

# Recent Advances in Non Surgical Rehabilitation Approaches for Medial Collateral Ligament Injuries: A Narrative Review

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## ABSTRACT

The Medial Collateral Ligament (MCL) is frequently injured, particularly in athletes involved in contact sports. Recent advancements in non surgical rehabilitation have shown promise in effectively treating MCL injuries, thereby avoiding the risks associated with surgical interventions. Cryotherapy remains the cornerstone of non surgical MCL rehabilitation, significantly reducing pain and inflammation. Ultrasound therapy has shown potential in promoting tissue healing and improving the range of motion. Low-level Laser Therapy (LLLT) and shockwave therapy have emerged as effective modalities for enhancing tissue repair and providing pain relief. Bracing plays a crucial role in providing stability and support, aiding the controlled rehabilitation process. Therapeutic exercises targeting the quadriceps and hamstrings are integral to restoring strength, flexibility and stability, thus facilitating the healing process. Despite these advancements, gaps remain in optimising the combinations and timing of these modalities. Future research should focus on comparing different rehabilitation protocols, evaluating long-term outcomes and exploring their cost-effectiveness. This review underscores the importance of non surgical rehabilitation in achieving favourable outcomes for MCL injuries, contributing to the growing body of evidence supporting these approaches.

**Keywords:** Exercise therapy, Medial collateral ligament, Orthotic devices, Physical therapy modalities

## INTRODUCTION

The MCL is one of the most commonly injured ligaments in the knee, particularly among athletes engaged in contact sports [1]. While surgical intervention has traditionally been the go-to approach for more severe MCL injuries, recent years have seen significant advancements in non surgical rehabilitation strategies that have the potential to yield favourable outcomes without the risks and recovery time associated with surgical procedures.

Comprehensive rehabilitation programs incorporating a variety of modalities have emerged as effective alternatives to surgery for many patients. Therapeutic exercises targeting the stabilising muscles around the knee joint, such as the quadriceps and hamstrings, can help restore strength, flexibility and range of motion, ultimately facilitating the healing process and reducing the likelihood of further injury [2].

Bracing and taping techniques have also proven valuable in the non surgical management of MCL injuries, providing external support and stability to the joint while allowing for controlled movement and progressive rehabilitation [3,4].

The healing process of the MCL typically involves several stages. Initially, the body responds to the injury by initiating an inflammatory phase to bring in the necessary cells for healing. This is followed by the proliferation phase, during which new tissue is laid down to repair the damaged ligament. Finally, the remodelling phase occurs as the new tissue matures and gains strength [5].

Non surgical rehabilitation plays a crucial role in each of these phases by focusing on restoring muscle strength and flexibility around the knee joint. This helps provide support and stability to the healing MCL and reduces the risk of reinjury [6]. Additionally, exercises that target proprioception—the body's awareness of its position in space—are also important for improving balance and coordination, further aiding in the healing process.

Along with targeted exercises, modalities such as ultrasound and electrical stimulation may be used to promote tissue healing and reduce inflammation. Gradual progression of weight-bearing

activities and joint mobility exercises are also integral in restoring normal function to the knee while protecting the healing MCL [7]. The majority of patients with MCL injuries, even those of moderate severity, can achieve a return to their preinjury activity level through non operative treatment alone.

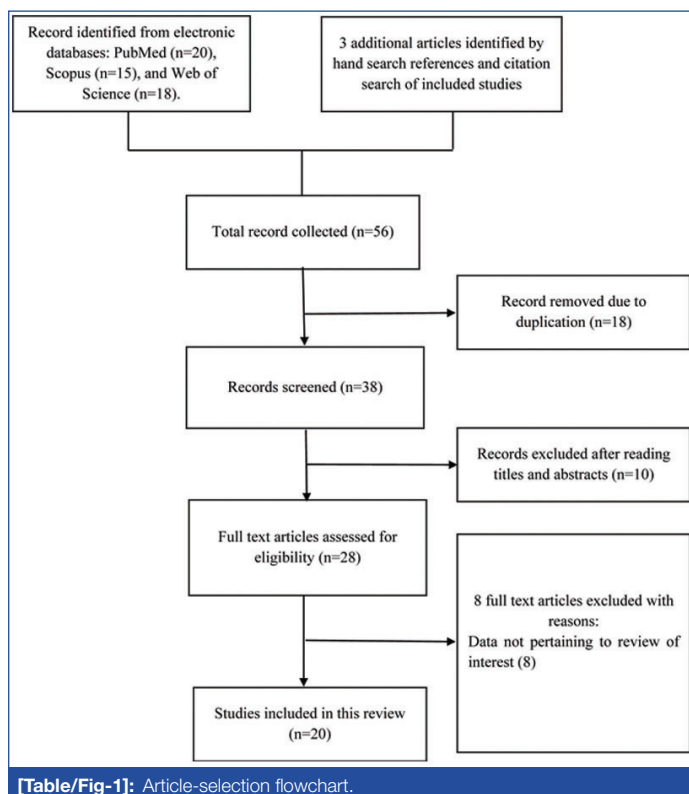
Overall, non surgical rehabilitation for MCL injuries aims to optimise the healing environment and restore full function to the knee, allowing individuals to return to their normal activities with a reduced risk of persistent instability or recurrent injury. The present narrative review on recent advances in non surgical rehabilitation approaches for MCL injuries provides a comprehensive understanding of the benefits of non surgical interventions. By exploring the effectiveness of therapeutic exercises, bracing and taping techniques, the present review highlights the potential for favourable outcomes without the need for surgical procedures.

The review also emphasises the importance of comprehensive rehabilitation programs that aim to restore strength, flexibility and range of motion, ultimately facilitating the healing process and reducing the likelihood of further injury. Additionally, it addresses the potential for patients with MCL injuries to achieve a return to their preinjury activity level through non operative treatment alone, thus emphasising the significant benefits of non surgical management. Overall, the present narrative review contributes to the growing body of evidence supporting the effectiveness of non surgical rehabilitation approaches for MCL injuries, thereby highlighting its relevance and potential impact on clinical practice.

## REVIEW OF LITERATURE

The present narrative review identifies and synthesises relevant literature on recent advances in non surgical rehabilitation approaches for MCL injuries. A comprehensive search of electronic databases, including PubMed, Medical Literature Analysis and Retrieval System Online (MEDLINE), Embase and Google Scholar, was conducted using a combination of keywords such as “MCL injury,” “physical modalities,” “bracing,” “therapeutic exercises,” and “taping techniques.” The search focused on studies published

until January 2023. The search focused on studies about the non surgical management of MCL injuries [Table/Fig-1].



Studies that investigated the effectiveness of non surgical interventions for MCL injuries, including therapeutic exercises, bracing and taping techniques, were included in the present review. Studies that focused on surgical interventions or those with incomplete follow-up data were excluded. Editorials, commentary pieces and unpublished theses/dissertations were also excluded. A narrative approach was adopted to present and discuss the results.

## RESULTS

The results of the literature review were interpreted and discussed in the context of the existing body of knowledge on non surgical rehabilitation for MCL injuries. The present literature review examines various types of physical modalities, therapeutic exercises, manual therapy and special techniques. The interventions were evaluated and the key findings are discussed.

### Physical Modalities

Cryotherapy is a versatile and effective component of non surgical rehabilitation for MCL injuries, aiding in pain management, reducing inflammation and accelerating recovery. Its application should be carefully tailored to each patient's specific needs and the characteristics of their injury to maximise benefits.

The use of cryotherapy or cold therapy has been a mainstay in the non surgical management of MCL injuries. Several studies have demonstrated the effectiveness of cryotherapy in reducing inflammation and pain after soft-tissue injury. A systematic review examining the physiological effects of cryotherapy found that it can significantly reduce blood flow, metabolic rate and inflammatory markers in affected tissues [8]. Another study showed that intermittent cryotherapy reduced the injured area by approximately 25% compared to untreated muscle, suggesting its potential to limit secondary hypoxic injury [9].

Ultrasound therapy is another modality that has been investigated for its role in the non surgical rehabilitation of MCL injuries. A review article in the Journal of Orthopaedic and Sports Physical Therapy concluded that ultrasound therapy can be effective in reducing pain and improving the range of motion in patients with ligament sprains,

including MCL injuries [10]. The authors suggest that the thermal and mechanical effects of ultrasound may help promote tissue healing and reduce inflammation. Further research into therapeutic ultrasound for MCL injury rehabilitation has shown promising results. A study showed the effects of therapeutic ultrasound in MCL injury rehabilitation and found that it led to significant improvements in pain relief and functional outcomes compared to standard rehabilitation alone [11]. Additionally, a systematic review in the Journal of Clinical Medicine highlighted the potential of therapeutic ultrasound in promoting collagen realignment and accelerating the healing process of ligament injuries [12].

Laser therapy, also known as LLLT, has been increasingly recognised for its potential in the non surgical rehabilitation of MCL injuries. Several studies have investigated the role of laser therapy in promoting tissue healing and pain reduction in MCL injuries. Putra SJ and Anggiat L demonstrated that physiotherapy interventions, including laser therapy, can effectively reduce pain and inflammation in MCL injuries. The authors reported that laser therapy resulted in a significant decrease in pain scores and improved functional outcomes in patients with MCL injuries. This suggests that laser therapy may be a valuable non invasive option for managing pain and discomfort during the rehabilitation process [13].

Furthermore, a study by Ezzati K et al., conducted a systematic review on the effects of high-intensity laser therapy on musculoskeletal pain. This review indicated that laser therapy can modulate the inflammatory response, promote tissue repair and enhance collagen synthesis, thereby supporting the healing process of ligament injuries. These findings suggest that laser therapy may play a significant role in accelerating the recovery of MCL injuries by targeting the underlying physiological mechanisms involved in tissue healing [14].

Incorporating laser therapy into the non surgical rehabilitation of musculoskeletal disorders, including MCL injuries, has shown promise in improving pain management and promoting tissue healing. Further research and clinical trials are warranted to establish the optimal protocols and efficacy of laser therapy in MCL injury rehabilitation [15].

Shock wave therapy has emerged as a novel approach for the non surgical rehabilitation of MCL injuries. A study examined the effects of shock wave therapy on musculoskeletal injuries and found that it could effectively stimulate the healing process and promote tissue regeneration. The authors reported that shock wave therapy led to improvements in pain relief and functional outcomes in patients with musculoskeletal injuries, making it a potential adjunct to conventional rehabilitation methods [16].

### Braces

Bracing is a crucial component of non surgical rehabilitation for MCL injuries. Several studies have investigated the role of braces in providing stability and support to the injured knee, thereby aiding the healing process and facilitating a gradual return to normal function. One study successfully developed a new, low-cost knee brace design using 3D printing materials, which proved effective for ligament injuries of the knee, including MCL injuries. This new design demonstrated improved safety features and affordability compared to traditional knee braces [17].

A study conducted by Blecha K et al., concluded that prophylactic braces reduce ligament injuries, including MCL injuries, in various sports activities [18]. Additionally, Dzikotor GK et al., supported these findings in their research [19]. Hewlett J and Kenney J highlight significant advancements in knee bracing technology that can enhance patient outcomes. The authors reported that using a brace led to improved proprioception and decreased the risk of reinjury during weight-bearing activities, thereby enhancing the overall stability of the knee joint [20].

These studies indicate that braces can help limit the range of motion at the knee joint and reduce strain on the healing MCL, thereby facilitating a controlled and protected environment for optimal healing.

This, in turn, may contribute to improved functional outcomes and reduced recovery time in individuals with MCL injuries.

### Therapeutic Exercises

Therapeutic exercises play a crucial role in the non surgical rehabilitation of MCL injuries. They are instrumental in promoting strength, flexibility and stability in the affected knee while also aiding in the restoration of normal function and range of motion. Therapeutic exercises play a crucial role in the rehabilitation of MCL injuries, as they are integral to the non operative treatment approach that is standard for most MCL injuries [21]. These exercises are part of an aggressive early functional rehabilitation program, which is the currently recommended treatment for isolated MCL sprains. The goal of therapeutic exercises is to restore motion, improve quadriceps muscle strength and ensure proper healing of the MCL, which is to achieving good functional outcomes without residual medial instability [22].

Therapeutic exercises are a fundamental component of the conservative management of MCL injuries, aimed at restoring the function and stability of the knee joint. The rehabilitation protocol must be tailored to the severity of the injury and the presence of any associated injuries, with a structured approach being critical for successful management and return to activity [23]. Despite the consensus on the importance of therapeutic exercises, the role of additional interventions, such as bracing and the specifics of exercise protocols in complex injury scenarios continue to be areas of ongoing research and discussion.

The role of specific exercises in the rehabilitation of MCL injuries has not been directly addressed in this study. However, several papers have discussed aspects of rehabilitation and recovery that can be related to the use of exercises in the treatment of MCL injuries. Khalid K et al., concluded that, compared to strength training, neuromuscular training was significantly more effective in reducing pain and improving function, quality of life, strength and power. Although this study did not specifically address MCL injuries, the principles of neuromuscular control and strength training are relevant to the rehabilitation of ligament injuries in general [24]. Razi M et al., presented a case in which spontaneous healing of ACL and MCL injuries occurred without surgical intervention, indicating that the body has an intrinsic capacity for healing ligament injuries. This suggests that conservative treatment, potentially including specific exercises, may be a viable option for some MCL injuries [25]. Further research is required to directly address the role of specific exercises in MCL injury rehabilitation.

### Taping Technique

The role of taping in the rehabilitation of MCL injuries is not explicitly detailed in published papers. However, the literature suggests that non operative treatment, including bracing and rehabilitation, is the mainstay for MCL injuries, particularly for isolated sprains [4]. Taping can be considered a form of lightweight support, similar to bracing, which is mentioned as part of the treatment regimen for MCL sprains. While prophylactic bracing has the potential to prevent MCL injuries, its effectiveness in the context of rehabilitation remains uncertain. Studies emphasise the importance of functional rehabilitation programs and structured rehabilitation protocols, which could potentially include taping as a supportive measure [26].

### Narrative Synthesis

Non surgical rehabilitation approaches for MCL injuries have shown promising results in recent years, offering a viable alternative to surgical intervention for many patients. These approaches focus on comprehensive rehabilitation programs that include therapeutic exercises targeting the stabilising muscles around the knee joint, such as the quadriceps and hamstrings. These exercises aim to restore

strength, flexibility and range of motion, ultimately facilitating the healing process and promoting a safe return to physical activities [27].

Recent advances in non surgical rehabilitation for MCL injuries can be attributed to the growing understanding of ligament anatomy, biomechanics and healing potential. The literature suggests that non operative treatment is often the standard of care for MCL injuries, particularly for isolated injuries. This approach typically includes bracing, activity modification and rehabilitation with an emphasis on early functional rehabilitation to promote healing and restore function [4].

However, contradictions and interesting facts should be considered. Although non operative management is widely accepted, the effectiveness of prophylactic bracing in preventing MCL injuries remains uncertain [11]. Additionally, the role of surgical intervention in cases of combined ligament injuries is still debated, with some advocating for early reconstruction of cruciate ligaments and others supporting delayed reconstruction following non operative MCL treatment [4].

Moreover, the use of advanced imaging techniques, such as Magnetic Resonance Imaging (MRI) and ultrasonography, has improved the ability to diagnose the extent of MCL injuries and tailor rehabilitation protocols. Research in this area has shown promising outcomes, demonstrating that non surgical rehabilitation approaches can effectively promote healing and improve functional outcomes in patients with MCL injuries.

However, despite these advancements, there is still a research gap in identifying the optimal combination of modalities and the timing of their application within the rehabilitation process. Future studies should focus on comparing different rehabilitation protocols, evaluating long-term outcomes and identifying specific patient populations that would benefit the most from non surgical approaches. Additionally, exploring the cost-effectiveness of non surgical rehabilitation compared with surgical intervention would provide valuable insights for clinicians and healthcare decision-makers. Closing these research gaps will further strengthen the evidence base for non surgical rehabilitation approaches and guide clinical decision-making for healthcare professionals.

### Future Perspectives

Future perspectives in the non surgical rehabilitation of MCL injuries may focus on refining functional rehabilitation protocols, clarifying the role of prophylactic bracing and integrating diagnostic tools like ultrasonography to tailor rehabilitation approaches. Continued research is needed to optimise treatment algorithms, particularly for combined ligament injuries and to address the controversies surrounding the timing and indications for surgical intervention. The goal remains to achieve good functional outcomes and a safe return to activity or sports for patients with MCL injuries.

## CONCLUSION(S)

In conclusion, the consensus in the literature review supports non operative management as the primary treatment for MCL injuries, with rehabilitation techniques evolving alongside advances in bracing technology and diagnostic imaging. The role of surgical intervention remains controversial, particularly in the context of multi-ligament knee injuries. Future research should continue to refine rehabilitation protocols and explore the efficacy of prophylactic bracing, with the goal of optimising patient outcomes and facilitating a safe return to activity.

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