Non-surgical management of proximal hamstring injury in an Olympic judo gold medalist: a case report

Manejo no quirúrgico de la lesión proximal de los isquiotibiales en una campeona olímpica de judo: estudio de caso

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Abstract

Objectives: To describe the clinical outcomes of conservative treatment in a high-level judo athlete with a proximal hamstring rupture and partial adductor rupture.
Methods: This case report study evaluated a 32-year-old Olympic judo champion who sustained a proximal hamstring rupture and partial adductor tear five months before the Paris 2024 Olympics. MRI confirmed the diagnosis six days post-injury. Hamstring strength asymmetry was assessed using the ActivForce2 dynamometer (pre-test) and the Biodex system (post-test). A three-phase conservative rehabilitation protocol was implemented over three weeks, combining soft-tissue therapies, progressive strength training, and sport-specific drills.
Results: Hamstring strength asymmetry decreased from 78.7% (day 6 post-injury) to 21.9-29.7% post-treatment. MRI demonstrated 70-80% structural recovery with reduced inflammation and improved tissue integrity. Agonist-antagonist ratios were bilaterally comparable and increased with angular velocity (62% to 79%). The athlete returned to international competition without reinjury, maintaining Olympic qualification and top-8 seeding.
Conclusion: Conservative management reduced limb asymmetry, improved judo performance, and enabled an unrestricted return to full training and elite-level competition in this high-level judo athlete, supporting its consideration as a viable initial treatment approach for proximal hamstring ruptures. While this case demonstrates excellent clinical and functional recovery, the persistent risk of reinjury highlights the need for rigorous long-term monitoring and individualized rehabilitation protocols.

Keywords

Conservative therapy; judo; olympic sports medicine; partial adductor rupture; proximal hamstring partial rupture; recovery time.

Resumen

Objetivos: Describir los resultados clínicos del tratamiento conservador en un atleta de judo de alto nivel con rotura proximal de isquiotibiales y rotura parcial de aductores.
Métodos: Este estudio de caso evaluó a una campeona olímpica de judo de 32 años que sufrió una ruptura proximal de los isquiotibiales y un desgarro parcial de aductores cinco meses antes de los Juegos Olímpicos de París 2024. La RM confirmó el diagnóstico seis días después de la lesión. La asimetría de fuerza de los isquiotibiales se evaluó mediante el dinamómetro ActivForce2 (pretest) y el sistema Biodex (postest). Se implementó un protocolo de rehabilitación conservadora de tres fases durante tres semanas, combinando terapias de tejidos blandos, entrenamiento de fuerza progresivo y ejercicios específicos del deporte.
Resultados: La asimetría de fuerza de los isquiotibiales disminuyó del 78.7% (día 6 post-lesión) al 21.9-29.7% post-tratamiento. La RM demostró una recuperación estructural del 70-80% con reducción de la inflamación y mejora de la integridad de los tejidos. Los ratios agonista-antagonista fueron bilateralmente comparables y aumentaron con la velocidad angular (62% a 79%). La atleta regresó a la competición internacional sin recaídas, manteniendo la clasificación olímpica y su condición de cabeza de serie entre las ocho mejores.
Conclusión: El manejo conservador condujo a una reducción de la asimetría de las extremidades, una mejora en el rendimiento deportivo y permitió un regreso sin restricciones al entrenamiento completo y a la competición de élite en esta atleta de judo de alto nivel, respaldando su consideración como un enfoque inicial de tratamiento viable para las rupturas proximales de los isquiotibiales.

Palabras clave

Judo; medicina deportiva olímpica; rotura parcial de los aductores; rotura proximal de los isquiotibiales; terapia conservadora; tiempo de recuperación.

Introduction

As in many sports, judo is also associated with a high rate of hamstring injuries (Silvers-Granelli et al., 2021). This can be attributed to the biomechanical features of the hamstrings, which function more as speed levers than as force levers (Hadib Abdulridha et al., 2026), limiting their active involvement in various exercises. Thus, the primary cause of the proximal hamstring injury during the match may have been high-speed overstretching of the hamstrings (Lee & Hensley, 2022; Leuciuc & Grosu, 2021). In our case, hamstring overstretching, defined in judo athletes as an angle between the upper body and the leg of less than 25^0, was accompanied by a very high stretch velocity, estimated at approximately 50^0 over 0.15 secs (around 333^0/s). As shown in the Methods section, the additional downforce applied by the opponent likely contributed to the partial rupture (Bosco & Komi, 1979; GymAware, 2025). Therefore, understanding the mechanisms that provoke these injuries is particularly important for effective prevention. Current literature links hamstring injuries to high-speed stretching (Kerin et al., 2022; Leuciuc & Grosu, 2021; Selmani et al., 2025), especially in cases involving proximal hamstring tendon avulsion (Bertiche et al., 2021; Sarimo et al., 2008). Recently, this type of stretch has been documented, and literature often suggests that proximal hamstring injuries require surgery and prolonged rehabilitation before full return to sport (Sarimo et al., 2008). On the other hand, there is evidence indicating the lack of high-quality literature supporting surgical intervention for proximal hamstring injuries (Harris et al., 2011). In line with this, previous studies have reported reductions in limb asymmetry, improvements in judo performance, and unrestricted return to full training and competition following non-operative treatment of proximal hamstring injuries in elite athletes (Kenny et al., 2025). However, evidence on this topic is lacking, specifically among professional judo athletes.

Additionally, a severe proximal hamstring rupture accompanied by a partial adductor tear occurred just five months before the Olympic Games, prompting the decision to pursue non-surgical treatment despite medical recommendations for surgery.

This study focuses on proximal hamstring rupture. Such an injury can pose a serious risk to the athlete's health and well-being and may significantly jeopardize, or even end, their career due to prolonged recovery time. In particular, surgical intervention is often accompanied by a loss of up to 80% of performance, which can take a year to regain (Dobson, 2020). The main challenge of the study was achieving full recovery in time for the 2024 Olympic Games in Paris, which are approximately five months away. Given the limited timeframe, it was insufficient to allow complete recovery following surgical intervention. Consequently, surgical treatment options were deemed no longer viable. Therefore, the future of sports medicine is focused on identifying effective non-surgical interventions, which present a distinct challenge. A further challenge in sports medicine is the lack of evidence from case studies involving professional athletes on optimal strategies to shorten recovery time after injury. This study is significant and innovative, as it focuses on the remarkable case of an Olympic judo gold medalist, and offers unique insights into elite athletic performance.

In light of the previous information, the aim was to evaluate the feasibility of avoiding surgery for a proximal hamstring rupture with a partial adductor tear in the right leg through non-surgical, conservative management. In addition, the success criteria aimed in this study included structural recovery on MRI (improved tissue continuity and reduced oedema signal without clinically relevant retraction), functional recovery (improvement in judo performance with acceptable limb symmetry in hamstring strength), and an unrestricted return to full judo training and competition without symptom recurrence. In this context, the study aimed to demonstrate that surgery can be avoided following proximal hamstring ruptures. Specifically, it evaluated the effectiveness of non-surgical management for proximal hamstring injuries in judo, with a focus on reducing recovery time after proximal hamstring and partial adductor ruptures. Additionally, the study sought to enhance muscle strength and facilitate the athlete's return to competition at the Paris 2024 Olympic Games.

Method

Study design

As the study is conducted without randomization or a control group but includes an intervention, it is structured as a case report, describing the recovery rate of an athlete who underwent a specific treatment for hamstring and adductor injuries. The study design relies on quantitative data and a pre-post test model, with results compared to existing literature on similar cases.

Figure 1. During the fight, the athlete exhibited leg instability and was unable to effectively control hip movements

Participants (case history)

Nora Gjakova, a 32-year-old elite female judo athlete and Olympic champion from the Tokyo 2020 Olympic Games, sustained an injury on February 16, 2024, five months prior to the Paris 2024 Olympic Games, during the Baku Grand Slam, a high-level international judo competition contributing points.

Figure 2. The precise moment of injury onset

Figure 3. As the opponent initiates an attack, the athlete extends her leg in a defensive maneuver

Toward Olympic qualification (see Figures 1-3). Prior to this injury, the athlete had a significant history of lower limb injuries. In 2013, she underwent anterior cruciate ligament (ACL) reconstruction and lateral meniscus repair on the right knee, followed by a partial lateral meniscectomy on the same knee in 2016. Since these procedures, the athlete has consistently exhibited a visible asymmetry in muscle mass and strength between the right and left legs, as well as limited flexion range at the right knee.

Procedure (injury description)

Approximately two minutes into a match on February 16, 2024, the athlete sustained a leg injury while defending against an opponent's attack (see Figures 1–3). The injury mechanism involved an overstretching movement during the defensive manoeuvre, resulting in sharp pain and a pulling sensation in the right hamstring and groin region. Despite experiencing instability and reduced hip strength, the athlete continued for an additional two minutes and ultimately won the match based on an earlier score.

MRI results (see Figures 4-5) confirmed a proximal hamstring rupture and a partial adductor tear on the right side. Figure 4, taken six days post-injury, shows a visible hematoma, which was associated with 78 % asymmetry in hamstring strength.

Figure 4. Six days post-injury, imaging revealed hematoma formation

While such injuries in elite athletes are often treated surgically, particularly in cases of tendon disruption, the expected six-month recovery period would have made it impossible for the athlete to train or compete, thereby threatening her participation in the Paris Olympic Games. Although she had already secured Olympic qualification, with only the top 18 athletes earning direct entry, over a two-year period, an extended absence risked both losing her qualification status and dropping out of the top-eight seeding, potentially resulting in more challenging early-round opponents. Following consultation with the physiotherapist, coach, and expert medical team, it was concluded that the athlete would proceed with a non-surgical treatment approach.

Instrument

ActivForce2 Dynamometer: The ActivForce2 is a handheld dynamometer and inclinometer used to measure muscle strength and joint range of motion. It provides objective data to monitor rehabilitation progress, fatigue, and chronic conditions, thereby supporting evidence-based treatment. A pretest of hamstring strength was conducted prior to the rehabilitation phase using handheld dynamometry. Measurements were taken during hamstring curls at two knee flexion angles (30° and 90°), in both a pointed-toes and a neutral foot position.

Biodex System: To measure hamstring strength and asymmetry during the post-test, the BIODEX™ system was used. This is a computer-controlled device that measures muscle strength by having the participant push against a lever arm using either the leg or arm while seated.

Kinovea 0.9.4: A program focused on four core missions related to studying human motion: capture, observation, annotation, and measurement was used to measure the speed of stretching of the hamstrings while injured (Kinovea, 2025).

Treatment protocol

The three-week (04.03.2024-23.03.2024) rehabilitation protocol combined daily soft-tissue therapies (massage, laser, TECAR, and electrotherapy) with progressive strength, stability, and functional training. Exercises targeted the hamstrings, quadriceps, glutes, and core through movements such as squats, deadlifts, lunges, and glute bridges. Proprioceptive drills, resistance-band exercises, and sport-specific movements were incorporated, along with cardio sessions and active recovery days. Training load was gradually increased, with ongoing monitoring of pain levels and adaptive responses.

Table 1. Summary of the rehabilitation protocol

Phase	Key Issues	Interventions	Judo Progression	Outcomes
Phase 1: Early Stage	Swelling and pain in the right hamstring and groin Limping and impaired balance Strength loss and hip instability Patellar pain due to quadriceps atrophy	Daily cold therapy, laser*, TECAR*, and deep tissue massage Isometric quadriceps exercises, calf raises, and glute bridges Core exercises: planks, side planks, and balance drills Deadlift patterns without load Light aerobic activity (cycling, treadmill, rowing, SkiErg) Easy stair running and slow jogging	Solo drills: ashi-waza (e.g., ouchi-gari, ko-uchi-gari) Groundwork drills Light rolls (excluding open-leg and handstand rolls) Band-resisted judo techniques Controlled partner techniques	Normal walking restored Able to jog, cycle, and perform basic rolls Reintroduced of basic judo movements
Phase 2: Mid Stage	Tightness in the right leg during partner uchi-mata Fear of reinjury, especially during explosive hip extension Instability during hopping and reacting to external forces Lack of confidence in fully committing to throws Pain during running and hamstring fatigue	Strength training: SL RDLs, hamstring curls, single-leg squats, adductor slides, and lunges Eccentric loading for confidence (using discs, and cable adduction) Change-of-direction and band-resisted power drills Fear-specific drills: open-leg rolls, and transitions Two-hour pre-training rehabilitation targeting major muscle groups	Stationary to dynamic throws Controlled-speed technical sessions Return to ne-waza randori Gradual reintroduction to standing randori, including grip fighting, light ashi-waza, attack-only drills, and full randori	Significant strength gains Improved movement control Resumed full judo training with modifications
Phase 3: Late Stage	Rebuilding confidence in full-intensity randori Fatigue in the right leg during prolonged sessions Strategic grip control to minimize exposure to explosive situations Insecurity during hand techniques Risk of losing top-8 Olympic seeding	Participation in international training camps (two sessions per day) Power-based training: plyometrics, hill sprints, and explosive lifts Range-specific RDLs to enhance hamstring resilience Tactical drills to optimize grip control and dominate throws	Return to full-speed sparring with international partners Tactical randori under realistic match conditions	Returned to competition prior to the Olympics Maintained Olympic qualification and top-8 seeding No reinjury or major setbacks

*The therapy was used as an adjunctive modality alongside the primary rehabilitation program

Based on Table 1, the selected strategy focused on an intensive non-surgical rehabilitation program, supported by frequent training modifications, adjusted weekly or even daily as the athlete's progress and response to treatment changed. This process required close and continuous coordination among the athlete, physiotherapist, and coaching team. The rehabilitation was structured into three progressive phases: Phase 1 prioritized pain and swelling reduction along with the restoration of basic mobility. Phase 2 emphasized strength rebuilding and addressing fear related to reinjury. Phase 3 focused on regaining confidence and performance under realistic sparring and competition conditions.

Hamstring-to-Hip Strength & Power Training

The lower-body training program, applied after the recovery treatment protocol and continued through the 2024 Olympic Games, began with a warm-up and combined compound and isolation exercises targeting key muscles, including the hamstrings, glutes, quads, calves, and adductors. While most routines prioritize compound lifts for heavier loads, starting with isolation exercises can help reduce knee pain. The program incorporates movements such as squats, lunges, hamstring curls, and hip-focused band work, concluding with explosive power exercises like jumps and stair runs. It balances

strength, muscle activation, and injury prevention through a structured progression. This comprehensive lower-body training regimen, emphasizing both compound and isolation exercises alongside explosive power development, was implemented by the athlete's doctor, who is also the third author of the paper.

Ethical Considerations

Written informed consent was obtained from the athlete for participation in the study and for the publication of this case report, including the use of medical images (e.g., MRI) and competition-scene photographs captured at the time of injury. The athlete, who is also the first author, reviewed and approved all information reported in this manuscript and consented to its publication. The co-authors oversaw data interpretation and reporting decisions to minimize potential bias and address any perceived conflicts of interest. Accordingly, the authorship team includes a sports scientist, the treating physician, and the physiotherapist involved in the athlete's rehabilitation. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data analysis

The pretest was conducted six days post-injury (22 February 2024) using the ActivForce2 dynamometer to assess maximal strength and calculate percentage differences. Additionally, an MRI scan was performed six days post-injury to establish the diagnosis. Thus, the severity of the injury and power loss were determined. To evaluate the effects of the treatment and training protocol, a post-test was administered, including a hamstring strength test on the Biodex. The percentage difference between the pre-test and the post-test was compared. Additionally, to analyze and estimate the potential causes of the injury, the overstretch magnitude, stretch velocity, and load during stretching at the moment of injury were analyzed using Kinovea 0.9.4.

Results

Based on the pre-treatment MRI (see Figures 5-6), there were visible signs of tissue damage, including swelling, increased signal intensity (indicative of inflammation or oedema), and structural disruptions such as partial tear, tendinosis, or fluid accumulation in the affected region. The post-treatment MRI demonstrates reduced signal intensity and swelling, suggesting decreased inflammation. The tissue's structural integrity appears better preserved, with evidence of remodelling and healing. Although minor residual changes may remain, the pathology shows overall improvement. Based on comparisons of pre- and post-treatment MRI images, the radiologist's visual assessment indicates ~70-80% structural recovery, evidenced by reduced inflammation, improved tissue continuity, and near-normal morphology. However, functional recovery, including motor abilities, should be assessed using specific tests that evaluate strength, mobility, and related parameters.

Figure 5. MRI six days after injury (22.02.2024)

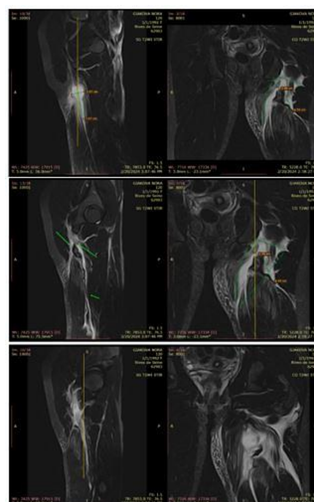

Figure 6. Post-rehabilitation MRI (12.08.2024)

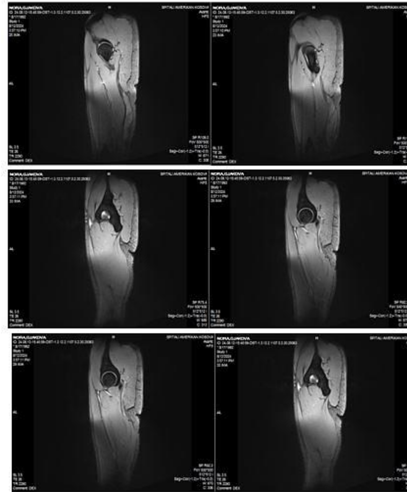

Table 2. Hamstring strength and asymmetry assessed six days (22.02.2024) post-injury (pre-treatment) using the ActivForce2

Date	Legs	Strength		
		Max (kg)	Diff. (kg)	Diff. (%)
22.02.2024	Right	12.59	11.33*	78.70*
	Left	28.91		

*Studies show that strength differences of 10% or greater increase the risk of injury (De Vos et al., 2014).

As shown in Table 2, the hamstring asymmetry was measured at 11.33 kg, with the right leg being weaker. This corresponds to a 78.70 % difference, indicating substantial muscle damage and strength loss.

Table 3. Hamstring strength and asymmetry assessed post-treatment and following conditioning training using the Biodex

Date	Leg	Unit	Peak Torque / Weight (Knee Flexion)						A%
			60^0/sec	A%	180^0/sec	A%	300^0/sec	A%	
05.07.2024	Right	PT (Nm)	76.8	23.9	64.1	18.5	47.4	23.4	21.9
	Left	PT (Nm)	101.0		78.7		61.9		
	Right	AVGP (W)	52.0	29.7	88.7	27.4	74.3	32.2	29.7
	Left	AVGP (W)	74.0		122.3		110.4		
	Right	AAR (%)	62.0	-	76.0	-	79.0	-	-
	Left	AAR (%)	62.0		76.0		79.0		

PT: Peak Torque
AAR Ratio: Agonist-Antagonist Ratio
Average Power (Watt)
A%: Asymmetry percentage

As shown in Table 3, post-treatment and conditioning training results demonstrate a substantial reduction in hamstring strength asymmetry. Based on peak torque measured at three angular velocities (60°/s, 180°/s, and 300°/s), the average asymmetry level was 21.9%. When assessed by using average power, the asymmetry level was 29.7%. The agonist-antagonist ratio did not differ significantly between the right and left legs. However, the ratio was low at 60°/s, within normal limits at 180°/s, and slightly elevated at 300°/s (79.0).

Discussion

Described in the Introduction and Methods sections, the proximal hamstring injury during the match appears to have been primarily caused by high-speed overstretching of the hamstrings. According to the literature, hamstring overstretching remains the leading cause of injuries (Kerin et al., 2022; Leuciuc & Grosu, 2021). In this case, hamstring overstretch (an angle between upper body and leg smaller than 25^0 is considered maximal stretch for Judo athletes), accompanied by a high speed of stretch, which is

approximately 50⁰/0.15 secs (around 333⁰/s) (Bosco & Komi, 1979; GymAware, 2025). As described in the Methods section, the additional downforce applied by the opponent caused the partial rupture.

Accordingly, the aim of the study was to evaluate the effectiveness of the non-surgical treatment protocol outlined in Table 1 for proximal hamstring injury, to achieve full recovery and enable the athlete to return to Olympic-level competition in the shortest possible time (Cancino-Jiménez et al., 2025). In this case, the athlete had only five months to return to competition.

As evidenced by the results, the athlete exhibited approximately 78% hamstring strength asymmetry following the injury. An initial three-week treatment program was implemented during the early stages, followed by a targeted strength training regimen for the remainder of the recovery period (see Methods section), alongside regular judo training (Cancino-Jiménez et al., 2025).

MRI comparison indicates approximately 70-80% structural recovery, evidenced by reduced inflammation and improved tissue integrity, although functional recovery remains to be evaluated through strength and mobility testing. Similarly, the post-test (see Results section) indicates a reduction in hamstring strength asymmetry from 78% pre-treatment to 29.7% based on average power and 21.9% based on peak torque. Additionally, the agonist-antagonist ratio of the right leg was comparable to that of the left leg and remained within normal ranges, except at 300°/s, where a relatively higher ratio was observed in both legs. This remarkable improvement in strength symmetry, coupled with two competitive successes following recovery, including the athlete's participation in the Peru Continental Open and the Paris 2024 Summer Olympic Games, demonstrates the effectiveness of the non-surgical treatment and rapid recovery process. These findings are consistent with evidence from the scientific literature (Kenny et al., 2025). When informed about the non-surgical treatment approach and the possibility of competing in the Olympic Games, the athlete stated: "I competed in the Paris Olympics at approximately 70% capacity, with no pain or reinjury." One-year post-injury, she won a bronze medal at the Paris Grand Slam in a higher weight class validated the effectiveness of the non-surgical recovery strategy. One factor contributing to the rapid recovery is that the injured right leg is the athlete's attacking leg; in judo, most power is generated through the supporting leg, in this case, the uninjured left leg, which facilitated adaptation and reduced strain during certain movements. This pilot case study supports the viability of non-surgical treatment for full-thickness proximal hamstring avulsion injuries, indicating that, in selected elite athletes, it can lead to reduced limb asymmetry, improving judo performance, and an unrestricted return to full judo training and competition (Kenny et al., 2025). Therefore, before deciding on surgery, it is essential to thoroughly analyze and clearly define the surgical indications. If these indications remain unclear, avoiding surgery may be the most appropriate course of action (Bertiche et al., 2021). While there is limited high-level literature supporting surgery for proximal hamstring injuries (Harris et al., 2011), surgical intervention should be reserved for cases that do not respond to non-surgical interventions, with future emphasis on prevention, early diagnosis, and minimally invasive treatments. Early diagnosis and timely surgical intervention are important, as delayed surgeries are associated with suboptimal outcomes and should be avoided whenever possible (Sarimo et al., 2008). Also, a clinical guide for the rehabilitation of acute hamstring strains and an algorithm to assist clinicians in the decision-making process are crucial (Erickson & Sherry, 2017).

On the other hand, a hamstrings asymmetry rate greater than 10%, as observed in this case (ranging from 21% to 29%), may be associated with an increased risk of injury (De Vos et al., 2014). Inter-limb strength asymmetries greater than 15% are common after major lower-limb injuries; therefore, achieving >80-90% symmetry and restoring normative hamstring-to-quadriceps ratios are frequently utilized as standard functional criteria for return to sport (RTS). Although the athlete achieved reduced limb asymmetry, improved judo performance, and an unrestricted return to full training and competition, current deficits suggest she remains at risk and requires targeted strength training to ideally reduce asymmetry below the 10% threshold. From a health perspective, competing under these conditions was not the optimal choice. However, this remains a subjective decision and may be interpreted differently. Moreover, there is currently no conclusive scientific evidence to prove or disprove it. Despite incomplete recovery, the athlete's participation in competitions can be attributed to psychological factors such as confidence, self-efficacy, motivation, rehabilitation adherence, and a risk-taking mindset. Social support and psychological readiness to return to sport should be considered, as they can meaningfully influence recovery progress and return-to-play decisions. The athletes' statement regarding participation in competition despite incomplete recovery was: ''After two years of

preparation and with the Olympic Games approaching, I considered the competitive risk justified given the importance of the event. Additionally, my performances across several international training camps were very strong, which further supported my decision to compete. I acknowledge that elite sport essentially involves risk, and although physical performance is essential, it represents only one of several determinants of overall performance; therefore, maximal overall performance is not always achieved under conditions of complete physical readiness''. According to recent literature, while asymmetries of 5-15% or higher are common, they do not necessarily exclude competitive participation; indeed, elite athletes can maintain performance levels even with asymmetries reaching up to 30% (Afonso et al., 2025). This suggests that while the athlete is functional enough to compete at an Olympic level, her existing injury risk is still indicated by the bilateral agonist-antagonist ratios, which remain relatively high at 300^0. Ultimately, classifying inter-limb asymmetries of 5-15% as 'normal' should be avoided, as a heightened risk of reinjury may persist despite functional gains (Parkinson et al., 2021).

In conclusion, while the non-surgical treatment outlined in Table 1 can facilitate significant recovery and enable a return to elite performance following a proximal hamstring rupture, persistent strength asymmetries and muscle imbalances highlight the importance of ongoing rehabilitation, early diagnosis, and careful clinical decision-making to minimize the risk of reinjury (Kurosawa et al., 1996).

Another dimension to pay attention to and investigate is the psychological impact of injuries in Judo. Given the literature findings, further research is needed to investigate the psychological mechanisms and long-term effects of judo-based interventions (Gravino et al., 2025; Triadi Desnantyo et al., 2025).

Conclusions

The conservative (non-surgical) management protocol for proximal hamstring injuries has proved to be efficacious and is recommended as a first-line treatment over surgical intervention. The athlete achieved complete recovery within five months, enabling her to compete in the Paris 2024 Olympic Games. Surgery should be considered only after non-surgical options have been attempted, if the athlete has a longer recovery period, or when experts determine that the injury cannot heal without surgical intervention.

Future approaches should prioritize injury prevention, early diagnosis, targeted non-surgical and minimally invasive interventions, and the identification of biomechanical risk factors to reduce the likelihood of injury. Although the athlete has achieved full recovery, a hamstring asymmetry ratio above the accepted normal range implies a continued risk of reinjury. The psychological impact of the injury and the non-surgical treatment methods should be further investigated in future studies.

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