



## Technical Note

# Reconstruction of chronic tearing of the distal triceps using the double-row configuration: technical note <sup>☆</sup>



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### ABSTRACT

Tearing of the distal triceps is uncommon and may be difficult to diagnose, especially in situations of partial tearing. Imaging methods such as ultrasonography and magnetic resonance imaging should be used to confirm the diagnosis and define the extent of the injury. The preferred treatment for complete tearing of the triceps is surgical, unlike in cases of partial tearing, in which the treatment depends on factors such as pain, functional deficit and the patient's expectations. Here, we describe the case of a patient with partial tearing of the distal triceps after falling to the ground, which was not diagnosed at the time of first attendance and evolved with pain and great functional loss. The surgical procedure was performed nine months after the injury, with reconstruction of the triceps by means of reinforcement using the tendon of the ipsilateral semitendinosus and fixation in the olecranon using the double-row configuration. The patient remained immobilized using a sling for one week and then gains in passive range of motion (ROM) were introduced. Three weeks later, the patient was released for gains in active ROM. Muscle strengthening was started after 12 weeks. Six weeks after the surgical procedure, the patient was free from pain and presented complete ROM, grade V elbow extension force and hypertrophy of the triceps. The technique described here was shown to be useful for treating tears of the tendon of the distal triceps.

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### Reconstrução de ruptura crônica do tríceps distal sob a configuração de dupla fileira: nota técnica

#### R E S U M O

Rupturas do tríceps distal são incomuns e podem ser de difícil diagnóstico, especialmente as parciais. Métodos de imagem, como USG e RNM, devem ser usados para a confirmação

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diagnóstica e para definição da extensão da lesão. O tratamento de escolha para as rupturas completas do tríceps é o cirúrgico, diferentemente das parciais, que dependem de fatores como dor, déficit funcional e expectativas do paciente. Descrevemos o caso de um paciente com ruptura parcial do tríceps distal após queda ao solo. Não foi diagnosticado no momento do primeiro atendimento e evoluiu com dor e grande perda funcional. O procedimento cirúrgico foi feito após nove meses do trauma, com a reconstrução do tríceps por meio de reforço com o tendão do semitendíneo ipsilateral e fixação no olécrano sob a configuração de dupla fileira. O paciente permaneceu imobilizado com tipoia por uma semana e iniciou-se, a partir daí, o ganho de amplitude de movimento (ADM) passiva. Após três semanas foi liberado para o ganho de ADM ativa. O fortalecimento muscular iniciou-se após 12 semanas. Após seis meses do procedimento cirúrgico o paciente apresenta-se sem dor, ADM completa, força de extensão do cotovelo grau V e hipertrofia do tríceps. A técnica descrita se mostrou útil para o tratamento de rupturas do tendão do tríceps distal.

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## Introduction

Tearing of the tendon of the distal triceps is a rare injury that accounts for less than 1% of the tendon injuries of the upper limbs.<sup>1</sup> For this reason, few studies in the literature have defined any treatment patterns or made any comparisons between the types of treatment. This injury generally occurs as an avulsion at the bone insertion of the tendon, in the olecranon. More rarely, it occurs as a lesion within the muscle<sup>2</sup> or at the muscle-tendon junction.<sup>3</sup> The injury mechanism consists of falling with the hand extended, but direct trauma to the posterior face of the elbow<sup>4</sup> has also been described.

Cases of complete tearing require surgical treatment, with primary repair or reconstruction. On the other hand, cases of partial tearing are often difficult to diagnose immediately after the injury. These are usually diagnosed after long periods of pain and functional limitation of the limb.<sup>5</sup> Imaging methods such as ultrasonography (USG) and magnetic resonance imaging (MRI) are generally used for the diagnosis and for ascertaining the extent of the injury.

Surgical treatment of partial tearing is generally done when the patient continues to present symptoms despite the non-surgical treatment. Primary repair of the injury is often difficult in cases in which a long period of time has elapsed since the injury. In these cases, tendon reconstruction techniques need to be applied.<sup>5</sup>

This article presents a description of a patient who suffered chronic tearing of the distal tendon of the brachial triceps muscle and then underwent reconstruction using a graft from the tendon of the semitendinosus muscle, with fixation to the olecranon in a double-row configuration. The technique was shown to be reproducible, with good results.

## Case report

The patient was 38 years of age and had suffered a fall to the ground during sports practice nine months earlier. Since then, he had presented pain and difficulty in tasks that required elbow extension force, such as pushing a car door to open it.

He had initially been attended at another institution, where the injury had not been diagnosed. Instead, he had been diagnosed as having bruising on his elbow. He received the correct diagnosis eight months after the trauma. He was then referred to our service for the correct treatment. Conservative treatment had already been administered over this period, but without any improvement in his condition.

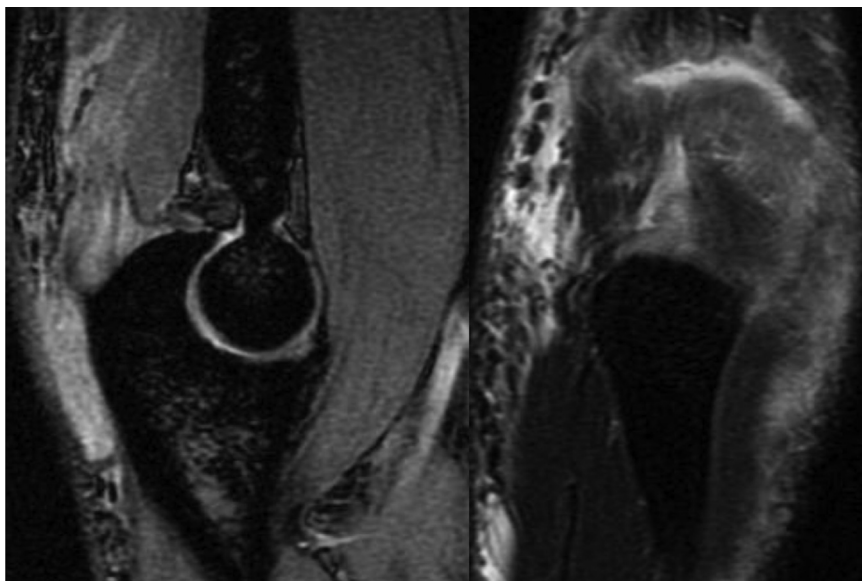
At the physical examination, he presented bulging in the posterior region of the distal third of the upper arm, a complete range of flexion-extension, grade IV elbow extension strength and pain when performing extension against resistance. MRI showed partial tearing of the insertion of the triceps tendon in the olecranon (Fig. 1).

## Surgical technique

Surgical treatment was indicated. Reconstruction surgery on the injured tendon was chosen because of the length of time since the injury and the degree of retraction of the torn fibers. The technique of transferring the tendon of the ipsilateral semitendinosus muscle was used because of our familiarity with this technique and with the characteristics of the transferred tendon.

The patient was positioned on dorsal decubitus because of the need to remove the tendon from the knee, and the limb was fixed to the positioning device of the table (*Trimano*).

A posterior longitudinal incision was made, and the ulnar nerve was isolated and protected. The triceps tendon was exposed and it was observed that a thin layer of tendon fibers was still inserted in the olecranon. These fibers were then deinserted. The tendon of the semitendinosus was harvested by means of a small longitudinal incision above the insertion of the goosefoot tendons and by using a stripper. It was transferred with reinforcement from the tendon of the distal triceps interlaced in this (Fig. 2). The triceps graft combination was inserted in the olecranon by means of a double-row configuration. Two bioabsorbable 2.9 mm anchors were used in the most anterior region of the olecranon, which were placed close and parallel to the joint surface. The anchor threads were passed in a U shape through the most proximal portion of the tendon.



**Fig. 1 – Magnetic resonance imaging (sagittal and coronal) showing partial tearing of the tendon of the distal triceps.**

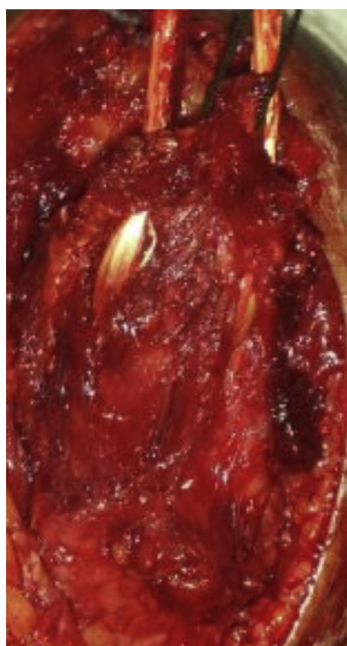
Two transosseous sutures were made more posteriorly, using no. 2 high-resistance thread, which was passed through the triceps graft combination with the suture locked. The exit was at the most distal extremity of the tendon (Figs. 3 and 4). The sutures were made with the elbow flexed at 90°.

The patient was kept immobilized by means of a sling for one week. Subsequently, self-performed passive exercises were started. Three weeks later, gains of active movement were started. Muscle strengthening exercises were started after the third postoperative month. Six months after the operation, MRI was produced again, and this showed that complete tendon healing had been achieved (Fig. 5).

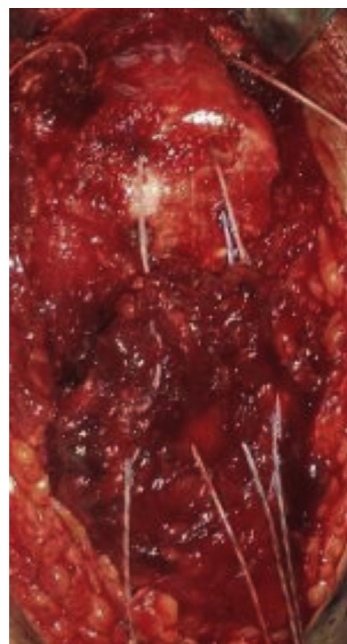
The patient evolved in a very satisfactory manner. A complete range of motion was achieved and grade V muscle strength was reached, free from pain. The patient is very satisfied with the treatment that was performed.

### Discussion

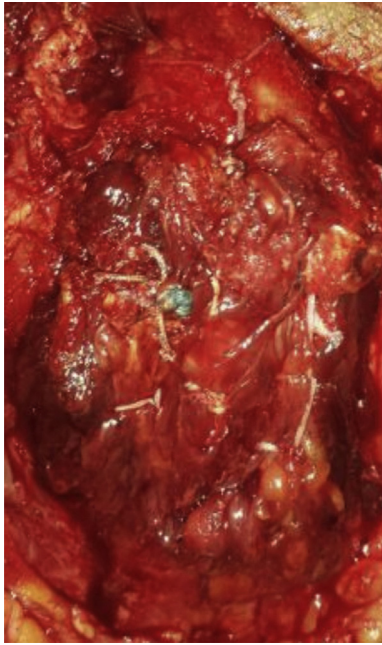
Tearing of the distal tendon of the triceps is a rare injury that accounts for less than 1% of all tendon tears.<sup>1</sup> There is little information in the literature to guide surgical treatment. The



**Fig. 2 – Intraoperative imaging showing the graft from the semitendinosus interlaced in the triceps tendon.**



**Fig. 3 – Intraoperative imaging showing the positioning of the two anchors in an anterior position in the olecranon and the two posterior bone tunnels.**



**Fig. 4 – Intraoperative imaging showing the final fixation of the tendon to the olecranon.**

mean age at which it occurs is 36 years (range: 7–75), and it occurs more commonly in males (3:1).<sup>6</sup>

This injury is generally caused by a fall to the ground with the wrist extended, which generates an eccentric contraction of the triceps.<sup>7</sup> Substantial force is usually required for the triceps tendon to tear; However, when the structural integrity of the tendon is altered, tearing may occur as a consequence of minimal to moderate force.<sup>7</sup> Hyperparathyroidism secondary to chronic kidney disease, hypocalcemia, rheumatoid arthritis, imperfect osteogenesis, use of anabolic steroids and insulin-dependent diabetes are systemic factors that have been reported as related to tearing of the triceps tendon.<sup>7</sup> Among the local factors that have been cited, local injection of corticoids, degenerative arthritis and bursitis of the olecranon have been the most frequent.<sup>7</sup>

The diagnosis of acute tearing of the triceps can easily go unnoticed. When tearing occurs, elbow extension against gravity becomes difficult or impossible. A palpable defect proximal to the olecranon may be detected, but the local swelling in acute cases may limit initial identification.<sup>7</sup>

The radiographic findings associated with tearing of the distal triceps are minimal. Avulsion of a bone fragment from the tip of the olecranon has been described in the literature, and this finding may be very useful in making the diagnosis. MRI enables accurate demarcation of the location and extent of the injury and it is commonly the preferred examination for making the diagnosis.<sup>5</sup> Finally, ultrasonography has been described as an important diagnostic method for these injuries, given that it provides dynamic images and is a much cheaper method than MRI, although the quality of the images depends on the technique used.<sup>7</sup>

In most cases, complete tearing of the distal triceps is immediately treated surgically, comprising repair or reconstruction.<sup>7</sup> On the other hand, in cases of partial tearing,



**Fig. 5 – Postoperative magnetic resonance imaging showing tendon healed in the olecranon.**

the initial treatment is usually non-surgical. When part or all of the tendon has become detached from the proximal ulna and persistent pain, weakness or functional deficit is present, primary surgical treatment should be considered.<sup>8</sup>

Several surgical techniques have been described for treating partial or complete tearing of the triceps tendon. Primary repair of acute complete tears using non-absorbable suturing with locking stitches across the tendon and passing through perforations in the olecranon has been proposed when possible.<sup>8</sup> An auto or allograft should be used when primary repair is impossible.<sup>8</sup>

Use of grafts from the flexor tendons of the knee (semitendinosus and gracilis) has been described in the literature for cases of chronic or recurrent tearing. Biomechanical tests on the flexor tendons have demonstrated significant loading strengths. The tendons of the semitendinosus and gracilis can bear maximum loads of 1216 and 838N, respectively.<sup>9</sup> The anatomy and variations in length and diameter have been defined. The mean diameter of the semitendinosus is 5.2 mm, with an average cross-sectional area of 14 mm<sup>2</sup>, while the diameter of the gracilis is 4.2 mm, with a cross-sectional area of 7.6 mm<sup>2</sup>.<sup>9</sup> The mean length of these grafts is much greater than 30 mm.<sup>9</sup> The greater strength, cross-sectional area and length of autografts from the knee flexors establish them as ideal grafts, in comparison with other autografts that have been used.<sup>6</sup>



In a series presented by van Riet et al.,<sup>7</sup> cases of tearing of the distal tendon of the triceps were identified. Reconstruction was necessary in nine cases and transfer of autogenous tissue was necessary in six patients. The tendons transferred were the Achilles, plantar, semitendinosus, latissimus, anconeus and palmar tendons. In each case, the tendon transferred was interlaced with the distal stump of the triceps and the suturing was passed through perforations in the olecranon.<sup>7</sup>

In the case of our patient, an autograft from the semitendinosus had to be used, even though this was a case of partial tearing, because of the chronic nature of the injury. The tendon-graft combination was fixed to the olecranon by means of transosseous suturing and suture anchors, which reinforced the fixation and made it more secure.

The technique described here is easy to carry out and enables early gains of range of motion, thus making active extension of the elbow possible six weeks after the operation, with good long-term functional results. We observed that because this is a rare injury, there is great difficulty in undertaking large prospective studies to compare the surgical treatment methods for this injury. However, the technique described above seems to be a good option for cases of chronic tearing of the distal triceps.

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### Conflicts of interest

The authors declare no conflicts of interest.

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