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Case Studies

A novel approach for rehabilitation of a triceps tendon rupture: A case report

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A B S T R A C T

Objective: Generate hypotheses and add new perspectives to the literature in the nonsurgical management of large ruptures in the distal part of the triceps tendon.
Methods: The patient was physically active, right handed, with a history of 20 years of resistance training practice and involvement in many activities, mostly combat sports (boxing, karate and mixed martial arts). The exercise program was designed with high repetitions and low rest intervals between sets in order to increase the metabolic stress. The resistance training with focus on tendon rehabilitation was performed in 28 weeks, with a follow-up of 52 weeks. The outcomes were changes in muscle strength and in the morphology of muscle and tendon.
Results: The results obtained in the isokinetic tests showed that the functional deficit was more evident during isometric than dynamic actions, and was also higher is slow than fast actions. Dynamic performance was fully recovered at the end of the follow up, while isometric strength did not.
Conclusions: The present case reports a successful rehabilitation program after a near maximum triceps tendon rupture. The novelty was in the use of a simple resistance training program, that demanded low time commitment and was performed in a regular fitness facility.

1. Introduction

Triceps injuries are uncommon traumatic events, and the distal triceps tendon ruptures are rare (Celli, 2015). The most common mechanism of triceps tendon ruptures is a forceful eccentric contraction, usually induced by the absorption of an impact (Kokkalis, Ballas, Mavrogenis, & Soucacos, 2013). The literature has proposed many approaches to triceps tendon rupture. In general, reviews published about this topic provided knowledge regarding medical outcomes after primary repair for complete and partial injuries (Bennett & Mehlhoff, 2015; Celli, 2015; Keener & Sethi, 2015; Kokkalis et al., 2013; Tom, Kumar, Cerynik, Mashru, & Parrella, 2013) and much attention has been given to primary repair techniques and reconstructive procedures. Regarding tendon rehabilitation, most discussions were in respect to outcomes after triceps repair or reconstruction (Bennett & Mehlhoff, 2015) and information about rehabilitation and conservative treatment protocols are scarce.

In case of ruptures of less than 50% of the tendon, or of ruptures greater than 50% in patients with a sedentary life style, the nonsurgical treatment is often the primary choice (Tarallo, Zambianchi, Mugnai, Costanzini, & Catani, 2015). The indicate treatment for total triceps tendon rupture is acute operative repair, since an untreated complete rupture could result in significant functional disability (Vidal, Drakos, & Allen, 2004). For individuals with high functional demands (e.g. athletes), for tears greater than 50% and with extensive loss of extension strength the surgical management is generally necessary (Stucken & Ciccotti, 2014). Also with respect to surgical treatment, in chronic ruptures (>6 weeks from injury) the direct repair is often not possible, representing a

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more challenging clinical problem (Bain & Durrant, 2010). This is a common situation in patients who does not have particular medical resources.

Nevertheless, one common concern in active individuals undergoing surgery is losing muscle mass and being absent from training. In a previous study, median time from triceps rupture to surgery was 22 days (Balazs et al., 2016) and, after the surgery, it is usually necessary a long period of immobilization and inactivity, which results in several months before returning to training (Finstein et al., 2015). Therefore, a rehabilitation protocol that would resemble the patient's usual training routine and that could bring him back to his activities in a short time period after the injury would be an attractive alternative to surgery. In this sense, considering active patients with tears greater than 50%, it remains into question if there is some possibility to consider conservative treatments. However, the option between surgical and conservative treatment remains vague, since it is not possible to draw conclusions on how effective the surgical treatment is when compared to non-surgical treatment due to the scarcity of data about conservative procedures.

In the present report, we describe the conservative treatment used to treat a 90% traumatic distal triceps tendon rupture in a physically active 37-year-old man. The purpose of this case report is to generate hypotheses and add new perspectives to the literature in the nonsurgical management of large ruptures in the distal part of the triceps tendon.

2. Material and methods

2.1. Case description

This case report presents a novel perspective approach for the rehabilitation of a 90% distal rupture of the triceps tendon in the left arm of a 37-year-old male. The patient was physically active, right handed, with a history of 20 years of resistance training practice and involvement in many activities, mostly combat sports (boxing, karate and mixed martial arts). At the time of the rupture, the patient was regularly involved with resistance training and boxing. The patient has no recent history of using any drug or substance known to affect muscle and tendon function or morphology, including anabolic steroids, has no history of upper-limb musculoskeletal injury or surgery and did not have any systemic disease.

The distal triceps tendon injury occurred in a trampoline, while the patient tried to absorb a fall with his left hand against the floor. The patient was conducted to a hospital and, over the 2 h after the event, he was immobilized and received analgesic and anti-inflammatory injections during the emergency attendance. After that, there was no administration of any other medication. The results of X-ray exams showed no fracture or injuries in the bones of upper-limb. Three 3 h after the fall, the injury was confirmed by an ultrasound image examination. Four days after the fall, the injury was confirmed by magnetic resonance imaging, with 90% of tendon rupture.

After three days, the immobilization cast was removed by patients decision and a physical therapist, certified in manual therapy, motor control exercises and mechanical diagnosis and therapy, evaluated and treated (three sessions) the mid-lower left cervical spine with glides mobilizations in attempt to decrease elbow pain and partially restore elbow flexion function. This procedures were employed because the primary tendon nociceptors may produce increase neuronal excitability in the spine cord, and these changes may result in dorsal horn stimulation, which is known as central sensitization (Bialosky, Bishop, Price, Robinson, & George, 2010). In the next day, the patient started the supervised resistance exercise program.

2.2. Resistance exercise program

In order to facilitate the patient adherence, the exercise protocol was designed to be performed in a conventional fitness facility and to resemble an ordinary resistance training routine. The program involved three sets of elbow extensions in a pulley every 4 days. The exercise was performed during upper body sessions that also included seated row, dumbbell biceps curl and peck deck.

The elbow extension exercise was initially performed with 20–30 repetitions to the point of discomfort defined as volitional interruption of the exercise due to pain or feeling of unsafely (Steele, Fisher, Giessing, & Gentil, 2017) with 30–45 s of rest between the three sets. Patient was oriented to take 1 s to conclude the eccentric and concentric phases, with no pause between each phase. The load was progressively increased until the exercise was performed to concentric failure (define as when the patient was not able to conclude a complete repetition (Steele et al., 2017), which occurred in the third week after injury. By the third week until the 8th week, the number of sets was kept in three, but the number of repetitions decrease to 15–20 and rest intervals between sets was set at 1 min. During this period, load was reduced by 20–30% from set to set to account for muscle fatigue and keep repetitions inside the proposed range. In the 9th week the patient included bench press after the triceps extension, with three sets of 20–25 repetitions performed to the point of discomfort, with 1 min of interval between sets.

The program was designed with high repetitions and low rest intervals between sets in order to increase the metabolic stress (Bottaro, Martins, Gentil, & Wagner, 2009; Kraemer et al., 1990), because previous studies showed that collagen incorporation increases in the presence of lactate (Klein, Pham, Yalamanchi, & Chang, 2001; Yalamanchi, Klein, Pham, Longaker, & Chang, 2004). Moreover, previous studies showed that the performance of a high number of repetitions at low loads performed to momentary muscle failure is an efficient strategy to promote increases muscle cross section area (De Souza et al., 2010; Mitchell et al., 2012; Morton et al., 2016; Takarada & Ishii, 2002). Moreover, using short interval lengths may be a good strategy to promote gains in muscle size and strength without the need of using high loads (De Souza et al., 2010; Takarada & Ishii, 2002). Considering the close relation between the anabolic response of tendons and muscles to training (Miller et al., 2005), the participant was progressively conducted to train to muscle failure because this procedure seems to be necessary in trained subjects, especially when using low loads (Burd et al., 2010; Farup et al., 2015; Giessing, 2012).

By the 13th week triceps extension and peck deck exercises were substituted by the bench press. This exercise was performed with three sets of 10–15 repetitions performed to momentary muscle failure and 1–2 min of interval between sets. By this time, the bench press exercise was performing the concentric phase as fast as possible in taking ~2 s to complete the eccentric phase. Bench press was chosen because previous studies reported that multi joint exercises promotes the same gains in muscle size and strength in arm muscles as single joint exercises (Gentil, Soares, & Bottaro, 2015) and the inclusion of a single joint exercise to a multi-joint exercise program resulted in no additional benefit (Gentil et al., 2013; de França et al., 2015) (Steele et al., 2017). Therefore, we opted to perform only a multi-joint exercise due to time-efficiency.

From the 20th to the 28th week, the patient started to perform the exercises with 4–6 maximum repetitions and emphasis on the eccentric phase of the exercise (4–5 s to conclude the eccentric phase) and to perform the concentric as fast as possible. The rest intervals were increased to 2–3 min between sets. The number of sets was maintained at three because it has been previously shown