

## Aggressive Massage Techniques can Accelerate Safe Return after Hamstrings Strain: A Case Study of a Professional Soccer Player

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### Abstract

**Study Background:** Hamstrings strains are very common in soccer players and their rehabilitation involves a demanding process which may be considerably time consuming depending on the severity of the injury. Traditional treatment for these injuries includes conservative forms of treatment such as gentle massage, passive stretching, electrotherapy and functional exercises during training. The aim of this case study was to evaluate the effectiveness of an aggressive rehabilitation program in the treatment of grade I hamstring strain in a professional athlete.

**Methods:** A 30 year old professional soccer player clinically diagnosed with grade I hamstrings' strain underwent a 15 days aggressive rehabilitation program. This included aggressive massage techniques with cups, instruments and stripping techniques, cryostretching/cryokinetics exercises, core strengthening and supervised functional exercises in the field.

**Results:** The applied aggressive rehabilitation techniques reduced the conventional time of the athlete's absence from sports participation by almost 50%. In addition, further relapses in the following period were prevented.

**Conclusion:** This case study provides some evidence that aggressive physiotherapy techniques can reduce the absence from sports participation after hamstrings strain. Implementation and testing of these techniques in large randomised control studies is necessary for securing firm conclusions regarding their effectiveness in muscle strain rehabilitation.

**Keywords:** Hamstrings strain; Aggressive physiotherapy; Stripping massage; Cryostretching; Soccer

### Introduction

Lower extremity injuries are very common among professional soccer players with reported incidence rate varying from 7.4-47.5 injuries per 1000 hrs of play. The vast majority of these injuries refer to the lower extremity (68-88%) [1,2], approximately 25% of which are non-contact hamstring muscle strains [3,4]. These injuries are mainly caused by an excessive stretch of an eccentrically contracted muscle [5,6] and etiology is attributed to both extrinsic and intrinsic factors [7,8]. The main extrinsic factor, recorded in 44-74% of the injuries [9,10], is the physical contact between opponent players (contact injury). Contrariwise, asymmetries in muscle strength, flexibility, proprioception, anatomical and anthropometric characteristics [9-16] and previous injury [5,6] constitute the main intrinsic etiological factors for hamstrings' strains.

Hamstrings' strains are classified into three grades (grades I, II, III) with regard to the severity of symptoms. Grade I refers to a mild strain where few muscle fibres are torn while grade II strain is a moderate injury associated with a greater number of injured fibers. Symptoms of both Grades I and II muscle strains include pain and tenderness upon pressure, local swelling, muscle spasm and a decrease in the range of motion. Pain becomes stronger during passive stretching or contraction of the muscle. Grade III strain is a complete tear of the muscle causing absolute loss of muscle function, as well as considerable pain, swelling, tenderness and ecchymosis [17].

Physiotherapy techniques applied to treatment at the acute and sub-acute stages of muscle healing are primarily aiming at reducing inflammation, pain and swelling and secondary at early muscle loading and strengthening. The reduction of swelling and intramuscular hematomas is of critical importance since it relates directly to the speed of the healing process [18].

For this purpose, different types of sports' massage, electrotherapy and cryotherapy are being used by physiotherapists. The massage performed in most cases includes pain-free superficial and deep effleurages (stroking) in an effort to mechanically enhance the venous

blood return and decrease muscle spasm and pain [19]. Nevertheless, techniques of aggressive massage (cupping massage, stripping massage and massage with the use of instruments-Instrument Assisted Soft Tissue Massage-IASTM) which have been developed in the last years are being carried out with particular intensity and pressure causing considerable pain (VAS=4-5) [20,21].

These aggressive procedures have not yet been tested in the treatment of muscle strain. This represents a challenge worthy of investigation, given their obvious contribution to accelerating reduction of swelling and hematoma after a strain. In that direction, this case study presents the application and effect of an aggressive rehabilitation programme which included a combination of aggressive massage with cupping therapy-IASTM, cryostretching-cryokinetics and progressive core and lower extremities strengthening on a professional soccer player of the Greek Second National Division diagnosed with a Grade I hamstring muscle strain.

### Case Report

In April 2013, a 30 year old soccer player suffered a right hamstrings' injury during soccer speed drills. The evaluation of the injury from the team of orthopedic physicians identified the presence of a grade I biceps femoris muscle strain near the musculotendinous junction. MRI examination showed a 3-4 mm lesion and confirmed diagnosis

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(Figure 1). Physical examination revealed a 10° deficit in hip flexion with extended knee, compared with the healthy limb, due to pain and increased muscle spasm. The compression of the area caused moderate pain (3-4 Vas scale) and the athlete reported a feeling of tightness in the hamstrings region during daily living activities (walking, ascending and descending stairs etc.)

### Aggressive rehabilitation program

**Physiotherapy:** The rehabilitation process began immediately after the injury and its contents are presented in table 1 below. The first two days after the strain, during the acute phase, the main objectives of rehabilitation were (i) decreasing swelling and hematoma, (ii) preventing re-injury, (iii) decreasing pain, and (iv) accelerating the healing process. In this regard, R.I.C.E. (Rest-Immobilisation-Cryotherapy-Elevation) and therapeutic non-warm ultrasound were applied daily. To prevent further swelling a soft wrapped bandage and therapeutic non-thermal ultra sound were used [22].

First (A) sub-acute phase treatment took place from the 3<sup>rd</sup> until the 7<sup>th</sup> day with the main objectives of (i) reducing/removing the hematoma and swelling, (ii) initialising alignment and reattachment of muscle fibers and minimising the risk of developing scar tissue. The treatment started with 10 min of thermotherapy (short-wave diathermy) followed by cupping, stripping and IASTM stripping massage techniques.

The application of negative pressure massage (suction cups) started with static applications over the injury site for 5 min and progressed to dynamic application and movement of the cups towards the heart (Figure 2) [23,24].

Stripping massage with or without instruments was performed with high pressure intensity (pain perception VAS6-7) in two phases: initially to the region centrally to the injury for “draining” of the thigh great vessels and then directly upon the site of the injury for the mobilisation-decrease of muscle hematoma-swelling (Figures 2 and 3) [23].

In addition, cryotherapy, pain-free cryokinetic isometric and cryostretching exercises were used to achieve the aforementioned objectives [25,26]. These cryostretching exercises were performed with an ice bag attached to the injury site, passively by the physiotherapist.

The program concluded with therapeutic ultrasound, TENS and gentle passive stretching. Core stabilisation was enhanced through plank exercises in all directions [27]. In order to prevent a subsequent injury, kinesiotaping was applied on the hamstrings at the end of each treatment session.

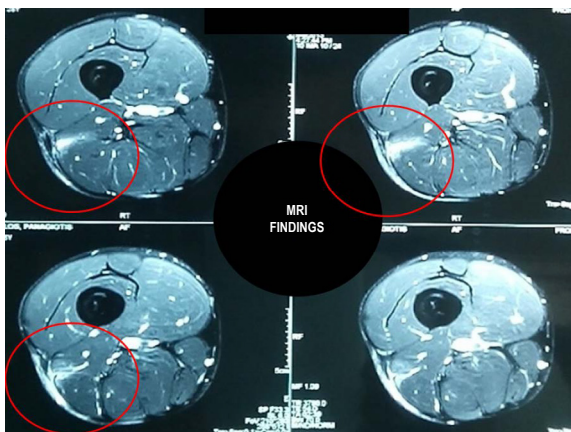


Figure 1: MRI findings from the site of injury.



Figure 2: Aggressive massage techniques. 1: Static cupping therapy, 2: Dynamic cupping massage, 3: Stripping massage, 4: IASTM massage.

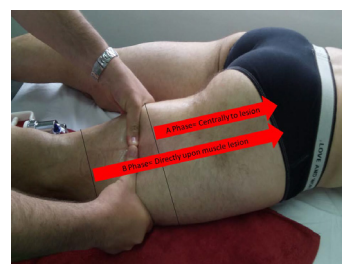


Figure 3: Phases of aggressive massage techniques: (i) A Phase=centrally from the injury site towards the trunk, (ii) Phase B=directly upon the injury site with direction towards the trunk.



Figure 4: Initial appearance and gradual reduction of superficial hematomas after aggressive forms of sports massage. 4.1 Echymosis after 1<sup>st</sup> day of treatment, 4.2 Echymosis at 4<sup>th</sup> day of treatment, 4.3 Echymosis at 8<sup>th</sup> day of treatment, 4.4 Echymosis at 12<sup>th</sup> day of treatment.

On the 4<sup>th</sup> and 5<sup>th</sup> day, after the injury began to emerge signs of surface displacement of intramuscular hematomas, the patient reported significantly less pain during massage and passive hip flexion improved by 5°. The skin echymosis was progressively removed until 10<sup>th</sup>-2<sup>th</sup> day (Figure 4).

On the 7<sup>th</sup> day, treatment had successfully progressed and the

Phase/Programme description	Acute Phase (Days 1-2)	Sub-acute Phase A (Days 3-7)	Sub-acute Phase B (Days 8-15)
<b>Physiotherapy Objectives</b>	<ol style="list-style-type: none"> <li>1. Swelling–Hematoma stabilization</li> <li>2. Prevention of relapses</li> <li>3. Pain reduction</li> <li>4. Initializing–Accelerating inflammatory rehabilitation process</li> </ol>	<ol style="list-style-type: none"> <li>1. Reducing/removing hematoma - swelling</li> <li>2. Initializing alignment and reattachment of muscle fibres</li> <li>3. Minimizing development of scared tissue</li> <li>4. Reduce pain</li> <li>5. Regaining strength and agility</li> </ol>	<ol style="list-style-type: none"> <li>1. Achieving elasticity of the scar tissue</li> <li>2. Regaining functional muscle ability (agility-strength-endurance-proprioception)</li> </ol>
<b>Aggressive Physiotherapy Techniques</b>	<ol style="list-style-type: none"> <li>1. Cryotherapy</li> <li>2. Elevation</li> <li>3. Immobilization</li> <li>4. Use of crutches</li> <li>5. Compression (Soft-wrapped bandage)</li> <li>6. Therapeutic non-warm ultrasound (0.5 W/cm<sup>2</sup> /1-3-MHz/10')</li> </ol>	<ol style="list-style-type: none"> <li>1. Diathermy (10')</li> <li>2. Massage (15')</li> <li>3. Cupping massage (8')</li> <li>a) Static application on the injury site (5')</li> <li>b) Dynamic application with cups motion towards the core (3')</li> <li>4. Stripping massage (5')</li> <li>a) centrally to injury site</li> <li>b) directly upon injury site with direction towards the trunk</li> <li>5. IASTM Stripping massage (2') (application same as above)</li> <li>6. Cryotherapy (20')</li> <li>7. Cryokinetic</li> <li>Isometric exercises of hamstring muscles (4 sets with 10 isometric contractions) (6'' of progressive contraction -2'' break)</li> <li>8. Cryostretching</li> <li>Stretching through active motion -Stretching of antagonist muscles (12'' stretch -12'' relaxation)</li> <li>9. Electrotherapy</li> <li>Therapeutic Ultrasound-TENS</li> <li>10. Core stabilisation exercises (planks in supine - lateral and prone position)</li> </ol>	<ol style="list-style-type: none"> <li>1. Diathermy (15')</li> <li>2. Massage</li> <li>2.1. Stripping massage (5')</li> <li>a) centrally to injury site</li> <li>b) directly upon injury site with direction towards the trunk</li> <li>2.2 Stripping massage in combination with gentle eccentric hamstrings' contraction (with elastic band/5')</li> <li>3. Cryotherapy (20')</li> <li>4. Cryokinetic</li> <li>Isotonic- concentric contraction of hamstrings with the use of elastic bands (4-5 sets 10-12 repetitions)</li> <li>5. Cryostretching</li> <li>2 sets x 5 stretching repetitions for 30'' (1 set with extended knee - 2'' set with flexed knee)</li> <li>6. Electrotherapy</li> <li>T.E.N.S ,Therapeutic Ultrasound</li> <li>7. Core stabilisation exercises (planks in supine - lateral and prone position)</li> <li>8. Balance exercises</li> </ol>
<b>Home-based Rehabilitation</b>	Rest/ Cryotherapy (Continuous application 20'-30' with a 90' break.)	<ol style="list-style-type: none"> <li>1. Hamstrings' stretching (2 sets of 7 repetitions for 30'' with extended and flexed knee position)</li> <li>2. Isometric exercises (4 sets of 10 contractions (6'' of progressive contraction-2'' of relaxation)</li> <li>3. Low resistance exercises in a pool – swimming</li> </ol>	<ol style="list-style-type: none"> <li>1. Hamstrings' stretching: 2 sets of 7 repetitions for 30'' (with extended and flexed knee position)</li> <li>2. Strengthening with elastic bands : (daily 6-7 sets of 10-12 repetitions in sitting and standing positions)</li> <li>3. Myofascial release exercises with Foam roller on hamstrings (10 repetitions for 1' with a 1' relaxation break)</li> </ol>
<b>Functional rehabilitation in the field</b>		<ol style="list-style-type: none"> <li>1. Trunk and upper limbs strengthening exercises in the gym</li> <li>2. Upper body ergometer</li> <li>3. After day 4, beginning organized gait (forward and backward)</li> <li>5<sup>th</sup> day-walking 10'</li> <li>6<sup>th</sup> day- walking 15'</li> <li>7<sup>th</sup> day-walking 20' (2x10')</li> </ol>	<p><b>8<sup>th</sup>-10<sup>th</sup> Days</b>                      Aerobic training: Running (2x10' / 30-40% Vo<sub>2</sub> max)                      Skipping routines/Stretching                      Trunk-pelvis stabilisation exercises                      Combined exercises (proprioception-agility-balance)</p> <p><b>11<sup>th</sup>-13<sup>th</sup> Days</b>                      Aerobic training: Running (2x 10' / 50% Vo<sub>2</sub> max)                      Skipping routines - Stretching/pelvis stabilisation exercises                      10x50 m (60% Vo<sub>2</sub> max) / 5x100 (60% Vo<sub>2</sub> max)                      Ballistic hip exercises (dynamic stretching)/10x50 m (60% Vo<sub>2</sub> max) /5x100 (alternating intensity rhythm: 50 m at 50% and 50 m at 60-70% Vo<sub>2</sub> max)</p> <p><b>14<sup>th</sup>-15<sup>th</sup> Day</b>                      Aerobic training: Running (2x10' / 50% Vo<sub>2</sub> max)                      Isokinetic strengthening (concentric –eccentric contraction)/                      Skipping routines – Stretching/ Pelvis stabilisation exercises / Ballistic hip exercises/5x100 m (70% Vo<sub>2</sub> max)                      Dynamic proprioception exercises of lower limbs                      5x100 (alternating intensity rhythm: 50 m at 60% and 50 m at 70-80% Vo<sub>2</sub> max)/10x40 m (alternating intensity rhythm: 20-20 m at 60%/80-90% Vo<sub>2</sub> max) Soccer mimetic exercises- plyometric strengthening</p>
<b>Precaution - rehabilitation</b>		Kinesiotaping	Kinesiotaping
<b>Criteria for progression to the next phase</b>		<ol style="list-style-type: none"> <li>1. Swelling–pain minimization</li> <li>2. &lt;5° range of motion deficit</li> <li>3. Minimum pain (2-3 VAS SCALE) during compression of the area</li> </ol>	<ol style="list-style-type: none"> <li>1. Isokinetic strength symmetry (concentric 60° /180° /300° sec.-eccentric 60/180° sec)</li> <li>2. Full range of motion</li> <li>3. Performing soccer burst exercises (changing direction-sprint etc.) without discomfort</li> <li>4. Good psychological state -confidence of the athlete</li> </ol>

Table 1: Aggressive rehabilitation program for grade I hamstrings strain in a professional soccer player.



athlete was able to meet the criteria which would allow treatment to progress to the next stage, namely (i) reduction of swelling and pain, (ii) full range of hip flexion with knee extended and (iii) minimum pain (VAS =1-2) during compression (Table 1). It must be noted that during the A subacute phase, the athlete reported daily improvement, either in terms of pain or of his functional ability (flexibility, strength etc.).

Second (b) sub-acute phase treatment aimed at (i) ensuring elasticity of the scar tissue and (ii) regaining functional muscle ability, strength, endurance and coordination. From the 8<sup>th</sup> until the 15<sup>th</sup> day, the athlete was subjected to roughly the same techniques as in the previous phase with minimum qualitative adjustments such as the application of stripping massage combined with eccentric exercise [20] and incorporating hamstrings isotonic exercises with elastic resistance (Table 1).

IASTM stripping massage and cupping therapy were not used at this stage since swelling and hematoma had already retreated. Balance exercises were also added to the program in order to prepare the athlete to rejoin regular training. Isokinetic strengthening began on the 14<sup>th</sup> day after the injury while kinesiotaping application continued to be used in order to prevent further injury. Criteria set to determine completion of this phase and the ability of the athlete to rejoin regular training were met on the 15<sup>th</sup> day including (i) isokinetic strength symmetry, (ii) full range of motion in hamstrings' movement, (iii) the ability to perform soccer burst exercises without experiencing discomfort, and (iv) positive psychology and confidence (Table 1).

### Home-based rehabilitation program

During all phases the athlete was given instructions to follow a daily home-based physiotherapy program. During the acute phase, the athlete was expected to rest with repeated intermittent cryotherapy application on the injured muscle. Sub-acute phase homework included hamstrings' stretching up to the limit of pain, and isometric exercises. Sub-acute phase B home-based rehabilitation comprised of hamstrings' stretching, muscle strengthening exercises with elastic bands in standing position and foam roller myofascial release exercises (table 1).

### Progressive Sports Rehabilitation program

Following the acute phase, the athlete also followed a progressive sports rehabilitation protocol which was executed in the field. During sub-acute phase A, strength building exercises for the trunk and upper extremities were performed under the guidance of the team physiotherapist. After day 4, organised gaiting was added to the program in forward and backward motion. During sub-acute phase B, a progressive rehabilitation program was designed to be executed from the 8<sup>th</sup> until the 15<sup>th</sup> day in order to prepare the athlete for safe reintegration to normal training schedule. Cardiovascular conditioning was achieved through an aerobic running regime of gradually elevated duration and intensity. The athlete also performed several skipping routines and dynamic (ballistic) stretching exercises. Special attention was paid to the trunk and pelvis stabilisation exercises throughout this stage. The program gradually progressed from isokinetic strengthening and dynamic stretching to dynamic stabilisation and proprioception exercises of lower limbs. Soccer mimic exercises and plyometric training were initiated on the 14<sup>th</sup> day (table 1).

After 15 days, full strength and range of motion were achieved, the palpation of the area was pain-free and the athlete was released to return to full competition.

The athlete was monitored for six months following completion of rehabilitation in which no re-injury episode occurred. This period

represents an extended timeframe within which the injury at the same site can be characterised as a recurrence injury. More specifically, although the site of the injury is active and sensitive for the following several months, [28] no recurrences of muscle strains have been reported in sports literature after a period of 5-6 months from the initial injury [29].

### Conclusions

The implementation of an aggressive rehabilitation protocol in the treatment of a grade I muscle strain of a soccer player decrease recovery time by 50% approximately compared with traditional muscle strain rehabilitation protocols [17,28] proposing absence from sports and physiotherapy for 20-30 days. In this case study the athlete was able to return to full training within 15 days from injury and did not experience re-injury in the following 6 months.

The proposed treatment protocol was based on aggressive techniques which were performed under considerable pain. This method has not been reported in international literature since techniques that cause pain are avoided in classical physiotherapy [17,30] because of the belief that these cause re-injuries and increase the recovery period. In the present case study, massage techniques performed with great intensity directly on the injury site provoked significant temporary pain. However, they also significantly accelerated the mobilisation of hematoma and edema without causing any other problems to the athlete besides temporary pain. The pain exacerbated by the execution of these massage techniques is attributed to temporary increase in pressure on pain receptors from mechanical stress and not from deterioration of the injury [31]. This theoretical assumption is reinforced by the fact that the athlete reported significant improvement in his symptoms and functional capacity after each treatment.

The intense pressure and cephalic direction of massage strokes mobilise the swelling-hematomas in the superficial layers of the muscle, through myofascial pathways. This "draining" adaptation creates favourable conditions for the re-union of the injured muscle fibers and preliminarily explains the significant reduction in recovery time from grade I hamstrings strain observed in our case study.

In relation to the positive results of massage, it has been observed that cryostretching also contributed to a faster recovery of the passive range of hip flexion. These techniques have limited research support but are generally considered safe when performed with care and to the limits of pain [26]. Furthermore, integrating core exercises also helped the dynamic stabilisation of the trunk-pelvis of the athlete and probably reduced his risk of re-injury, confirming previous research findings [27]. The findings of the present case study are very encouraging. Further research with large randomised controls studies is deemed necessary in order for the effects of aggressive physiotherapy techniques to be clarified.

On the basis of the aforementioned results, the preliminary conclusion may be drawn that aggressive massage techniques have a positive effect on reducing edema-hematoma after hamstrings strain. In addition, they significantly reduce the recovery time in comparison to the standard approach.

These techniques need to be tested also in treatment of more severe muscle strains (grade II). However, based on the promising findings of this case study, it can be assumed that such techniques are likely to have an equally important impact on reducing the time of absence after more severe muscle strains. This is being amplified by the fact that reduction of post-traumatic edema-hematoma constitutes the predominant problem in these cases. Future studies should also compare traditional

and aggressive physiotherapy in restoration of other important parameters such as elasticity, strength and proprioception.

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