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A Rehabilitation Protocol excluding primary adductor exercises for chronic adductor- and pubic-related groin pain in an amateur football player: A Case Report

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Abstract

Introduction Adductor strengthening is the best-supported conservative treatment for long-standing adductor-related groin pain, but evidence is lacking for athletes who cannot tolerate it.

Case Presentation A 24-year-old male amateur football player with chronic adductor- and pubic-related groin pain had experienced multiple recurrences since age 16 in football and futsal. From October 2024 to May 2025, despite care from several physiotherapists and sports medicine physicians, he no longer responded to the Hölmich protocol, its validated modifications or other groin pain programmes, whose adductor exercises all provoked pain ≥7–8/10 on a visual analogue scale (VAS). The adductor squeeze test was positive; ultrasonography suggested active enthesopathy at the ischial insertion of the left adductor magnus. A novel 114-day protocol excluded all exercises in which the adductors act as primary agonists. Its core was a progressively loaded parallel back squat, initially with a 3-1-3 tempo, plus knee, calf, gluteal, hip-flexor and trunk exercises, with 2–3 repetitions in reserve. Pain resolved completely (VAS 0/10) after the first month. During flare-ups (5–6/10), sessions were postponed until pain fell to 3–4/10. Tenderness at the common adductor insertion fell from 5–6/10 to 0–1/10 after week 6. Fifty-eight sessions were completed (88% adherence); squat load rose from 10 to 47.5 kg. After more than four consecutive weeks at 0/10, isolated adductor exercises were reintroduced and rehabilitation ended.

Conclusions In an amateur football player intolerant to adductor-specific loading, a protocol excluding primary adductor exercises was associated with complete pain resolution. It could be useful for non-responders to traditional protocols.

Introduction

Groin pain is among the most frequent and burdensome musculoskeletal conditions in football. In professional male football, hip and groin injuries account for 12–16% of all injuries per season, with adductor-related injuries being the most common entity [1]. Adductor-related injury is also the most common presentation in sub-elite players, and previous groin injury is a significant risk factor for a new one [2]. Injury recurrence is more frequent at national and amateur levels than at the top professional level [3].

The Doha agreement classifies groin pain in athletes into defined clinical entities, including adductor-related and pubic-related groin pain [4], building on the clinical-entity approach [5]. Adductor-related groin pain is nevertheless challenging to diagnose and manage, because of the complex regional anatomy and overlapping clinical presentations [6].

Adductor tendinopathy is a mechanical enthesopathy, generally caused by repetitive strain [7]. The proximal adductor tendons insert through fibrocartilaginous entheses whose vascularity decreases towards the bone, and the adductor brevis and gracilis share a common tendinous insertion [8]. The proximal tendon of the adductor longus is small, with a cross-sectional area of about 49 mm² at its origin, where tendon forms only 38% of the attachment and muscle fibres the remaining 62% [9]. The

adductor longus and rectus abdominis also contribute to the capsule of the pubic symphysis [10], whereas the ischial portion of the adductor magnus originates next to the hamstrings on the ischial tuberosity [11]. Adductor enthesopathy on imaging is associated with recalcitrant symptoms: in competitive athletes with adductor longus dysfunction, 16 of 17 with enthesopathy on magnetic resonance imaging relapsed within weeks of an entheseal injection, compared with none of the 7 without it [12]; in recreational athletes, by contrast, 75% had a good result at one year, regardless of the imaging findings [13].

Exercise therapy is the cornerstone of conservative management: a systematic review found high-quality evidence that physical therapy aimed at the strength and coordination of the muscles stabilising the pelvis is more effective than passive therapy [14]. In the randomised trial by Hölmich et al., an active training programme targeting the muscles acting on the pelvis, in particular the adductors, returned 23 athletes to sport without groin pain, compared with 4 after passive physiotherapy (odds ratio 12.7) [15]. The effect persisted 8–12 years after treatment [16]. The programme has since been modified [17], and alternative approaches have been tested, such as multimodal manual therapy [18] and rehabilitation targeting intersegmental control [19]. High-activation adduction exercises, such as the Copenhagen adduction exercise (Copenhagen plank) [20], increase eccentric adduction strength [21] and form the basis of the Adductor Strengthening Programme, which lowered the risk of groin problems by 41% in male football players [22].

Even with exercise therapy, return to sport is slow: after the Hölmich programme it took a median of 18.5 weeks [15], and in a later randomised trial only 55% of athletes treated with a Hölmich-based programme returned to full sport, after about 17 weeks; the authors concluded that neither of the treatments compared was very effective [18]. Long-standing presentations also relapse: in a case series of 44 athletes treated with a comprehensive physical therapy programme, 10 of the 38 who returned to sport relapsed at mid-term follow-up [23]. The Hölmich-based [15-17] and Copenhagen [21, 22] programmes share one feature: the adductors are loaded as primary agonists from the earliest phase, starting with static adduction against a ball in the Hölmich programme [15]. Pain during exercise is not necessarily detrimental: painful exercise offers a small short-term advantage over pain-free exercise in chronic musculoskeletal pain [24]. When adductor exercises provoke severe pain, however, progression stalls, and recalcitrant cases are usually referred for injections or surgery, such as adductor release [14, 25]. Overall, the evidence on groin pain treatment remains of low or very low quality [26-28].

This case report describes a rehabilitation protocol that excluded all exercises in which the adductors act as primary agonists. It was applied to an amateur football player with chronic adductor- and pubic-related groin pain who no longer responded to the Hölmich protocol [15, 16], its modifications [17] or other groin pain programmes. The report follows the CARE guidelines [29].

Case Presentation

The patient is the author of this report and consented to its publication.

Patient information and medical history

A 24-year-old male amateur football player presented with chronic adductor- and pubic-related groin pain. Since the age of 16, he had suffered numerous episodes of pubic-related groin pain and adductor tendinopathy while playing football and futsal, including recurrent chronic tendinopathy of the adductor magnus.

The current episode began on 17 September 2024. From October 2024 to 5 May 2025, he was managed without success by several physiotherapists and sports medicine physicians. Treatments included the original Hölmich protocol [15, 16] and its modified versions [17], as well as other published programmes for groin pain: comprehensive physical therapy [23], multimodal and manual therapy [18, 30], rehabilitation targeting intersegmental control [19], Copenhagen adduction-based strengthening [21, 22] and criteria-based rehabilitation of adductor injuries [31]. In every programme, all isometric, eccentric and concentric exercises in which the adductors acted as primary agonists provoked pain ≥7–8/10 on a 0–10 visual analogue scale (VAS); the Copenhagen plank, the exercise at the core of the Copenhagen adduction programmes [21, 22], was the most painful of all. Adductor and abductor machine exercises with 2.5 kg, even through a limited range of motion, and hip abduction against a mini band also provoked pain >6/10. This prevented any progression of adductor-specific loading.

Physical examination

From the onset of the current episode until the start of the protocol, pain involved the pubic symphysis, the common adductor tendon, the pelvic floor and the insertion of the adductor magnus. Adduction against resistance was painful in every contraction mode, and the adductor squeeze test, whose values are reliable at 0°, 45° and 90° of hip flexion [32], was positive in all three positions throughout this period, with pain >6/10, including on 5 May 2025, the day before the protocol started. The common insertion of the adductor tendons was tender on palpation: during the first six weeks of the protocol, pain on palpation fluctuated between 5–6/10 and 3/10 on the VAS. Clinical examination tests for groin pain show good intra- and inter-observer reliability [33], and numeric pain ratings during maximal adductor activation, such as the squeeze test, are reliable, valid and responsive to clinical change [34].

Diagnostic assessment

Two musculotendinous ultrasound examinations were performed at the same university sports medicine centre; the first was reported by a specialist in diagnostic radiology and sports medicine. Their findings, translated from Italian, are reported below.

On 9 October 2024, the examination of the insertional profile of the abdominal muscles, in particular the rectus abdominis, at the pubis showed no myofibrillar disorganisation or insertional enthesopathy, either in static or in dynamic conditions. It showed, however, modest ectasia of the intramysial vessels without evident oedematous congestion. The pubic crest profile appeared slightly diastatic, probably owing to anatomical configuration.

On 5 March 2025, compared with the contralateral side, the examination of the left adductor muscles showed fluid infiltration suggestive of active enthesopathy of the ischial insertional profile of the left adductor magnus, associated with increased fibrotic–connective components of the same insertional profile. Functional manoeuvres showed no pathological myofibrillar diastasis.

The second examination was performed about five months after conventional rehabilitation had begun. Based on these clinical findings and imaging, the condition was classified as adductor-related and pubic-related groin pain according to the Doha agreement [4]. Clinical examination should guide the interpretation of imaging [35], because diagnostic terminology is inconsistent, ultrasonographic evidence is scarce [36] and imaging findings are also common in asymptomatic players [37]. In young athletes, cortical irregularities of the pubis can also reflect incomplete fusion of secondary ossification centres, observed up to the age of 26 [7]. The timeline of the case is shown in Table 1.

Table 1 Timeline of the case (day 0 = 6 May 2025)

Date	Event
From age 16	Numerous episodes of pubic-related groin pain and adductor tendinopathy in football and futsal, including recurrent chronic tendinopathy of the adductor magnus
17 September 2024	Onset of the current episode: pain at the pubic symphysis, common adductor tendon, pelvic floor and adductor magnus insertion; adductor squeeze test positive at 0°, 45° and 90° (pain >6/10)
9 October 2024	Ultrasound of the rectus abdominis insertion: no enthesopathy; modest intramysial vessel ectasia; slightly diastatic pubic crest profile, probably anatomical
October 2024 to 5 May 2025	Hölmich protocol [15, 16], its modifications [17] and other groin pain programmes, delivered by several physiotherapists and sports medicine physicians, without success: VAS ≥7–8/10 during adductor exercises in every programme, the Copenhagen plank being the most painful; adductor and abductor machines with 2.5 kg, even through a limited range of motion, and mini-band abduction >6/10
5 March 2025	Ultrasound of the left adductors: fluid infiltration suggestive of active enthesopathy at the ischial insertion of the adductor magnus, with increased fibrotic–connective components
5 May 2025	Adductor squeeze test still positive at 0°, 45° and 90° (pain >6/10)
6 May 2025 (day 0)	Start of the protocol excluding primary adductor exercises; squat with 3-1-3 tempo
Weeks 1–2 (6–19 May)	VAS 4–5/10
Weeks 1–6 (6 May–16 June)	Pain on palpation of the common insertion of the adductor tendons between 5–6/10 and 3/10
Weeks 3–4 (20 May–2 June)	VAS 1–3/10
From early June (week 5)	VAS 0/10, with intermittent tendon pain flare-ups up to 5–6/10; sessions postponed until pain fell to 3–4/10 (sometimes by 1–2 days)
From week 7 (17 June)	Pain on palpation 0–1/10
Late July to 28 August	VAS 0/10 for more than four consecutive weeks, without flare-ups
12 August 2025 (day 98)	Squat tempo shortened from 3-1-3 to 2-1-2
28 August 2025 (day 114)	Adductor and abductor machine reintroduced (2×10, 5 kg, 2–3 RIR); end of rehabilitation

VAS visual analogue scale, RIR repetitions in reserve

Therapeutic intervention

The protocol ran from 6 May to 28 August 2025 (114 days) and was built on four principles.

The first principle was the exclusion of primary adductor exercises. No exercise in which the adductors act as primary agonists was prescribed, and isolated hip adduction and abduction were excluded in every contraction mode (isometric, eccentric and concentric). This removed the adductor-specific components of the Hölmich programme, such as static adduction against a ball [15], as well as the Copenhagen plank [20, 21] and the adductor and abductor machines.

The second principle was indirect loading through the squat, intended to act on both the common adductor tendon and the adductor magnus. A bilateral back squat to parallel depth was the core exercise. From a flexed hip, the adductor longus, which contributes to the common adductor tendon, acts as a hip extensor, and the hip-extension moment arm of the adductor magnus increases with hip flexion [38]. In vivo, the potential torque of the adductor magnus for hip extension is more than twice that for adduction [39], and both its proximal and distal portions are most active during hip extension [40]. Squat training increases adductor muscle volume, more so at greater depth [41], and stance width modulates adductor longus activity during the parallel squat [42]. The squat therefore loaded the adductor muscle–tendon units within a sagittal-plane, multi-joint movement in which adduction is not the primary action and the hip-extension demand is shared among the hip extensors. The leg curl, aimed mainly at the hamstrings, was intended to add a minor stimulus to the adductor magnus only, whose ischial portion originates next to the hamstrings on the ischial tuberosity [11]; this contribution is likely small, because the adductor magnus does not cross the knee [38].

The third principle was progressive overload with control of time under tension. Loads were increased in 2.5-kg steps, approximately once a week, following the principle of progressive overload [43], and working sets of the main loaded exercises progressed from 2×10–12 to 4×10–12. All working sets were performed with 2–3 repetitions in reserve (RIR), estimated with the repetitions-in-reserve scale [44]; training to failure offers at most a trivial hypertrophic advantage over stopping short of failure [45]. When loads were low, sets of 12–20 repetitions were used, because low-load training produces muscle hypertrophy similar to high-load training when sets are performed close to volitional failure [46, 47]. Leg curl and leg extension were performed with a 2-1-2 tempo throughout the protocol. Slow knee-extension exercise with low loads increases muscle size and strength [48] and the acute muscle protein synthetic response [49], and movement tempo should be controlled together with load, volume and rest intervals [50].

The tendon, however, adapts mainly to slow, heavy loading. Tendon adaptation requires high strain magnitudes, whereas low-magnitude loading of similar frequency and volume is ineffective [51, 52]. The duration of each loading phase also matters: with similar strain magnitude and loading volume, protocols with 3-s or 12-s loading phases increased Achilles tendon cross-sectional area by 4.2% and 5.3% and stiffness by 57% and 25%, whereas fast, high-strain-rate loading produced only non-significant trends [53]. Training-induced changes in adductor tendon cross-sectional area have not, to the author’s

knowledge, been measured; given the small size of the proximal adductor longus tendon [9], the protocol assumed that the adductor tendons respond to strain magnitude and duration as other tendons do. From the first lower-body session, the squat was therefore performed with a 3-1-3 tempo (3 s eccentric, 1 s isometric pause, 3 s concentric), i.e. 7 s per repetition and 70–84 s under tension per set. This tempo reproduces the 3-s eccentric and 3-s concentric phases of heavy slow resistance training, which reduced tendon swelling and vascularisation and increased collagen turnover in patellar tendinopathy [54] and reduced tendon thickness and neovascularisation in Achilles tendinopathy [55]. From 12 August (day 98), the tempo was shortened to 2-1-2 (2 s eccentric, 1 s isometric pause, 2 s concentric; 5 s per repetition and 50–60 s per set) to return progressively to shorter times under tension and higher movement velocities, as recommended in the later stages of tendon rehabilitation [56], while loads continued to increase. The parallel depth also limited hip flexion, which may have reduced compressive load at the ischial enthesis [57, 58].

The fourth principle was pain monitoring. Pain intensity was rated on the 0–10 VAS, and pain during exercise was not allowed to exceed 4/10. During the expected tendon pain flare-ups, the next session was performed only once pain had fallen to 3–4/10, which sometimes required 1–2 extra days beyond the planned microcycle.

The programme comprised two lower-body and two upper-body sessions per week. Heart rate was recorded in every session with a Polar H10 chest strap (Polar Electro Oy, Kempele, Finland), which shows excellent agreement with electrocardiography at rest and during exercise [59]. Data were analysed in intervals.icu, which provided moving time, mean heart rate and a heart-rate-derived training load in arbitrary units (AU). Lower-body sessions followed a fixed order: aerobic warm-up, calf raises, wall hip flexion, squat, glute bridge, leg curl, leg extension, dead bug and sit-ups. From 25 June, leg curl and leg extension preceded the glute bridge. Each loaded exercise began with one or two lighter warm-up sets of 15 repetitions. The complementary exercises are reported in Table 2 and the progression of the main loaded exercises in Table 3.

Table 2 Complementary exercises of the lower-body sessions

Exercise	Initial prescription (6 May)	Final prescription (28 August)
Aerobic warm-up	15 min, zones Z1–Z2.5	15 min, zones Z1–Z3 (from 31 May)
Calf raises	3×20	1×15 + 2×12 eccentric
Wall hip flexion	2×20	2×20
Glute bridge	2×12 + 1×30 s isometric hold	2×12 + 1×45 s isometric hold (from 25 June)
Dead bug	3×12	3×15 (from 20 May)
Sit-up	2×15	2×15
Adductor and abductor machine	Excluded	2×10 at 5 kg, 2–3 RIR (reintroduced)

RIR repetitions in reserve. All working sets were performed with 2–3 RIR. Rest between sets was 1 min for calf raises, wall hip flexion, dead bug and sit-up, and 2.5 min for the other exercises

Table 3 Progression of the main loaded exercises (working sets; warm-up sets excluded)

Date 2025 (day)	Squat	Leg curl	Leg extension
6 May (0)	2×12 at 10 kg	2×10 at 20 kg	2×10 at 25–27.5 kg
13 May (7)	2×12 at 10 kg + 1×10 at 12.5 kg	2×10 at 20 kg	2×10 at 25–27.5 kg
20 May (14)	3×10 at 15 kg	3×12 at 22.5 kg	3×12 at 32.5 kg
27 May (21)	3×12 at 17.5 kg	4×10 at 22.5 kg	4×10 at 32.5 kg
31 May (25)	3×12 at 17.5 kg	4×12 at 22.5 kg	4×12 at 32.5 kg
Week 5 (3–9 June)	3×12 at 20 kg	4×12 at 22.5 kg	4×12 at 35 kg
Week 6 (10–16 June)	3×12 at 20 kg	4×12 at 25 kg	4×12 at 35 kg
21 June (46)	4×10 at 22.5 kg	4×12 at 25 kg	4×12 at 37.5 kg
25 June (50)	4×12 at 25 kg	4×12 at 27.5 kg	4×12 at 40 kg
Week 9 (1–7 July)	4×12 at 27.5 kg	4×12 at 27.5 kg	4×12 at 42.5 kg
Week 10 (8–14 July)	4×12 at 30 kg	4×12 at 27.5 kg	4×12 at 42.5 kg
Week 11 (15–21 July)	4×12 at 32.5 kg	4×12 at 30 kg	4×12 at 45 kg
Week 12 (22–28 July)	4×12 at 35 kg	4×12 at 30 kg	4×12 at 45 kg
29 July (84)	4×12 at 37.5 kg	4×12 at 30 kg	4×12 at 47.5 kg
Week 14 (5–11 August)	4×12 at 40 kg	4×12 at 32.5 kg	4×12 at 50 kg
12 August (98)	4×12 at 42.5 kg, tempo 2-1-2	4×12 at 35 kg	4×12 at 52.5 kg
22 August (108)	4×10 at 45 kg, tempo 2-1-2	4×12 at 37.5 kg	4×12 at 57.5 kg
28 August (114)	4×10 at 47.5 kg, tempo 2-1-2	4×12 at 37.5 kg	4×12 at 57.5 kg

[a]Last set attempted at 25 kg. Working sets were performed with 2–3 repetitions in reserve (RIR). Squat tempo: 3-1-3 until 11 August; 2-1-2 from 12 August. Leg curl and leg extension: 2-1-2 throughout. Rest between sets: 3 min for the squat and 2.5 min for leg curl and leg extension

Upper-body sessions began with a 15-min aerobic warm-up (zones Z1–Z3) and a resistance-band warm-up, followed by plank, biceps curl, lateral raises, triceps pushdown, chest press and lat machine, with working sets performed with 2–3 RIR (Table 4). They were not part of the groin-specific loading. Upper-body loads progressed between the first (20 May) and last (26 August) checkpoints: chest press from 37.5 to 55–57.5 kg and lat machine from 37.5 to 45 kg. In both session types, rest intervals were 3 min between sets of multi-joint exercises (squat, chest press and lat machine), 1 min for core exercises (plank, dead bug and sit-ups), calf raises and wall hip flexion, and 2.5 min for all other exercises; longer rest periods for multi-joint exercises are recommended when training for strength [43].

Table 4 Progression of the upper-body sessions (working sets; warm-up sets excluded)

Date 2025	Chest press	Lat machine	Triceps pushdown	Biceps curl	Lateral raises
20 May	4×12 at 37.5 kg	4×12 at 37.5 kg	2×12 at 10 kg	2×12 at 8 kg	2×12 at 6 kg
21 May	5×12 at 40 kg	4×12 at 40 kg	3×10 at 12.5 kg	3×12 at 8 kg	2×12 at 6 kg
27 May	4×12 at 37.5 kg	4×12 at 37.5 kg	3×12 at 10 kg	3×10 at 8 kg	2×12 at 6 kg
31 May	2×12 at 37.5 kg + 2×10 at 40 kg	2×12 at 37.5 kg + 2×10 at 40 kg	2×12 at 10 kg + 1×10 at 12.5 kg	3×10 at 8 kg	2×12 at 6 kg
2 June	1×12 at 40 kg + 3×12 at 42.5 kg	1×12 at 40 kg + 3×12 at 42.5 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 6 kg + 1×10 at 8 kg
Week 5 (3–9 June)	1×12 at 40 kg + 3×12 at 42.5 kg	1×12 at 40 kg + 3×12 at 42.5 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 6 kg + 1×10 at 8 kg
Week 6 (10–16 June)	1×12 at 40 kg + 3×12 at 45 kg	1×12 at 40 kg + 3×12 at 42.5 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 6 kg + 1×10 at 8 kg
Week 7 (17–23 June)	1×12 at 40 kg + 3×12 at 45 kg	1×12 at 40 kg + 3×12 at 42.5 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 6 kg + 1×10 at 8 kg
25 June	4×12 at 45 kg	4×12 at 42.5 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 6 kg + 1×10 at 8 kg
2 July	3×10 at 35 kg	3×10 at 35 kg	3×10 at 12.5 kg	2×10 at 8 kg	2×12 at 6 kg
Week 10 (8–14 July)	3×10 at 40 kg	3×10 at 37.5 kg	3×10 at 12.5 kg	2×10 at 8 kg	2×12 at 6 kg
Week 11 (15–21 July)	3×10 at 42.5 kg	3×10 at 37.5 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 8 kg
Week 12 (22–28 July)	3×10 at 47.5 kg	3×10 at 40 kg	3×10 at 12.5 kg	2×10 at 10 kg	2×12 at 8 kg
1 August	5×12 at 50 kg	5×12 at 40 kg	3×10 at 12.5 kg	1×12 at 8 kg + 1×10 at 10 kg	1×15 at 6 kg + 2×10 at 8 kg
Week 14 (5–11 August)	5×12 at 55 kg	5×12 at 42.5 kg	3×10 at 13 kg	1×12 at 8 kg + 1×10 at 10 kg	1×15 at 6 kg + 2×10 at 8 kg

Date 2025	Chest press	Lat machine	Triceps pushdown	Biceps curl	Lateral raises
18 August	5×12 at 57.5 kg	3×12 at 45 kg + 2×12 at 42 kg	3×12 at 13.5 kg	1×12 at 8 kg + 2×10 at 10 kg	1×15 at 6 kg + 2×12 at 8 kg
Week 16 (19–25 August)	5×12 at 57.5 kg	3×12 at 45 kg + 2×12 at 42 kg	3×12 at 14 kg	1×12 at 8 kg + 2×10 at 10 kg	1×15 at 6 kg + 2×12 at 8 kg
26 August	5×12 at 55 kg	3×12 at 45 kg + 2×12 at 42 kg	3×12 at 14.5 kg	1×12 at 8 kg + 2×12 at 10 kg	1×15 at 6 kg + 2×12 at 8 kg

Working sets were performed with 2–3 repetitions in reserve (RIR). Rest between sets: 3 min for chest press and lat machine, 2.5 min for the other exercises and 1 min for the plank. Plank on hands and elbows: 15 and 45 s, ×2 (2×30 s on 2 July; 15 and 60 s, ×2, from 18 August). Additional exercises: seated cable row on 21 May (1×15 at 25 kg); chest fly and an additional pulling exercise on 18 and 26 August

Outcomes and follow-up

Pain resolved after the first month and, apart from intermittent flare-ups, remained at 0/10 until rehabilitation ended on day 114; tenderness on palpation took longer to resolve. Before the protocol, pain was ≥7–8/10 during primary adductor exercises. During the protocol, it was 4–5/10 in weeks 1–2 and 1–3/10 in weeks 3–4, reaching VAS 0/10 after the first month. Intermittent tendon pain flare-ups up to 5–6/10 occurred thereafter; sessions were postponed until pain fell to 3–4/10, and pain during exercise was kept ≤4/10. In the final phase, VAS 0/10 was maintained without flare-ups for more than four consecutive weeks. Pain on palpation of the common insertion of the adductor tendons fluctuated between 5–6/10 and 3/10 during the first six weeks and was 0–1/10 thereafter.

Squat load increased from 10 to 47.5 kg (+375%), a mean of 2.3 kg per week, while working sets increased from 2×12 to 4×10 and the tempo moved from 3-1-3 to 2-1-2 (Table 3). Session volume load in the squat (sets × repetitions × load, warm-up excluded) rose from 240 to 1900 kg. Leg extension load increased from 27.5 to 57.5 kg (+109%), and leg curl load from 20 to 37.5 kg (+88%).

Fifty-eight sessions were completed on 57 days: 3.5 per week, or 88% of the four planned weekly sessions. Total moving time was 95 h, with 3.1–7.2 h per week in weeks 1–16 (Fig. 1). Session duration increased from 82 to 112 min across the three phases, while mean heart rate remained between 109 and 114 bpm (Table 5).

Table 5 Training exposure by phase: number of sessions (mean per week) and mean ± SD per session

Phase	Pain (VAS)	Sessions (per week)	Moving time (min)	Mean heart rate (bpm)	Training load (AU)
Weeks 1–4 (6 May–2 June)	4–5/10, then 1–3/10	17 (4.3)	82 ± 19	111 ± 5	23 ± 7
Weeks 5–12 (3 June–28 July)	0/10, flare-ups to 5–6/10	26 (3.3)	101 ± 9	109 ± 5	26 ± 4
Weeks 13–17 (29 July–28 August)	0/10, no flare-ups	15 (3.4)	112 ± 12	114 ± 4	33 ± 6

VAS visual analogue scale, SD standard deviation, AU arbitrary units

After more than four consecutive weeks at VAS 0/10, adductor and abductor machine exercises were reintroduced on day 114 (2×10 at 5 kg, 2–3 RIR). Rehabilitation ended on that day.

Conclusions

Relevance of the case

A player who no longer tolerated primary adductor exercises reached complete pain resolution after the first month with a protocol that excluded them. Pain fell from ≥7–8/10 to 0/10 and tenderness on palpation from 5–6/10 to 0–1/10, while squat load increased 4.75-fold; isolated adductor loading could then be reintroduced. The Hölmich programme and its derivatives load the adductors as prime movers from the first phase [15, 17], and high-activation adduction exercises are central to current prevention and rehabilitation [20, 22]. When these exercises are the main source of pain, the first step of the progression cannot be completed. In this player, even adductor and abductor machine exercises with 2.5 kg through a limited range of motion, or abduction against a mini band, provoked pain >6/10, and the Copenhagen plank was the most painful exercise of all. The present protocol reversed the usual sequence: it built load tolerance indirectly and postponed isolated adductor work until pain had resolved.

The gap in the evidence is visible in the trials themselves. Withdrawals were few: 9 of 68 athletes withdrew from the original Hölmich trial, 5 of them from the active-training group, none because of pain [15]; 3 of 17 did not complete a reproduction of the protocol [60]; and 3 of 18 withdrew from the modified protocol, again not because of pain [17]. This low attrition reflects selection as much as tolerance. The original trial set no upper limit of pain at inclusion [15], but the modified protocol enrolled only athletes with pain below 6/10 on resisted adduction, because in its pilot study those with higher pain could not complete the functional tests; it removed the sliding adduction and abduction exercises of the original programme, which were painful for some participants and caused side effects; and it introduced the Copenhagen adduction exercise only from week 7, and only if it did not provoke pain [17]. The Copenhagen programmes, in turn, were developed for strength gains and prevention in football teams; in the strength trial, compliance was 91% and median muscle soreness ranged from 0 to 2 [21, 22]. In a recent randomised trial in 30 players with adductor-related groin pain, adding the Copenhagen adduction

exercise to rehabilitation improved strength and pain more than rehabilitation without it [61]. None of these reports, however, attributed withdrawals to pain or described players who, like the present one, could not tolerate any adductor loading. Withdrawal because of pain has been documented in another groin pain entity: in a randomised trial in athletes with chronic groin pain attributed to sportsman's hernia, 7 of 30 athletes (23%) allocated to at least two months of active physiotherapy, corticosteroid injections and anti-inflammatory drugs abandoned conservative care for surgery because of persistent pain, and only 8 (27%) returned to sport [62].

Proposed mechanisms

The ultrasound findings suggestive of enthesopathy involved the ischial insertion of the adductor magnus, the portion that acts mainly as a hip extensor [38, 39]. The squat therefore did not unload the affected tissue: it loaded it progressively as a hip extensor, within a multi-joint task in which the demand is shared among the hip extensors [38, 39, 41]. The common adductor tendon was loaded in a similar way, through the extensor action of the adductor longus from a flexed hip [38]. This distribution of load, rather than its absence, may explain why structures that did not tolerate isolated adduction tolerated a 4.75-fold increase in squat load.

The first ultrasound showed no insertional pathology of the rectus abdominis and attributed the slightly diastatic pubic crest profile to a probable anatomical configuration. The adductor longus and rectus abdominis contribute to the capsule of the pubic symphysis [10], and combined adductor and abdominal pain is associated with longer injury time in football players [2]. Bilateral, symmetrical exercises may impose less asymmetric stress on the pubic region than unilateral frontal-plane adduction; this hypothesis remains untested. Trunk and hip-flexor exercises were retained, consistent with the abdominal components of the Hölmich programme [15] and with rehabilitation targeting intersegmental control, which returned 73% of 205 patients to pain-free play [19].

Heavy slow resistance training produces clinical outcomes comparable to eccentric training in patellar and Achilles tendinopathy [54, 55]. The squat followed its slow-tempo principle from the first session, although the protocol was not designed as a heavy slow resistance programme, and the tempo was shortened only in the final phase to reintroduce faster movements. Low-load, high-repetition sets at 2–3 RIR early on and progressively heavier loading later may have allowed muscle hypertrophy while pain was still limiting and then provided the high-magnitude loading that tendons require [46, 51].

During flare-ups up to 5–6/10, each session was postponed until pain had fallen to 3–4/10, sometimes by 1–2 days, and pain during exercise was not allowed to exceed 4/10. These rules are more conservative than the ≤5/10 limit of the pain-monitoring model, with which continued loading showed no negative effects in Achilles tendinopathy [63]. Some pain during exercise need not hinder outcomes [24], but the pain of ≥7–8/10 provoked by adductor exercises before the protocol exceeded any accepted threshold. Replacing pain-provoking exercises with tolerable ones may have reduced symptoms and supported adherence, but these mechanisms cannot be separated in a single case.

Clinical implications

The protocol is a bridge, not a replacement: isolated adductor strengthening, the evidence-based core of treatment and prevention [15, 22], was reintroduced once pain had resolved. For athletes who do not respond to traditional protocols, including those who cannot start the Hölmich programme [15] because of pain, an initial phase of indirect loading through multi-joint exercises could be a useful approach and a route back to adductor-specific training. It might also be tried before injections or surgery, the usual options for recalcitrant adductor-related groin pain [14, 25]; a recent case report described a competitive player who returned to sport six weeks after an ultrasound-guided platelet-rich plasma injection combined with physical therapy [64]. At the end of the protocol, the player met the palpation component of the clinical milestones proposed before return to sport (no or minimal pain, 0–2/10), but not yet the milestones that require heavy adductor loading and the Copenhagen adduction exercise [34].

Limitations

A single case cannot establish causality; natural history, regression to the mean and co-interventions cannot be excluded. The author was also the patient, designed and delivered the protocol, and recorded pain and training data, which may have introduced expectation and reporting bias. Pain and tenderness on palpation were the only clinical outcomes, and no follow-up imaging was performed. No patient-reported outcome measure or objective adductor strength measurement was collected, although squeeze and eccentric adductor strength are usually reduced by about 20% in adductor-related groin pain [34].

Squat stance width was not documented. Heart-rate-derived load reflects internal rather than mechanical load and was not complemented by session rating of perceived exertion. Outcome assessment was not blinded. Finally, rehabilitation ended with the reintroduction of isolated adductor loading; the response to that loading, return to play and recurrence, a frequent problem in this population [23], are not reported.

Take-home message

In an amateur football player with chronic, recurrent adductor- and pubic-related groin pain who no longer responded to the Hölmich protocol [15, 16], its modifications [17] or other groin pain programmes, a protocol excluding all exercises in which the adductors act as primary agonists was associated with complete pain resolution after the first month. The load on the squat, the core exercise, increased 4.75-fold over 114 days, and isolated adductor work could then be reintroduced. This approach could be useful for non-responders to traditional protocols; case series and controlled studies are needed to confirm it.

Declarations

Competing interests The author has no relevant financial interests to disclose. Non-financial interests: the author is the patient described in this case report and designed and delivered the rehabilitation protocol.

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Ethics approval Not applicable. This single-patient case report describes the author's own rehabilitation, and no other participants were involved. The case was managed in accordance with the principles of the Declaration of Helsinki.

Consent to participate The author, who is the patient described in this report, consented to participate.

Consent to publish The author, who is the patient described in this report, consents to its publication.

Data availability the data supporting this case report are available from the corresponding author upon reasonable request.

Author contributions Davide Palmieri, who is also the patient described, conceived the case report, designed the rehabilitation protocol, collected and analysed the data, and wrote and approved the final manuscript.

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Figures

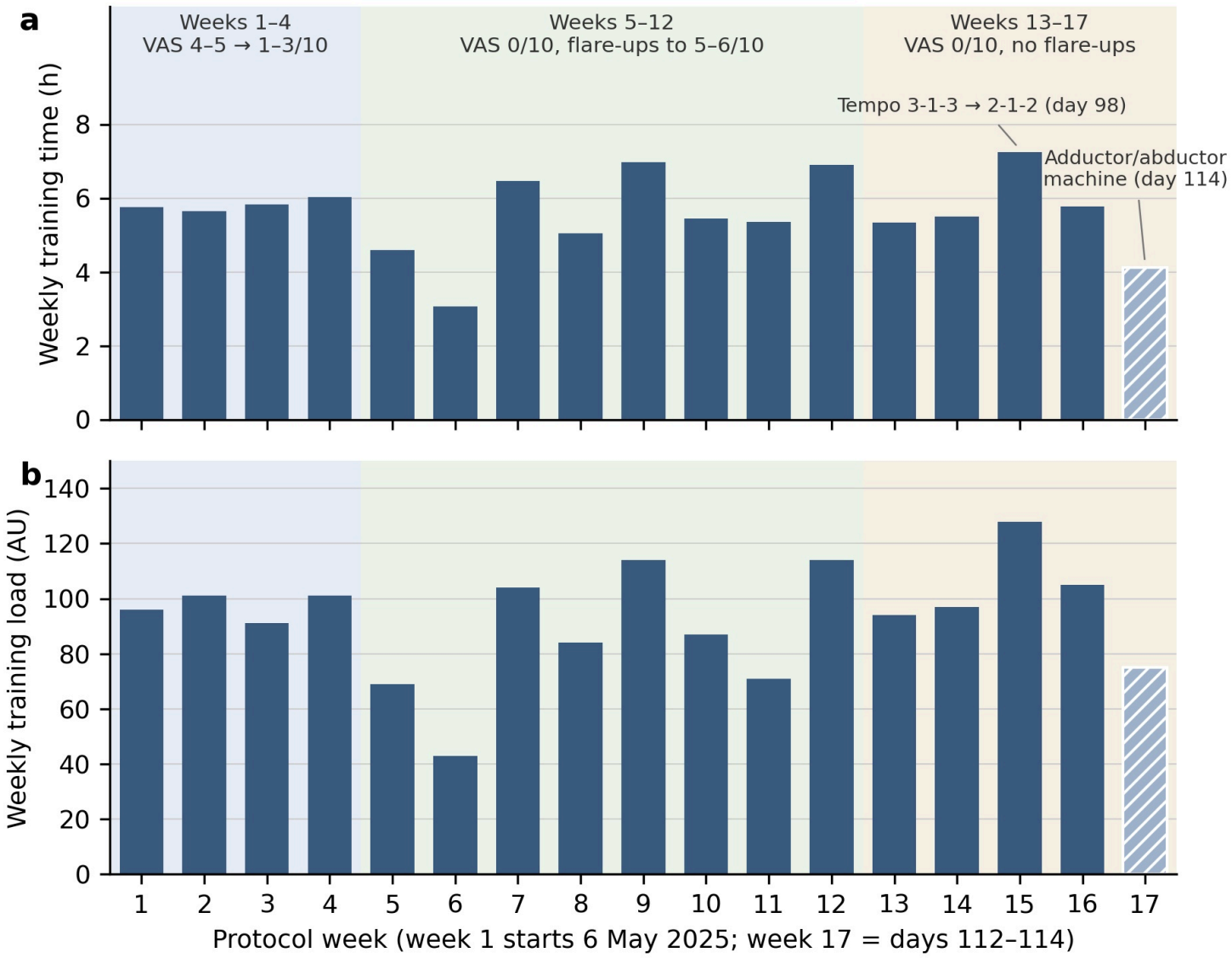


Figure 1

Weekly training time (a) and heart-rate-derived training load (b) across the protocol, from Polar H10 recordings analysed in intervals.icu. Shaded bands mark the pain phases; week 17 (hatched) includes only days 112–114. VAS visual analogue scale, AU arbitrary units