Proceedings of the 6th International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/2026.37933

The Management of Hamstring Strain Injury with Kinesitherapy

Yimeng Wang

Life and Health Institute, Sanda University, Shanghai, China
YimengWang606@outlook.com

Abstract. Nowadays, with the development of science and technology, and the widespread dissemination of health knowledge. There is an increasing number of people are beginning to pay attention to their health. Sports have become an important part of the public's lifestyle. Sports Injuries are no longer confined to professional athletes. Therefore, the management of injuries and scientific prevention have become more important. Common injuries include muscle strains, sprains, and fractures. Hamstring Strain Injury is one of the Sports Injuries. This review is aimed to focus on the Hamstring Strain Injury and explore how to treat and rehabilitate the patients who have the Hamstring Strain Injury with Kinesitherapy. Helping them back to their daily life more quickly and moving on to the next stage of exercising or training.Kinesitherapy is one of the important methods of the physical therapy. Instead of using machines during rehabilitation training, it needs patients to cooperate with the therapists to perform simple movements and start with targeted exercise training more actively.Furthermore, this review also provides a brief explanation on how to prevent hamstring injuries.

Keywords: Management, Hamstring Strain Injury, Kinesitherapy

1. Introduction

Hamstring Strain Injury is a soft tissue injury and it is usually accompanied by pain, swelling, bruising and decreased muscle strength, etc. [1]. It refers to an injury that occurs in skeletal muscles at the back of the thigh due to excessive stretching, sudden force application, or excessive load during exercise. Most Hamstring Strain Injuries occur in the long head of the biceps femoris. The main symptoms include pain, swelling, loss of strength and limited mobility in skeletal muscles at the back of the thigh. Hamstring Strain Injury is relatively prevalent among athletes.It is a common injury and accounts for 12% of all muscle injuries [2]. The incidence rate of Hamstring Muscle Injury among athletes ranges from 12% to 37%. The recurrence-rate of Hamstring Strain Injury is from 12 % to 31 % [3]. Running, jumping and kicking are the High-Risk activities that cause Hamstring Strain Injury. Football, rugby, and track and field are more likely to cause Hamstring Strain Injury.The previous study shows that for every 25 football players, 4 to 6 of them suffer from hamstring injuries [4]. These movements will cause the muscles overstretched and lead to damage of muscle fibers and disruption of associated vascular and connective tissue structures. When the anatomical positioning changes from eccentric contraction to concentric contraction rapidly, the

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-8818/2026.37933

hamstring muscles are more likely to be strained [3]. Besides sports, anterior pelvic tilt can also lead to Hamstring Strain Injury. It will stretch the Hamstring muscles and increase the potential risks of Hamstring Strain Injury [1].

Hamstring Strain Injury will limit the flexion of the knee joint, and people will have difficulties in squatting up and downs or going upstairs and downstairs. The recovery period for Hamstring Strain Injury is quite long, which can affect people's normal life and the quality of life. For athletes, Hamstring Strain Injury will lead to a long recovery period, which may reduce their exercise intensity and frequency. Daily rehabilitation also takes up a considerable amount of time, and it is accompanied by some emotional and financial costs [5]. Hamstring Strain Injury can be treated with physical therapy. The commonly used physical therapy includes Kinesitherapy. However, there are currently few reviews on the management of hamstring injuries through with Kinesitherapy, and there is a lack of systematic organization and analysis. This review mainly focuses on using Kinesitherapy to help athletes or amateurs prevent hamstring injuries, and to facilitate their autonomous rehabilitation after the Hamstring Strain Injury in order to minimize the recurrence of injuries and return to their daily training and life more quickly.

From an anatomical perspective, the Hamstring muscles are a group of muscles located on the back of the thigh. From lateral to medial, they are the biceps femoris long head, biceps femoris short head, semitendinosus, and semimembranosus [6]. Most of them originate from the ischial tuberosity, and respectively insert on the tibia and fibula .

Biceps femoris muscle is located in the posterior thigh. When the proximal part is fixed, the biceps femoris long head extends the thigh at the hip joint and the biceps femoris short head causes the lower leg to flex and rotate outward at the knee joint. When the distal part is fixed, both sides contract together will make the posterior pelvic tilt, and one sides contract will flex the thigh at the knee joint.

Semitendinosus is located in the superficial layer of the posterior thigh. Semimembranosus is located in the deep layer of the posterior thigh. When the proximal part is fixed, it extends the thigh at the hip joint and makes the lower leg flex and do internal rotation at the knee joint. When the distal part is fixed, the main activities are the same as when the biceps femoris is fixed at the distal part.

From a physiological perspective, Hamstring muscles' mainly fiction is to flex the knee joint and extend the hip joint, and help to keep the lower limbs stable and coordinated during movement. Hamstring muscles can control the excessive movement of the knee joint and the hip joint through eccentric contraction and concentric contraction. Besides, hamstring muscles can also help to reduce the impact force caused by exercise and minimize the stress on the joints.

2. The management of Hamstring Strain Injury

After the patient is diagnosed with the Hamstring Strain Injury, the most important thing is to formulate management and rehabilitation plans. The management can help the patients back to their normal activities more quickly and reduce the risk of recurrence of the hamstring muscles.The management of the Hamstring Strain Injury can be divided into three stages. The first stage mainly aims to relieve the patients' pain, reduce inflammation and swelling. In the second stage, patients can increase the intensity of the exercise according to their own conditions. The third stage mainly involves using some eccentric resistance training to help patients regain their muscle strength [7]. It's worth noting that the management should be formulate based on patients' own condition. If the patients feel that the pain is increased or joint stiffness during rehabilitation, the treatment should be temporarily halted to prevent further damage. The followings are the managements of Hamstring

DOI: 10.54254/2753-8818/2026.37933

Strain Injury with Kinesitherapy, including Eccentric Exercise, Progressive Running, and Progressive Agility and Trunk Stability Exercises (PATS).

2.1. Eccentric exercise

Eccentric exercise ,such as stretching, diving and gliding, the research has shown that eccentric exercise can shorten the recovery time significantly. A study included 2122 participants. The average age is 23 and 93.7 % male athletes across the study. It has shown that Eccentric exercise helps patients return to play significantly faster (MD = − 4.39, 95 % CI [− 5.67, − 3.11]) compared to those who didn't use eccentric exercise during rehabilitation. What's more, it also showed that the average recovery time for athletes who do eccentric exercise during rehabilitation was 49 days, while the average recovery time for those who did not do eccentric exercise was 86 days [3]. Another study included 75 participants who have acute hamstring strain injury. It showed that people who do eccentric exercise can return to play in about 28 days, but those do not do eccentric exercise can return to play in about 51 days. From this study, the conclusion is that the rehabilitation program centered on eccentric exercise can help people return to play more quickly [8].

It is known that eccentric exercise accelerates the recovery of hamstring injuries. The training starts on the 5th day after the injury. Pain induction is strictly prohibited throughout the process. Supervision and training are conducted at least once a week, gradually increasing speed and load. Firstly, the hip flexion is at 90°, the affected thigh is fixed, and the knee is slowly extended until it approaches the pain. This is done twice a day, 3 sets of 12 repetitions each.

The affected leg stands and simulates a dive, maintaining the pelvis level. The standing knee is 10-20°, the leg is lifted and flexed at 90°, the movement is extremely slow. Every other day, 3 sets of 6 repetitions.The affected leg bears the weight of the heel, the other leg slides backward until it is close to the pain, relying on the arms to return, and the affected leg does not exert force. Every 3 days, 3 sets of 4 repetitions [8]. In this way, it can help patients to recover more effectively and faster. If patients do not do this training, it may lead limitation of ROM in joints, and result in a second injury to the hamstring muscles. The Nordic Hamstring Exercise (NHE) is also a kind of eccentric exercise.When the patients can complete the simple eccentric exercise at maximum intensity, they can start to do The Nordic Hamstring Exercise (NHE). Physiotherapists ask athletes to perform the exercise eccentrically-concentrically. This management is one of the fundamental approaches for treating hamstring injuries. With the help of the assistant, individuals keep both feet stable and then start in a kneeling position.When the thighs descend, the force is gathered in the posterior muscles of the thighs through eccentric contraction, and then the return to the upright kneeling position is accomplished by contracting the posterior thigh muscles [9].

Eccentric exercise can not only serve as a rehabilitation exercise of Hamstring Strain Injury, but also can effectively prevent the injury and recurrence. A study has compared the group of people who recovered from hamstring injuries through eccentric exercise with the group who did not. The results showed that eccentric exercise can significantly reduced the probability of secondary hamstring injuries, helped patients returned to exercise faster, and also enhanced muscle strength. Eccentric exercise has reduced the risk of recurrence (MD = − 1.95, 95 % CI [− 1.81, − 0.29]), and the recurrence reported at 2, 6, and 12 months is low. The analysis shows that eccentric exercise can reduce lower limb injuries by 28%. The research has shown that persisting in eccentric exercises can reduce hamstring injuries by 65% [10]. Besides, The Nordic Hamstring Exercise is the most common exercise performed in injury prevention program [11].

However, a study, involving 9,688 teenage participants, reached the conclusion that the management is less effective in preventing lower limb injuries among teenagers (RR = 0.75) [12].

DOI: 10.54254/2753-8818/2026.37933

The closer the RR value is to 1, the weaker the protective effect of the intervention is. One of the reasons is that the muscles and tendons of teenagers are still in the process of development [12]. It is worth noting that there are significant individual differences among teenagers, so training needs to be tailored to the specific needs of each individual.

2.2. Progressive running

For athletes, in order to recover their physical power more quickly and back to normal training, they can adopt the method of steadily increasing their running speed, and gradually return to sprint and high-speed running. The management can be divided into three stages. Athletes can use 50%, 70%, and 100% of their perceived maximal running speed respectively during rehabilitation [13]. When athletes have mild pain while walking, they can start the first stage: jogging. And gradually adjust to running at a moderate intensity according to their individual tolerance. When the moderate intensity running can be accepted, athletes can move on to the next stage: high-speed running. After the athletes can finish the high-speed running without pain, they can move on to the third stage. In the third stage, the progress to the maximum sprint speed should proceed with a slow rate. The reason is that when the running intensity exceeds 80% of the maximum speed, the eccentric contraction workload of the hamstring muscles will be increased significantly [14]. Progressive training can prevent recurrence of the hamstring muscles, while also helping athletes maintain a certain level of intensity in their exercise and preventing muscle strength decline.

Besides, this management can combine with eccentric exercise. It is called PRES. A study has shown that the mean time to return-to-sport was 28.8 ± 11.4 days by using PRES($P = .346$) [15].

The management can help athletes return to the daily training more quickly to some extent, minimizing the economic and time losses caused by Hamstring Strain Injury and help athletes return to the competition field more quickly. It is worth noting that when athletes do progressive running, they should also incorporate eccentric training and hamstring flexibility exercises to prevent recurrence to the hamstring muscles.

Although this management does help athletes recover faster, it still has its limitations. First of all, it is more suitable to the for athletes that require explosive power such as Football, track and field, etc. What's more, this management may lead to recurrence of the hamstring muscles. Among the 29 participants who began the PRES rehabilitation program, 3 of them suffered re-injury of hamstring strain injury [15]. So if athletes choose this management during their rehabilitation, they need to combine with their own conditions.

2.3. Progressive agility and trunk stability exercises

Progressive Agility and Trunk Stability Exercises (PATS) is also a management of rehabilitation for Hamstring Strain Injury, which aims to improve agility and trunk stability. The movement mainly occurs in the sagittal plane and the transverse plane of the human body. Progressive Agility and Trunk Stability Exercises can help patients apply load to their muscles through sagittal plane movements, preventing the tendon of the hamstring muscles from being overly stretched [16].

If the patient has just finished surgery, stretching the hamstring muscle 4 times a day after the surgery has finished about 48hours, which can appropriately accelerate the recovery of the knee joint extension range of motion after Hamstring Strain Injury [14].

Progressive Agility and Trunk Stability Exercises show no significant differences from progressive running and eccentric exercise in terms of returning to sports and the rate of recurrence of the hamstring muscles. The mean time to return-to-sport was 25.2 ± 6.3 days in the PATS

DOI: 10.54254/2753-8818/2026.37933

rehabilitation group (P = .346) [15]. It can be used as a rehabilitation method after hamstring muscle injury. However, the treatment effect needs further research due to the lack of data comparison [16].

3. Prevention

In addition to the managements and rehabilitation after hamstring injury, the prevention of hamstring injury should not be overlooked either.

First of all, the most fundamental and easiest thing to do is to warm up before exercise, to prevent the hamstring muscles from getting strained due to the sudden increase in exercise intensity. Hamstring Strain Injury is mainly caused by strength, flexibility, muscle fiber length and limb asymmetry. For insufficient strength of the hamstring muscles, eccentric exercises can be adopted to enhance the strength of the hamstring muscles, including the concentric strength. For insufficient flexibility, static stretching can be used to improve it, such as hip extension exercises. For the length of muscle fibers, eccentric exercises can also be used to improve it, and NHE can also help in improving the muscle fiber length. Studies have shown that eccentric exercises can increase the length of muscle bundles by 16.2%, while NHE can increase it by 7.4%. For limb asymmetry, athletes can perform abduction exercises or practice with resistance bands. Through these exercises, people can make up for the deficiency of the hamstring muscles to some extent and prevent hamstring injuries [17]. The training exercises for the hamstring muscles also include supine hip extension, roll-out, crunches, push-ups, knee, and skier, aiming to enhance core strength and flexibility and prevent hamstring injuries [2].

4. Conclusion

This review mainly discusses the management of hamstring injuries with Kinesitherapy, elaborating on several commonly used and effective treatment methods. Among them, eccentric exercise is not only the most effective in treating hamstring injuries but also can effectively prevent secondary hamstring injuries, and is an important part of rehabilitation. At the same time, the review also briefly summarizes the preventive measures for hamstring injuries, covering aspects such as training load management and flexibility training. Current research has fully affirmed the role of Kinesitherapy such as eccentric exercise in the management of hamstring injuries and the prevention of recurrence. However, there are still certain differences in the management and prevention effects brought about by different intervention modes. In the future, it is necessary to further explore the internal physiological mechanisms of Kinesitherapy, optimize key parameters such as training frequency, cycle, and load, and construct more precise individualized training prescriptions. At present, most related research focuses on athletes, and empirical data for other groups is still relatively lacking. In the future, the scope of research can be expanded to cover more types of sports.

References

[1] Martin, R. L., Cibulka, M. T., Bolgla, L. A., Koc, T. A., Jr, Loudon, J. K., Manske, R. C., Weiss, L., Christoforetti, J. J., & Heiderscheit, B. C. (2022). Hamstring strain injury in athletes. *The Journal of Orthopaedic and Sports Physical Therapy, 52*(3), CPG1–CPG44. https://doi.org/10.2519/jospt.2022.0301

[2] Al Attar, W. S. A., & Husain, M. A. (2023). Effectiveness of injury prevention programs with core muscle strengthening exercises to reduce the incidence of hamstring injury among soccer players: A systematic review and meta-analysis. *Sports Health, 15*(6), 805–813. https://doi.org/10.1177/19417381231170815

[3] Gómez-Soria, I. (2025). Comparative effectiveness of rehabilitation protocols for hamstring injuries: A systematic review and meta-analysis. *Journal of Bodywork and Movement Therapies, 44*, 820–832. https://doi.org/10.1016/j.jbmt.2025.06.030

DOI: 10.54254/2753-8818/2026.37933

[4] Sancese, A., Taylor, L., Walsh, G., Byrd, E., & Delextrat, A. (2023). Effects of sprint versus strength training on risk factors for hamstring injury in football players. *The Journal of Sports Medicine and Physical Fitness, 63*(4), 580–587. https://doi.org/10.23736/S0022-4707.22.14529-9

[5] Paton, B. M., Read, P., van Dyk, N., Wilson, M. G., Pollock, N., Court, N., Giakoumis, M., Head, P., Kayani, B., Kelly, S., Kerkhoffs, G. M. M. J., Moore, J., Moriarty, P., Murphy, S., Plastow, R., Stirling, B., Tulloch, L., Wood, D., & Haddad, F. (2023). London International Consensus and Delphi study on hamstring injuries part 3: Rehabilitation, running and return to sport. *British Journal of Sports Medicine, 57*(5), 278–291. https://doi.org/10.1136/bjsports-2021-105384

[6] Marrero, A. M., Mazza, L. A., Cedola, N., Neville, M. F., Trueba, R. H., Napoli, A., Pascual, T. A., Velez, C. M., Tapia, J., Rabino, M. A., Eivers, P. A., & Cobeñas, R. L. (2025). MRI and US in hamstring sports injury assessment: Anatomy, imaging findings, and mechanisms of injury. *Radiographics: A Review Publication of the Radiological Society of North America, Inc, 45*(5), e240061. https://doi.org/10.1148/rg.240061

[7] Erickson, L. N., & Sherry, M. A. (2017). Rehabilitation and return to sport after hamstring strain injury. *Journal of Sport and Health Science, 6*(3), 262–270. https://doi.org/10.1016/j.jshs.2017.04.001

[8] Askling, C. M., Tengvar, M., & Thorstensson, A. (2013). Acute hamstring injuries in Swedish elite football: A prospective randomised controlled clinical trial comparing two rehabilitation protocols. *British Journal of Sports Medicine, 47*(15), 953–959. https://doi.org/10.1136/bjsports-2013-092165

[9] Yetter, T. R., Halvorson, R. T., Wong, S. E., Harris, J. D., & Allahabadi, S. (2024). Management of proximal hamstring injuries: Non-operative and operative treatment. *Current Reviews in Musculoskeletal Medicine, 17*(9), 373–385. https://doi.org/10.1007/s12178-024-09911-0

[10] Goode, A. P., Reiman, M. P., Harris, L., DeLisa, L., Kauffman, A., Beltramo, D., Poole, C., Ledbetter, L., & Taylor, A. B. (2015). Eccentric training for prevention of hamstring injuries may depend on intervention compliance: A systematic review and meta-analysis. *British Journal of Sports Medicine, 49*(6), 349–356. https://doi.org/10.1136/bjsports-2014-093466

[11] Augustsson, J., & Augustsson, S. R. (2022). Development of a novel Nordic hamstring exercise performance test device: A reliability and intervention study. *Sports (Basel, Switzerland), 10*(2), 26. https://doi.org/10.3390/sports10020026

[12] Hu, C., Du, Z., Tao, M., & Song, Y. (2023). Effects of different hamstring eccentric exercise programs on preventing lower extremity injuries: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 20*(3), 2057. https://doi.org/10.3390/ijerph20032057

[13] Hickey, J. T., Timmins, R. G., Maniar, N., Rio, E., Hickey, P. F., Pitcher, C. A., Williams, M. D., & Opar, D. A. (2020). Pain-free versus pain-threshold rehabilitation following acute hamstring strain injury: A randomized controlled trial. *The Journal of Orthopaedic and Sports Physical Therapy, 50*(2), 91–103. https://doi.org/10.2519/jospt.2020.8895

[14] Hickey, J. T., Opar, D. A., Weiss, L. J., & Heiderscheit, B. C. (2022). Hamstring strain injury rehabilitation. *Journal of Athletic Training, 57*(2), 125–135. https://doi.org/10.4085/1062-6050-0707.20

[15] Silder, A., Sherry, M. A., Sanfilippo, J., Tuite, M. J., Hetzel, S. J., & Heiderscheit, B. C. (2013). Clinical and morphological changes following 2 rehabilitation programs for acute hamstring strain injuries: A randomized clinical trial. *The Journal of Orthopaedic and Sports Physical Therapy, 43*(5), 284–299. https://doi.org/10.2519/jospt.2013.4452

[16] Poursalehian, M., Lotfi, M., Zafarmandi, S., Arabzadeh Bahri, R., & Halabchi, F. (2023). Hamstring injury treatments and management in athletes: A systematic review of the current literature. *JBJS Reviews, 11*(11), e23.00161. https://doi.org/10.2106/JBJS.RVW.23.00161

[17] Rudisill, S. S., Varady, N. H., Kucharik, M. P., Eberlin, C. T., & Martin, S. D. (2023). Evidence-based hamstring injury prevention and risk factor management: A systematic review and meta-analysis of randomized controlled trials. *The American Journal of Sports Medicine, 51*(7), 1927–1942. https://doi.org/10.1177/03635465221083998