The 3D CT imaging technique may provide more detailed morphological information than does conventional MRI. However, most of the previous clinical studies used MRI for the evaluation of the regenerated tendon and have consisted of relatively few patients; hence, the actual percentage of cases in which regeneration of the tendon was unsuccessful remains unknown. Furthermore, only little is known about the causes of unsuccessful regeneration of the semitendinosus tendon. We encountered two cases of unsuccessful regeneration of the semitendinosus tendon caused by apparent reasons. These patients experienced a sudden sharp pain in the dorsal aspect of their thighs when their hamstring muscles were subjected to aggressive load at 3 and 4 weeks after surgery. Järvinen et al. [14] also reported a case of unsuccessful regeneration of the harvested semitendinosus tendon, which was evaluated by MRI. The patient supposedly experienced a persistent sharp pain in the dorsal aspect of his thigh 2 weeks after the surgery. Although the mechanism of hamstring tendon regeneration has not been determined, Papandreou et al. [15] showed that, using ultrasonography, an irregular hypoechoic structure appeared in a near-anatomic position of the semitendinosus tendon in all cases at 1 month after harvesting the tendon. Thus, unsuccessful regeneration of the semitendinosus tendon may be caused by the rupturing of the regenerate structure in the early stage of regeneration. In addition, severe proximal retraction of the semitendinosus muscle belly was confirmed in the current cases. It has been demonstrated that morphological changes in the semitendinosus muscle-tendon complex after harvesting the tendon can cause deficits in knee flexion torque [3,5–7,16]. Avoiding excessive hamstring-strengthening exercises in the first month after surgery may prove beneficial for the regeneration of the tendon and knee flexion torque.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


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