

PLANIFICACIÓN DIETÉTICA Y REHABILITACIÓN A LARGO PLAZO DE JUGADORES PROFESIONALES DE TENIS Y FÚTBOL MEDIANTE UNA APROXIMACIÓN MULTIDISCIPLINAR

Martínez-Rodríguez, A. ¹; Moreno-Pérez, V. ²;
Roche, E. ¹; Vicente-Salar, N. ¹

1. Department of Applied Biology, Institute of Bioengineering, University Miguel Hernández
2. Sport Research Center. University Miguel Hernández

RESUMEN

Con frecuencia las lesiones relacionadas con el deporte requieren una aproximación multidisciplinar. En el caso de las tendinopatías, el proceso de recuperación es complejo y prolongado ya que el tendón es un tejido pobremente vascularizado y presenta un difícil tratamiento con las estrategias terapéuticas actuales. En este contexto, el fisioterapeuta debe tener en cuenta que una lesión tendinosa podría implicar un aumento de la composición grasa del deportista debido a su inactividad y a otros factores que favorecen el aumento de la ingesta de alimentos. Un alto porcentaje de grasa corporal podría estar relacionado en la prevalencia e incidencia de las tendinopatías por lo que el dietista-nutricionista juega un papel primordial durante la recuperación del deportista. El dietista-nutricionista puede ofrecer las herramientas necesarias que ayudarían a mantener al deportista en una óptima composición corporal y evitar futuras recaídas. En el presente trabajo, una jugadora de tenis y un futbolista fueron tratados de una tendinopatía patellar y del tendón de Aquiles respectivamente. Durante el periodo de rehabilitación, el fisioterapeuta y el nutricionista trabajaron durante las distintas fases de recuperación, controlando dieta y la composición corporal. Una vez alcanzada la recuperación los sujetos no presentaron ninguna recaída.

Palabras clave: enfoque multidisciplinar, nutrición, rehabilitación, tendinopatía

ABSTRACT

The current study aims to explore a multidisciplinary approach during prolonged recovery process in the complex sports-related injuries. In this regard, tendinopathies implicate a difficult treatment with current therapeutic strategies, delaying the recovery in athletes and could imply an increase in body fat due to inactivity. Thus, the nutritionist plays an instrumental role during recovery by providing the tools that help maintain an optimal body composition. A female tennis player and a male soccer player were treated for a patellar and Achilles tendinopathy, respectively. During the rehabilitation period, the therapist and nutritionist worked together throughout the recovery phases, controlling both diet and body composition. VISA-A and P tests results showed an optimal recovery beside the images obtained by ultrasonography, on the other hand, percentage of fat mass was maintained (7.6%) or decreased (22.7% to 21.2%) in the soccer and tennis player, respectively. Multidisciplinary collaboration of physical activity and health professionals promotes optimal recovery of athletes with a positive increase in physical performance and avoiding relapses.

Key Words: multidisciplinary approaches, nutrition, rehabilitation, tendinopathy

Correspondencia:

Néstor Vicente Salar
Department of Applied Biology-Nutrition. Institute of Bioengineering.
University Miguel Hernandez
Avda. de la Universidad s/n, 03202, Elche
nvincente@umh.es

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INTRODUCTION

Professional athletes are susceptible to numerous serious injuries that vary depending on the sport discipline. For example, sports where the players have frequent physical contact (such as soccer, American football, rugby, handball, etc.) or those where continuous and repetitive movements are performed (i.e. running, tennis, etc.) have a high probability of causing a serious injury.

Tendinopathies are considered frequent injuries during sports practice (Lian, Engebretsen & Bahr, 2005), representing 40-50% of sport-related injuries (Lian et al., 2005) and implicate prolonged rehabilitation periods. These injuries occur due to the overuse of sport-specific actions (Maganaris, Narici, Almekinders & Maffulli, 2004). Classically, the most accepted mechanism entails repetitive efforts that cause micro-sores in tendon tissue. As a result, different mechanisms are activated to repair the damaged tissue, although restoration is incomplete in some cases leading to a tendon with degenerated, disoriented and thinner fibers (Khan, Maffulli, Coleman, Cook & Taunton, 1998), as well as hypoxia, oxidative stress and hyperthermia located in the injured area with irregular apoptosis (Khan, Bonar, Desmond, Cook, Young, Visentini et al., 1996). This deficient repair decreases the tendon's capacity to support subsequent workloads and thus the tendinopathy persists longer.

There is a general consensus that the recovery period from such injuries should not be less than 6 months (Kader, Saxena, Movin & Maffulli, 2002). This long-term recovery period imply that the athletes tend to increase fat mass and decrease muscle due to the inactivity accompanied by a poor dietary and nutritional planning. Thus, it is very important to control protein intake during this period since excess protein appears to be responsible for the acidification of the body's pH (Remer, 2001). Metabolic acidosis is associated with protein loss due to muscle catabolism, negatively affecting the treatment applied for muscle-tendon repair (Caso, Garlick, Casella, Sasvary & Garlick, 2004). In this report, we provide information of a specific program implemented in our research center in which a dietitian-nutritionist and a therapist worked actively together in order to improve the recovery from tendinopathies in two athletes.

METHOD

Case report

A sport-functional reeducation was performed in two professional athletes who suffered chronic tendinopathies: a professional soccer player of the Spanish major soccer league and a female tennis player ranked 95th in the WTA (Women's Tennis Association) (Table I). During treatment, both athletes were under a dietary and nutritional plan based on a moderate protein intake and focused in maintaining high

reserves of liver and muscle glycogen. Body composition was regularly controlled through anthropometry. A dietetic reeducation program was also performed simultaneously. Dietetic intervention was performed after obtaining the informed consent from participants and according to the procedures approved by the Ethics Committee of University Miguel Hernandez (reference: IB-ER-05-13).

TABLE I
Physical characteristics of the subjects

Tendinopathy	Sport	Genre	Age (years)	Weight (kg)	Height (m)	Days off
Achilles tendon	Soccer	Male	32	66.5	1.70	153
Patellar	Tennis	Female	18	64.4	1.76	120

A validated VISA-A and VISA-P questionnaire was used to establish the severity of the Achilles and Patellar tendinopathies in the soccer and tennis player, respectively (Robinson, Cook, Purdam, Visentini, Ross, Maffulli et al., 2001; Visentini, Khan, Cook, Kiss, Harcourt & Wark, 1998). The state of tendons and vessels was obtained through ultrasonography and color Doppler (M-turbo SonoSite, Fujifilm, USA) (Öhberg & Alfredson, 2004). The generated data indicated hypoxic areas in both tendons with blood vessels often found in close association with nociceptive nerve fibers of substance P and glutamate (Alfredson, Thorsen & Lorentzon, 1999; Öhberg, Lorentzon & Alfredson, 2001; Schubert, Weidler, Lerch, Hofstadter & Straub, 2005). The evaluation was performed weekly in order to establish the evolution of injury and to control functionality and pain. In addition, we observed that the evaluation tests seemed to improve the mood and confidence of the athletes during the recovery phase.

The reeducation process was structured into 3 overlapped phases (Figure 1): recovery, re-adaptation and training phase (Table II).

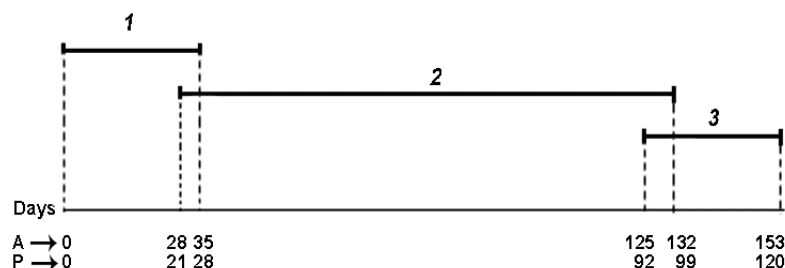


FIGURE 1: Time scheme of the rehabilitation process: Recovery phase (1), re-adaptation phase (2) and training phase (3). Abbreviations used: A, Achilles tendon injury; P, patellar tendon injury.

TABLE 2
Techniques used in the different stages of functional rehabilitation and duration. (A):
Achilles tendon injury, (P): Patellar tendon injury

Recovery phase		Re-adaption phase	Training phase
Acute phase:	Subacute phase:	- Increase in muscle	- Gradual reintegration
- Medical	- Onset of muscle	strength of injured	to sport
- Physiotherapeutic	conditioning	area (eccentric	
- Orthopedic	(electroestimulation)	exercises)	
- Partial physical	- Increase in flexibility	- Keeping fit and onset	
activity restriction	- Keeping qualities	of specific workloads.	
- Correction of risk	unaffected parties		
factors			
Duration		Duration	Duration
(A): 35 days		(A): 104 days	(A): 28 days
(P): 28 days		(P): 78 days	(P): 28 days

At the same time, the recovery phase was split into two periods: one in which the athlete suffered acute pain during treatment (acute phase) and a second period characterized by reduction of injury symptoms (subacute phase). The recovery phase was considered from the moment of the injury to the medical discharge, when the re-adaptation phase commenced. The objectives of the re-adaptation phase were to reach the original properties of the tendon and to maintain optimal body composition levels to reintegrate the athlete into the training phase. Finally, this last phase was focused specifically in the optimization of the technical gesture and sport-specific movements.

The treatment was based in increasing muscle strength in the injured area by using eccentric exercises. According to Stanish (Stanish, Rubinovich & Curwin, 1986), tendons respond favorably to progressive and controlled stress, promoting pain reduction most likely due to a decrease in new vessel formation (Langberg, Ellingsgaard, Madsen, Jansson, Magnusson, Aagaard, et al, 2007; Knobloch, Kraemer, Jagodzinski, Zeichen, Meller & Vogt, 2007). Ultrasonography data demonstrated that eccentric exercises allowed the reduction of tendon volume (Öhberg, Lorentzon & Alfredson, 2004), providing after 3-4 days the stimuli to promote type I collagen production in tendons (Langberg et al., 2007). In addition, these exercises can help collagen fibers to follow the correct tension lines improving their mechanical properties (Stanish et al., 1986).

The daily energy expenditure was estimated taking in account basal metabolism (BM) from Harris-Benedict's equation (Long, Schaffel, Geiger, Schiller & Blakemore, 1979), using the corrected weight as the result of the relation between the real weight and the ideal weight $((\text{real weight} - \text{ideal weight}) \times 0.25 + \text{ideal$

weight), plus the expenditures due to physical activity (PA) and food thermogenesis (FT). PA expenditure was estimated from established reference values (Ainsworth, Haskell, Whitt, Irwin, Swartz, Strath et al., 2000) and FT was calculated as the 8.5% of BM + PA expenditure. Only in the case of the tennis player, the dietetic and nutritional program was designed to decrease body weight by reducing body fat content. To this end, the daily intake of energy was reduced around 10-15% with respect to the total energy expenditure.

Macronutrient distribution of diets was approximately 55% carbohydrates, 20% proteins and 25% fats. The quantity of macronutrients for the soccer player was 2 g protein/kg/day (20), 4 g carbohydrates/kg/day and 60 g fats/day. Prescribed ergogenic aids included oral creatine monohydrate (Nutrisport, Spain) (5g/day) (Sundell, Hulmi & Rossi, 2011). In the case of the tennis player, macronutrient quantities were 1.7 g protein /kg/day, 5.5 g carbohydrates/kg/day and 50 g fats/day and no ergogenic aids were consumed. DietSource 3.0 software (Novartis Medical Nutrition, Spain) was used for the preparation of the diets and to check their composition.

Anthropometry was used to evaluate changes in body composition during treatment, according to ISAK (International Society for the Advancement of Kinanthropometry) recommendations. Anthropometric parameters included weight in kg, height in m, skinfolds in mm (triceps, subscapular, biceps, suprailiac, supraspinal, abdominal, medial thigh and medial calf), perimeters in cm (relaxed arm, contracted arm, waistline, hip, thigh and calf) and bone diameters in cm (femoral biepicondylar, humeral epicondylar and bityloid of the wrist) (Marfell-Jones, Stewart & Carter, 2006).

Body density was calculated according to Withers' equation (Withers, Craig, Bourdon & Norton, 1987) and was used to estimate body fat from Siri's equation (Siri, 1961). Muscle and bone mass were both estimated according to Lee's (Lee, Wang, Heo, Ross, Janssen & Heymsfield, 2001) and Rocha's equations (Rocha, 1975) respectively.

RESULTS

Both athletes started the recovery phase with a third-phase tendinopathy of the Achilles and Patellar tendon (Blazina, Kerlan, Jobe, Carter & Carlson, 1973), which forced them to stop regular training routines. During the recovery phase, the main objective was to decrease the symptomatology by reducing the workload in the affected tendon. Moreover, in order to maintain an optimal physical condition, other unaffected muscle groups were worked by the therapist. This phase was extended for 28 and 37 days for Patellar and Achilles tendon respectively (Table II). At the end of this phase the VISA-P and VISA-A values were 32 and 49 points, respectively (Figure 2).

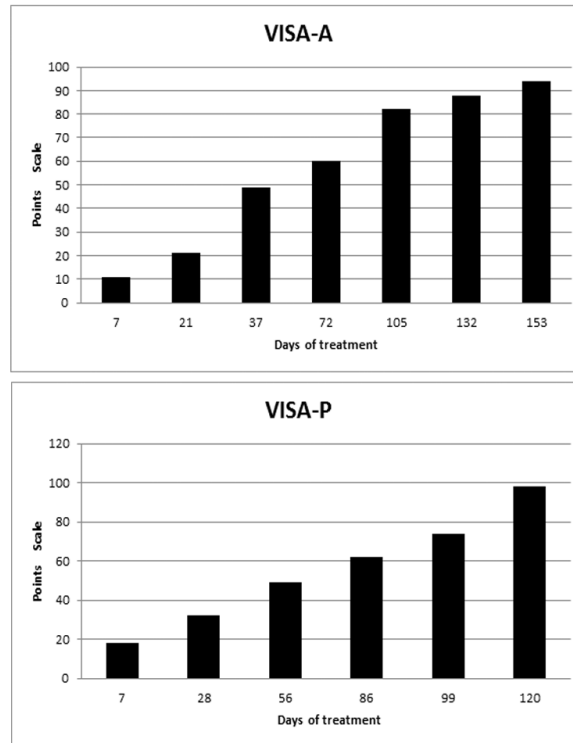


FIGURE 2: VISA-P and A test results throughout rehabilitation. High values on the point scale mean an improvement of the injury

The re-adaptation phase was initiated when pain sensation and tendon stiffness decreased. The rationale of this phase was the implementation of eccentric contraction stimulus (Table II), considering that heavy-load eccentric exercise programs seem to be very effective in tendinopathy treatment (Van der Plas, de Jonge, de Vos, van der Heide, Verhaar, Weir, et al., 2012).

The training phase consisted in adapting the tendon to functional and specific requirements for competition. This phase started around day 132 in the case of the soccer player with a VISA-A score of 86 points, and at day 99 for the female tennis player with a VISA-P score of 74 points (Figure 2). Contact pain symptoms as well as muscle elongation activity improved, together with the possibility to perform dynamic activities such as jumps, brakes and changes of direction. Once the proper criteria were met, that is, the absence of blood vessels (Figure 3) and optimal strength and endurance levels, the athletes were considered to be fully recovered from the injury.

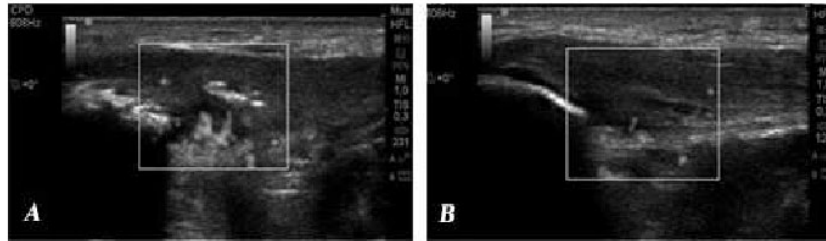


FIGURE 3: Patellar tendon images were obtained by ultrasonography and color Doppler from the female tennis player. A) Day 14 of treatment (recovery phase). B) Day 86 of treatment (re-adaption phase). Red color indicates high degree of vascularization

Both subjects showed good adherence to the diet plan, which was reflected in body composition at the end of the treatment. The soccer player showed an increase in muscle mass of 1.2%, meanwhile fat mass remained constant. The tennis player increased her muscle mass in 1% and fat mass decreased in 1.5% (Table III).

TABLE 3

Body composition values of both athletes and their variations throughout rehabilitation.
(A): Aquilles tendon injury, (P): Patellar tendon injury

	Soccer player (A)		Tennis player (P)	
	Start	End	Start	End
Weight (kg)	66.5	67.0	64.4	62.7
Muscle mass (kg)	32.4	33.6	21.9	22.9
Muscle mass (%)	48.7	50.1	34.0	36.4
Fat mass (kg)	5.1	5.1	14.6	13.3
Fat mass (%)	7.6	7.6	22.7	21.2

DISCUSSION

The main objective of this work was to demonstrate the advantages of performing a multidisciplinary approach in the rehabilitation of athletes with a long-term injury. Once the injury was established, both athletes continued competing during 8-9 weeks more until the inconveniences finally obligated them to leave their corresponding trainings and competitions. This favors the chronicity of the symptoms and hampers their recovery.

There are numerous factors that can condition tendinopathy evolution. For example, a high body mass index (BMI) or adiposity could increase recovery time, correlating with recurrent tendon injuries (Gaida, Cook & Bass, 2008). However, the studies addressing this issue are difficult to interpret, due to the wide variety of symptoms and severities displayed by tendinopathies and therefore making it diffi-

cult to find a correlation between diet adaptation and reduction of recovery time. On the other hand, the age difference between the two athletes in the present report could suggest that this should be considered as a factor that conditions the recovery time. Specifically, the female tennis player recovered faster than the male soccer player.

The maintenance of an optimal body fat content may be correlated with a faster tendinopathy recovery (Gaida et al., 2008). The increase of muscle mass could be due to a prolonged eccentric exercise plan during the re-adaptation phase (14-20 weeks). Unfortunately there are no studies addressing this issue. There is only one publication that establishes a correlation between certain BMI values and the risk of suffering injuries in soccer players. Interestingly, the BMI of the soccer player of our report is coincident with the values indicated in the study (Dane, Can & Karsan, 2002). In the case of tennis players there are no studies regarding changes in body composition during rehabilitation.

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