Article

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Title

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Abstract

Background and Purpose:

Chronic insertional patella tendinopathy is a complex condition to manage within elite athletes. Pain and symptoms increase when spikes or changes in relation to training or game load are experienced. These spikes are often seen in football on return to training or in periods of fixture congestion, presenting a contemporary challenge for the sports medicine team.

Study Design:

Case Study.

Case Description:

The presented case summarises the conservative rehabilitation and pain free return to play of a 24 years (yrs) old elite professional footballer with a long-standing history of patella tendinopathy. Symptoms returned post a spike in training load during pre-season, with a diagnosis of a 7.4 mm insertional thickening detected through magnetic resonance imaging. Presented is a summary of the assessment process, 24-week treatment and rehabilitation protocol and subsequent 12-week pre-habilitation plan, routinely completed on return to training and game play.

Outcomes:

The implemented management strategy led to the successful symptom free return to play of the athlete.

Conclusion:

The management of this injury was facilitated through subjective and objective assessment markers and imaging obtained to manage the athlete's symptoms. The authors suggest that medical and conditioning based specialists could apply a rounded loading approach with prescribed isometric and isotonic drills before progression to energy release and pitch-based training to advance the athlete through a safe and controlled return to sport clearance.

Level of Evidence:

5.

Keywords: *Tendon, Return to Play, Soccer, Injury, Treatment, Championship*

Background and Purpose

Patella Tendinopathy is a chronic condition of the patella tendon, which can affect athletes of all ages who partake in sport, particularly in activities that involve high impact movements or stop start actions[1,2,3,4]. The patella tendon can be disrupted in both the central portion and para-tendon, where repeated stress and load effect the collagen proteins within the tendon leading to pain and reduced function[5-7]. Insertional and mid tendon irritation can occur within the structure and present with similar symptoms that require comparable treatment[8-10]. Within elite sport, acute and chronic forms of patella tendinopathy are seen where athletes are subject to spikes and changes in load[11,12]. Due to the variability of sport and the constant adaptation of load to suit fixtures and opposition, the management and treatment of patella tendinopathy is wide and varied. The change in environments and need to maintain high training load make management challenging with acute and long-term strategies available in both manual and passive treatments.

Case Description

The present case study presents a 24 yrs old championship footballer with chronic patella tendinopathy. Symptoms have existed for 3-4yrs, with increases in the volume of training (load) being a key aggravating factor, i.e. return to pre-season training. The injury was initially diagnosed 4yrs ago utilising Magnetic Resonance Imaging (MRI)[7,11,13]. The player returned late to pre-season during the 2019/2020 season (week 3) and was utilised in two games playing 45 minutes (mins) in each game, separated by 48 hours (hrs). This represented an acute spike in training load[14] and replicated a period of fixture congestion where the athlete may not have adequately recovered between games[15,16]. Post-game 2, match day +1 (MD+1), the player reported 8/10 pain (visual analogue scale (VAS)) within his knee. Attempting to train he was unable to perform high velocity movements and was withdrawn from training.

Immediate assessment by the Physiotherapist identified left insertional tendon pain during a single leg squat and squat jump. Focal pain was noted at the infra apex of the patella and proximal patella tendon, with reduction in knee flexion and passive extension due to pain. Insertional tendinopathy was proposed with potential fat pad involvement as a diagnosis. MRI was completed 24 hrs post assessment, which revealed a normal distal patella tendon with thickening within the central tendon into the proximal attachment measuring 7.4 mm in length. A prominent inferior patella pole was noted but no calcification found. The MRI report suggested a partial interstitial tear of the central tendon which was reviewed by a consultant immediately via Ultrasound Scan (USS) to confirm no tear but aggravated

proximal patella tendinopathy. Conservative management was highlighted as the most appropriate method of treatment and only if this was unsuccessful surgery was to be explored. A carefully designed rehabilitation programme was developed and implemented (Table 1).

Table 1: Overview of Rehabilitation Programme Prescribed for Insertional Patella Tendinopathy.

Day	Insertional Patella Tendinopathy Conservative Management Weekly Rehabilitation Overview
1 - 2	• VAS = 5/10 (stable) • GTN patch – ½ (12 hrs, 8am – 8pm) • Vitamin C, collagen and whey protein supplementation – 1 hr before loading • Isometric Quadriceps twice daily – Leg Extension 24kg, 5 x 30s hold, knee position 45°, WR 1:2
3 - 5	• VAS = 3/10 (stable) • GTN patch – ½ (12 hrs, 8am – 8pm) – causing 2/10 headache • Isometric Quadriceps twice daily – Leg Extension 32kg, 4 x 45s hold, knee position 45°, WR 1:2 • NWB Conditioning – Battle Rope Intervals
6 - 9	• VAS = 3/10 (stable) • GTN patch – ½ (12 hrs, 8am – 8pm) – no side effects • Isometric Quadriceps thrice daily – Leg Extension 36kg, 4 x 45s hold, knee position 45°, WR 1:2 • Heavy/slow metronome leg extension – 5s up/5s down, 20kg, alternate days – completed on all exercises • BW (84kg) inverted leg press, 3 x 15, completed x 2 daily every 3rd day • Bike – steady state HR 60-70% 30 mins/Intervals • Gym Upper body • Gym Posterior Chain
10 - 11	• VAS = 5/10 (stable) • GTN patch – ¾ (12 hrs, 8am – 8pm) • Isometric Quadriceps x 3 daily – Leg Extension 36kg, 4 x 45s hold, knee position 45°, WR 1:2 • Heavy/slow metronome leg extension – 5s up/5s down, 20kg, alternate days – completed on all exercises • BW (84kg) inverted press, 3 x 15, completed twice daily every 3rd day • Hydrotherapy – Mechanics/Conditioning • Gym Upper Body • Bike – Steady state HR 60-70% 30 mins/Intervals • Ski Erg
12 - 13	• VAS = 3/10 (stable) • GTN patch – ¾ (12 hrs, 8am – 8pm) • Isometric Quadriceps thrice daily – Leg Extension 36kg, 4 x 45s hold, knee position 45°, WR 1:2 • Heavy/slow metronome leg extension – 5s up/5s down, 20kg, alternate days – completed on all exercises • BW (84kg) inverted press, 3 x 15, completed twice daily every 3rd day • Objective (Ox) Measures – CMJ, SLSQJ, TH distance, eccentric force • Calf Raise - assisted concentric (bilateral) to unilateral eccentric control (6 seconds) at maximum capacity x 5 • Airtack – mini rebound jumps, running drills and skips • Hydrotherapy – running drills • Gym Upper Body • Gym Posterior Chain • Bike – Steady state HR 60-70% 30 mins/Intervals • Ski Erg
14 - 20	• VAS = 2/10 (stable) • GTN patch – ¾ (12 hrs, 8am – 8pm)

	• Isometric Quadriceps thrice daily – Leg Extension 36kg, 4 x 45s hold, knee position 45º, WR 1:2 • Heavy/slow metronome leg extension – 5s up/5s down, 20kg, alternate days – completed on all exercises • BW (84kg) inverted press, 3 x 15, completed twice daily every 3rd day • Ox Measures – CMJ, SLSQJ, TH distance, eccentric force • Assisted concentric (bilateral) to unilateral eccentric control (6s) at maximum capacity x 5 • Airtack – mini rebound jumps, running drills and skips – completed pre-training • Controlled pitch-based drills – Volume, intensity, acceleration, deceleration (10yd acceleration, 10yd maintain, 10yd deceleration – gradual increase in intensity and volume – 10/20/10; 10/30/10; 10/30/5) – gradually increased to 80% game load • Daily STM and ice post training • Bike – Steady state HR 60-70% • Gym Upper Body
21 - 23	• VAS = 2/10 (stable) • Isometric Quadriceps thrice daily – Leg Extension 36kg, 4 x 45s hold, knee position 45º, WR 1:2 • Light training • Maintain STM and Ice post training • In line with squad gym protocol and periodised loading
24 - 29	• VAS = 2/10 (stable) • Isometric Quadriceps pre training daily – Leg Extension 36kg, 4 x 45s hold, knee position 45º, WR 1:2 • Full training • Maintain STM and Ice post training • In line with squad gym protocol, periodised loading and recovery
30	• VAS = 2/10 (stable) • Isometric Quadriceps pre-training daily – Leg Extension 36kg, 4 x 45s hold, knee position 45º, WR 1:2 • 45 mins competitive game play
36	• VAS = 2/10 (stable) • Isometric Quadriceps pre-training daily – Leg Extension 36kg, 4 x 45s hold, knee position 45º, WR 1:2 • Full 90 mins competitive game play • Player limited to two consecutive training days or game play
CMJ = Counter Movement Jump; GTN = Glyceryl Trinitrate; TH = Triple Hop; VAS = Visual Analogue Scale; STM = Soft Tissue Mobilisation; SLSQJ = Single Leg Squat Jump; S = seconds; HR Heart Rate; GTN = NWB = Non-Weight Baring	

Discussion

This case study describes the successful return to sport of a 24 yr old Championship footballer through the conservative management and rehabilitation of chronic insertional patella tendinopathy. Previous research and literature has shown that patella tendinopathy has been managed with rest, offload from aggravating factors and heavy eccentric exercise to load and stress the collagen within the tendon matrix[11,13,17,18,19]. This loading incorporates a high load with a high number of repetitions to cause maximum stress to the area, often resulting in fatigue and increase in symptoms for 24-hrs[3,6,7,9]. This technique has proved successful, but results can take 8 weeks of consistent management before symptoms change and adaptation noted[7,10]. Implementation of an isometric strength focussed conservative rehabilitation programme returned the current case study to light training at week 21, full training week 24 and playing competitively at week 30. Completion of a 6-month post RTP review highlighted that the player was still asymptomatic with no associated patella tendon pain. Although, it

must be noted that the players training load was continually monitored and he was not exposed to more than two consecutive days of functional training or game play.

Conservative management within the present case study focussed on the early introduction of isometric strengthening. Isometric loading of the patella tendon has recently been proposed as more effective for pain management and restoration of strength[11,13,20]. Loading in this manner shows a significant reduction in tendon pain during rehabilitation and allows loading to increase quickly without accumulative fatigue[21-23]. This early reduction in pain is vital in maintaining a steady 24-hr pattern and allowing progressive loading such as isotonic and heavy slow exercises[21]. Isolated isometric quadricep strengthening was implemented throughout the rehabilitation of the presented athlete and began day 1. Due to the longevity of the players condition and the initial VAS scale presentation of 8/10, pain was utilised as a key marker of player progression and gradual increase of training load. It was agreed with the player, with guidance from a specialist within the area, that pain must remain stable throughout rehabilitation. Stable pain was agreed as 5/10 VAS lasting no more than 24 hrs post exercise. Table 1 indicates the players VAS score throughout rehabilitation, with pain always remaining stable. Although, it is important to note increases in the players pain between days 9 - 11, which coincided with the introduction of heavy slow metronome work, representing more functional contraction through the musculature.

Evidence indicates that patella tendinopathy patients have high cortical inhibition of the quadricep muscle groups, and that heavy isometric loading causes a decrease in this substance within the tendon[21]. Isometric loading is positive for patella tendinopathy but should not be the sole exercise applied for effective management and pain control[7]. The current case study utilised a combination of isometric, isotonic and heavy slow patterns to produce improved strength, greater pain relief and a successful return to full function[22]. It is important to note that more functional strengthening work, whether closed or open chain, was only introduced when stable pain was reported by the athlete. Consideration was given to basic training principles in the rehabilitation design, most notably frequency and overload particularly in the earlier stages of isometric loading. Literature highlights that regular loading should be the foundation of any rehabilitation programme involving tendons, with short rest periods which stimulate the tendon and ensure matrix formations and collagen alignment is linear[13,22]. Careful consideration should also be given for rest between sets and longer total rest between sessions. Rest periods above 90 seconds between sets highlight no improvement in performance or pain control and longer rest between sessions show no collagen change within the tendon when compared to short rest periods and consistent daily loading[25]. Advocating the approach taken within the present case study.

Progressive loading from isometric to eccentric strength work without exacerbating the patients pain has been shown to be more successful in the treatment and management of patella tendinopathy, without the addition of other manual therapy techniques[2,4,21,26]. This was successfully demonstrated within the present case study. Due to the complex nature of elite athletes however, holistic approaches should not be discounted[27] and other modalities can be utilised to facilitate the rehabilitation process. Aetiological research associated with patella tendinopathy emphasises its multi factorial nature. The present study implemented the use of 15g gelatine with 200mg vitamin C consumed 60 mins before loading. Evidence suggests that this added supplementation facilitates tissue repair by increasing amino acid levels within the blood, with no side effects noted[28,29]. In addition to this to modulate pain and enhance function, glyceryl trinitrate (GTN) patches were utilised[4,30,31]. GTN patches consistently used within the patient's tolerance levels with a structured rehabilitation programme have exhibited very good patient outcomes within tendinopathy cases[32]. Research also highlights that GTN use in chronic conditions has resulted in increased tendon strength[30,33]. Careful consideration of their use must be given however, due to the side effects experienced, which can include severe headaches and skin rashes[32,33]. Predominantly research indicates only good outcomes when utilised for 24 weeks+[34,35]. Time pressures associated with returning athletes quickly and safely would not advocate its use. Although successfully implemented within the current case study further research is required to support its use within an elite setting and its successful use in this case study may be the result of a placebo effect.

Conclusion

Successful management of this injury was facilitated by completing a full subjective and objective assessment with markers obtained to control and manage the athlete's symptoms. Imaging was incorporated within the diagnosis of the condition and to identify the specific area of concern. A rounded loading approach was applied with isometric and isotonic drills prescribed before progression to energy release and pitch-based training. Medical and conditioning based specialists could apply these techniques with confidence in their effect and success on patella tendinopathy and structured return to play in a safe and controlled manner.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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References

1. Rodriquez-Merchan, EC. (2012). The treatment of patellar tendinopathy. *J Orthop Trauma.* 2012;14(2):77-81. https://dx.doi.org/10.1007%2Fs10195-012-0220-0

2. Hercules, RL., Johannes, Z., Nocholas, H., et al. How strong is the evidence that conservative treatment reduces pain and improves function in individuals with patellar tendinopathy? A systematic review of randomised controlled trials including GRADE recommendations. *British J Sports Med.* 2015;54(2):87-93. https://doi.org/10.1136/bjsports-2018-099747

3. Schwartz, A., Watson, JN., and Hutchinson, MR. Patellar tendinopathy. *Sports Health.* 2015;7(5):415-420. https://doi.org/10.1177/1941738114568775

4. Lopez-Royo, MP., Gomez-Trullen, EM., Ortiz-Lucas, M., Bataller-Cavero, A., Al-boloushi, Z., Haman-Alcober, Y., and Herrero, P. Comparative study of treatment interventions for patellar tendinopathy: a protocol for a randomised controlled trial. *Br J Sports Med.* 2020;10(2):340-343. https://doi.org/10.1136/bmjopen-2019-034304

5. El-Khoury, GY., Wira, RL., Berbaum, KS., et al. MR imaging of patella tendinitis. *Radiology.* 1992;18(3): 849-854. https://doi.org/10.1148/radiology.184.3.1509078

6. Andres, BM., and Murrele, GA. Treatment of tendinopathy: what works, what does not, and what is on the horizon. *Clin Ortho Related Res.* 2008;466(7):1-17. https://dx.doi.org/10.1007%2Fs11999-008-0260-1

7. Cook, JL., and Khan, K. What is the most appropriate treatment for patellar tendinopathy? *Br J Sports Med.* 2010;35(2):291-294. https://dx.doi.org/10.1136%2Fbjsm.35.5.291

8. Aicale, R., Oliviero, A., and Maffulli, N. Management of achilles and patella tendinopathy: What we know, what we can do. *J Foot Ankle Res.* 2020;13(59):2-10. https://doi.org/10.1186/s13047-020-00418-8

9. Simpson, M., and Smith, T.O. Quadricep tendinopathy – a forgotten pathology for physiotherapists? A systematic review of the content. *Phys Ther Rev*. 2013;16(6): 455-461. https://doi.org/10.1179/1743288X11Y.0000000035

10. Leibbrandt, DC., and Louw, Q. The development of an evidence based clinical checklist for the diagnosis of anterior knee pain. *South African J Physioth.* 2017;73(1):353-358. https://doi.org/10.4102/sajp.v73i1.353

11. Malliaras, P., Barton, CJ., Reeves, ND., et al. Achilles and patellar tendinopathy loading programmes. *Sports Med.* 2013;43(4):1-20. https://doi.org/10.1007/s40279-013-0019-z

12. Silbernagel, K., Vicenzino, B.T. Rathleff, M.S, et al. Isometric exercise for acute pain relief: is it relevant in tendinopathy management? *Br J Sport Med.* 2019;53(21):1-2. https://doi.org/10.1136/bjsports-2019-100591

13. Pizzolato, C., Lloyd, DG., Zheng, MH., et al. Finding the sweet spot via personalised Achilles tendon training: the future is within reach. *Br J Sport Med.* 2019;53(1):11-12. https://doi.org/10.1136/bjsports-2018-099020

14. Blanch, P., and Gabbett, TJ. Has the athlete trained enough to return to play safely? The acute:chronic workload ratio permits clinicians to quantify a players risk of subsequent injury. *Br J Sport Med.* 2016;50(8):471-475. https://doi.org/10.1136/bjsports-2015-095445

15. Rhodes D, McNaughton L, and Greig M. The Temporal Pattern of Recovery in Eccentric Hamstring Strength Post-Soccer Specific Fatigue. *Res Sports Med.* 2018;27(3):339-350. https://doi.org/10.1080/15438627.2018.1523168

16. Rhodes D, Alexander J, and Greig M. The Temporal Pattern of Recovery in Eccentric Strength – Post Localised Fatigue. *Journal of Health.* 2020;4(1):1-15.

17. Kamen, G. Characteristics of the Achilles tendon reflex following Isometric and isotonic exercise. *Res Quarterly Ex Sport.* 1985;56(3):238-244. https://doi.org/10.1080/02701367.1985.10605369

18. Alfredson, H. Where to now with Achilles tendon treatment? *Br J Sport Med.* 2011;45(5):386. https://doi.org/10.1136/bjsm.2011.084129

19. Visnes, H., and Bahr, R. The evolution of eccentric training as treatment for patellar tendinopathy (jumper's knee): a critical review of exercise programmes. *Br J Sport Med.* 2007;41(4):217–230. https://doi.org/10.1136/bjsm.2006.032417

20. Bianco, LC., May, JM., Fermin, SL., et al. The effect of positional release therapy on intercollegiate male basketball athletes classified with patella tendinopathy. *Int J Athl Ther Train.* 2019;24(3):108-114. https://doi.org/10.1123/ijatt.2018-0040

21. Rio, E., Kidgell, D., Purdam, C., et al. Isometric exercise induces analgesia and reduces inhibition in patellar tendinopathy. *Br J Sport Med.* 2015;49(19):1277-1283. https://doi.org/10.1136/bjsports-2014-094386

22. Van Ark, M., Cook, JL., Docking, SL., et al. Do isometrics and isotonic exercise programs reduce pain in athletes with patellar tendinopathy in season? A randomised control trial. *J Sci Med Sport.* 2016;19(9):702-706. https://doi.org/10.1016/j.jsams.2015.11.006

23. Golman, M., Wright, ML., Wong, TT., et al. Rethinking patellar tendinopathy and partial patellar tendon tears: a novel classification system. *Am J Sports Med.* 2020;48(2):359-369. https://doi.org/10.1177/0363546519894333

24. Silvan, DM., Pazos, FB., Valero, AR., et al. The effectiveness of an intensive exercise programme in the functional recovery of severe degenerative Achilles tendinopathy. Is it

enough by itself? A case report. *Br J Sport Med.* 2013;47(9):820-829. https://dx.doi.org/10.4085%2F1062-6050-49.3.36

25. Waugh, CM., Alktebi, T., Sa, A., et al. Impact of rest duration on Achilles tendon structure and function following isometric training. *Scand J Med Sci Sports.* 2018;28(2):436-445. https://doi.org/10.1111/sms.12930

26. Andres, BM., and Murrell, GAC. Treatment of tendinopathy: what works, what does not and what is on the horizon? *Clin Orthop Related Res.* 2008;466(7):1539-1554. https://dx.doi.org/10.1007%2Fs11999-008-0260-1

27. Foel, J. Is electro-acupuncture a safe and cost-effective treatment for Achilles tendonopathy in primary care setting? *Int Musculoskel Med.* 2010;32(2):51-54. https://doi.org/10.1179/175361410X12652805808278

28. Baar, K. Minimizing injury and maximising return to play: lessons from engineered ligaments. *Sports Med.* 2017;47(1):5-11. https://doi.org/10.1007/s40279-017-0719-x

29. Shaw, G., Lee-Barthel, A., Ross, MLR., et al. Vitamin C enriched gelatin supplementation before intermittent activity augments collagen synthesis. *Am J Clin Nut.* 2017;105(1):136-143. https://doi.org/10.3945/ajcn.116.138594

30. Paolini, JA. Topical glyceryl trinitrate in chronic tendinopathies. *Int Sports Med J.* 2006;7(4):238-255. https://doi.org/10.2106/00004623-200405000-00005

31. Rodriguez-Merchan, EC. The treatment of patellar tendinopathy. *J Orthop Trauma.* 2013;14(2):77-81. https://dx.doi.org/10.1007%2Fs10195-012-0220-0

32. Challoumas, D., Kirwan, PD., Borysov, D., et al. Topical glyceryl trinitrate for the treatment of tendinopathies: a systematic review. *Br J Sport Med.* 2019;53(4):1-13. http://dx.doi.org/10.1136/bjsports-2018-099552

33. Williamson, OD. Review: Topical nitroglycerin reduces pain during ADL in patients with chronic tendinopathies. *Ann Internal Med.* 2011;154(4):2-6. https://doi.org/10.7326/0003-4819-154-4-201102150-02006

34. Steunebrink, M., Zwerver, J., Brandsema, R., et al. Topical glyceryl trinitrate treatment of chronic patellar tendinopathy: a randomised, double blind, placebo-controlled trial. *Br J Sport Med.* 2013;47(1):34. https://doi.org/10.1136/bjsports-2012-091115

35. Zwerver, J., Steunebrink, M., Brandsema, R., et al. Topical glyceryl trinitrate treatment of chronic patellar tendinopathy: a randomised, double-blind, placebo-controlled clinical trial. *Br J Sport Med.* 2013;47(9):2. http://dx.doi.org/10.1136/bjsports-2012-091115