Can Instrument-Assisted Soft Tissue Mobilization Be Used to Increase Range of Motion in Frozen Shoulder?

Tuğba AKGÜLLER*, Yıldız ANALAY AKBABA**

Abstract

The aim of this review was to investigate studies using Instrument-Assisted Soft Tissue Mobilization (IASTM), to determine the effects of IASTM on shoulder mobility in frozen shoulder. Literature search was carried out on 21 March 2022 using PUBMED, Pedro, SCOPUS, Web of Science and Scholar databases. Appropriate clinical studies were identified from the above databases investigating the effects of IASTM on shoulder range of motion (ROM) in frozen shoulder and a narrative review was performed. Despite the very limited data on IASTM, which has just begun to increase in use in frozen shoulder, IASTM seems promising for ROM increase. Further studies with higher quality and larger samples are needed to confirm this view and recommend the appropriate IASTM technique for frozen shoulder.

Keywords: Frozen shoulder, adhesive capsulitis, instrument-assisted soft tissue mobilization, range of motion.

Donuk Omuzda Eklem Hareket Açıklığını Artırmak İçin Alet Destekli Yumuşak Doku Mobilizasyonu Kullanılabilir mi?

Öz

Bu derlemenin amacı, donuk omuzda Alet Destekli Yumuşak Doku Mobilizasyonunun (ADYDM) omuz mobilitesi üzerindeki etkilerini belirlemek için ADYDM kullanan çalışmaları araştırmaktı. 21 Mart 2022 tarihinde PUBMED, Pedro, SCOPUS, Web of Science ve Scholar veri tabanları kullanılarak literatür taraması yapılmıştır. ADYDM'nin donuk omuzda omuz eklem hareket açıklığı (EHA) üzerindeki etkilerini araştıran yukarıdaki veri tabanlarından uygun klinik çalışmalar belirlendi ve incelendi. Son dönemde donuk omuzda kullanımı artmaya başlayan ADYDM ile ilgili çok sınırlı veri olmasına rağmen ADYDM, EHA artışı için umut verici görünmektedir. Bu görüşü doğrulamak ve donuk omuz için uygun ADYDM tekniğini önermek için daha yüksek kalitede ve daha büyük örneklerle daha fazla çalışmaya ihtiyaç vardır.

Anahtar Sözcükler: Donuk omuz, adeziv kapsülit, alet destekli yumuşak doku mobilizasyonu, eklem hareket açıklığı.

Derleme Makale (Review Article)
Geliş / Received: 14.04.2022 & **Kabul / Accepted:** 06.07.2023
DOI: https://doi.org/10.38079/igusabder.1101132
* PhD Student, Department of Physiotherapy and Rehabilitation, Institute of Graduate Studies, Istanbul University-Cerrahpasa, Istanbul, Türkiye. E-mail: tugbaakguller@gmail.com ORCID https://orcid.org/0000-0002-5861-5521
** Assoc. Prof., Division of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Istanbul University-Cerrahpasa, Istanbul, Türkiye. E-mail: yildizanalay@iuc.edu.tr ORCID https://orcid.org/0000-0002-8141-6977

Introduction

Frozen shoulder, also often referred to as adhesive capsulitis, is a common musculoskeletal condition characterized by progressive loss of passive and active mobility of the glenohumeral joint[1]. In frozen shoulder, upper extremity functions are limited due to pain and stiffness in the glenohumeral joint. Patients typically report a gradual onset of pain and stiffness and worsening over time. They complain that their activities such as sleeping, dressing, reaching and grooming are limited due to pain and stiffness. Shortening and fibrosis occur in the joint capsule ligaments around the shoulder joint, which narrows the volume of the capsule, leading to decreased mobility[2]. Decreased joint range of motion (ROM) and pain may be caused by capsule and ligament tightness, and may also be caused by muscle tightness, fascial limitations, and myofascial trigger points in the muscles[3]. Previously, studies investigating the effects of methods such as joint mobilization, soft tissue mobilization, stretching, and proprioceptive neuromuscular facilitation (PNF) for the management of this reduction in ROM have been conducted[4].

Instrument assisted soft tissue mobilization (IASTM) technique, which is one of the soft tissue mobilization procedures, was developed from Cryiax cross friction massage and has become popular recently. The IASTM technique has been used in several different populations to date and has been shown to contribute to the increase in ROM[5,6]. However, there is still a lack of use of IASTM in frozen shoulder. Therefore, the purpose of this review was to examine studies using IASTM in frozen shoulder and to determine the usability of this technique for increasing shoulder ROMs. However, there is still insufficient data on the use of IASTM in frozen shoulder. Therefore, the purpose of this review was to identify studies using IASTM in frozen shoulder and to determine the effects of this technique in shoulder ROMs.

Frozen Shoulder

Frozen shoulder was first described by Duplay in 1872 as “periarthritis scapula-humera”, but later in 1934 Codman defined this condition as frozen shoulder[7,8]. Nevasier was the first to define "adhesive capsulitis", which is the thickening and contraction of the capsule that has become adhered to the humeral head[2]. Recently, the term frozen shoulder contracture syndrome has been suggested to describe the pathology, as the evidence for capsular adhesions in the humeral head has been refuted[9]. In frozen shoulder, limitation in function occurs due to pain and stiffness in the glenohumeral joint. Patients typically describe a process that begins with shoulder pain followed by loss of mobility[10]. Two types have been described in the literature, idiopathic and secondary frozen shoulder. Idiopathic frozen shoulder occurs spontaneously without any triggering factor and is associated with a chronic inflammatory response accompanied by fibroblastic proliferation, an abnormal immune response[11]. Secondary frozen shoulder occurs due to some intrinsic, extrinsic and systemic predisposing factors. Four stages of frozen shoulder have been described. In stage 1, patients describe sharp pain at the end of movements, pain at rest, and sleep disturbance, and this stage can last up to 3 months. In stage 2, there is a gradual loss of all-

round movement of the shoulder due to pain. This stage is also known as the "freezing" or "painful" or stage and can last from 3 to 9 months. There is aggressive synovitis/angiogenesis and some loss of movement. Stage 3 is also known as the "frozen" stage. There is pain and loss of movement and lasts 9-15 months. At this stage, synovitis/angiogenesis decreases, while axillary fold and ROM decrease due to progressive capsuloligamentous fibrosis. Passive ROM of the glenohumeral joint is limited in all directions, especially in external rotation (especially in adduction). Stage 4 is also known as the “Thawing” stage. Pain begins to resolve, but stiffness persists for 15-24 months after the onset of symptoms. Although frozen shoulder is initially thought to be a self-limiting process at 12-18 months, mild symptoms may persist for years, depending on the extent of the fibroplasia and subsequent resorption[12].

Role of Soft Tissue Mobilization in Frozen Shoulder

In frozen shoulder, it takes a long time to decrease the pain and achieve a significant improvement in ROM, and this causes a decrease in the quality of life of the patients. Therefore, the need for treatment options that promise recovery in a shorter time increases. Conservative treatment of frozen shoulder includes patient education, exercises, activity modification, manual therapy, corticosteroid injection and non-steroid anti-inflammatory drugs. Current literature reports that manual therapy combined with exercise has a positive effect on more effective pain and function[13]. In frozen shoulder, the joint capsule ligaments around the shoulder joint are shortened and fibrosis occurs. Contracture of the ligaments narrows the volume of the capsule, reducing the ROM[2]. Mobilizations for the glenohumeral joint (such as angular mobilization, translational mobilization, Mulligan technique and Maitland technique) are generally used to reduce this limitation in joint mobility[14]. However, ROM limitation and pain in these patients can be caused by capsule and ligament tightness, as well as muscle tension, facial limitations and myofascial trigger points in the muscles. There is usually limitation of the latissimus dorsi and subscapularis insertion, as well as the lower glenohumeral capsule and pectoral fascia. It was previously suggested that deep friction massage and soft tissue mobilization may benefit patients with frozen shoulder[3]. Atici et al. found that soft tissue mobilization to the subscapularis muscle combined with conventional treatment in both frozen shoulder patients and patients with rotator cuff lesions resulted in greater increases in pain, external rotation ROM, and overhead reach distance[15]. Guler-Uysal and Kozanoğlu found that deep friction massage performed with the Cyriax method in the early stage of frozen shoulder treatment responded faster and better than surface heat and diathermy[16]. Nambi et al. showed that myofascial release with trigger point therapy applied to frozen shoulder patients increased shoulder mobility more than scapular stabilization exercise and interference interferential therapy alone[17]. Yatheendra Kumar et al. determined that both active release technique and muscle energy technique increased shoulder ROM in frozen shoulder compared to conventional treatment alone[18].

Instrument-Assisted Soft Tissue Mobilization (IASTM)

IASTM, which has become increasingly popular recently, is a soft tissue mobilization derived from Cryiax cross friction massage and applied with special hard instruments[19,20]. The first IASTM study was conducted in 1997, but since then its use has increased as an alternative to other manual therapy techniques[21].

This method works through localized inflammation and facilitates collagen synthesis and realignment. By transmitting appropriate pressure to the soft tissues, localized inflammation with microvascular bleeding is achieved. Thus, blood flow to the injured area increases as more fibroblasts are recruited. Healing is supported by the removal of adhesions, as well as by laying fibroblasts with collagen organization[22]. In addition, it is thought that the tools used in the IASTM technique provide some advantages. These include providing mechanical advantage by affecting the more specific area and deeper tissue, and less stress on the clinician's hands and fingers compared to other manual techniques[20,22]. Also, the use of these instruments can increase the vibration perception of both the patient and the clinician, making it easier for the clinician to detect tissue properties and making it easier for the patient to feel the change in the treated tissues[22,23].

IASTM instruments have different material and design features used in various conditions involving the musculoskeletal system. Within the IASTM umbrella, there are many different instruments such as ASTYM, Fascial Abrasion Technique, Graston Technique, and HawkGrips, each of which is an application protocol determined by the manufacturer company[24]. Although they involve different instruments and application protocols, all these techniques are thought to collectively induce collagen repair and regeneration due to fibroblast recruitment by IASTM, as well as stimulate connective tissue remodeling by resorption of excess fibrosis. This leads to the release and breakdown of adhesions, fascial restraints, and scar tissue[25,26].

IASTM in the Literature

Initially, IASTM is mostly used in the asymptomatic population, but recently it seems that its use has increased in some musculoskeletal conditions. A recent systematic review identified baseball players, soccer players, overhead athletes and healthy people as the asymptomatic population for which IASTM was used. As musculoskeletal conditions, lateral epicondylopathy, patellar tendinopathy, achilles tendinopathy, carpal tunnel syndrome and spinal pain (Thoracic, neck and low back) were reported[5]. In the following years, studies were conducted in which IASTM was also used in some shoulder pathologies. Amin et al. found that IASTM had positive effects on pain, grip strength and function in subacromial impingement syndrome[27]. Aksan Sadikoglu et al. found improvement in pain, pressure pain threshold, ROM, function, active trigger points, anxiety and depression with the IASTM technique. They also found that IASTM was as effective as ischemic compression in improving pain and ROM [6].

IASTM and Frozen Shoulder in the Literature

Literature search was carried out on 21 March 2022 using Pubmed, Pedro, Scopus, Web of Science databases. Appropriate clinical studies were identified from the above databases investigating the effects of IASTM in frozen shoulder and a narrative review was performed. A total of 4 results were obtained, including the use of IASTM in AC, through literature review. Of these results, 1 was a clinical trial enrollment, 2 was a randomized clinical trial, and 1 was a case study (Table 1).

Table 1. Details of studies investigating the effects of IASTM on ROM in frozen shoulder patients

Author	Study Design	Condition	Intervention Group	Comparator Group	Outcome	Duration	Result
Fousekis & Mylonas [30] (2017)	Case Report	62-year-old patient	IASTM (Ergon® IASTM (Technique) + Strecth	None	-Flexion -Internal rotation	8 session	Increase in internal rotation
Kaya Mutlu et al. [29] (2020)	RCT	Frozen shoulder (Phase-II) (n=30)	IASTM (Graston Technique) + manuel stretching	Joint mobilization + manuel stretching	Active ROM: -Flexion -Extension -Abduction -IR -ER	2 days per week for 6 weeks	Abduction: Mobilization Group > IASTM Group
Aggarwal et al.[28] (2021)	RCT	Frozen shoulder (n=30)	IASTM (The Edge Mobility Tool) + Maitland mobilizations (III-IV), posterior capsular stretch, pectoral stretch, wand &codman's exercises. Application side: Pectoral fascia, Deltoid fascia, Glenohumeral capsule.	Conventional treatment group: Maitland mobilizations (III-IV), posterior capsular stretch, pectoral stretch, wand &codman's exercises.	Passive & Active ROM: -Flexion -Extension -Abduction -IR -ER	3 days a week Period 4 weeks	Passive ROM: IASTM > Conventional treatment (0-2 week: Abduction & IR : 2-4 week: flexion, extensiton, ER 0-4 week: All ROMs Active ROM: IASTM > Conventional treatment (0-2 week: Abduction, IR, ER 2-4 week: flexion, extensiton 0-4 week: All ROMs)

RCT: Randomized controlled trial, IASTM: Instrument-assisted soft tissue mobilization, ROM: Range of motion, IR: Internal rotation, ER: External rotation.

Aggarwa et al. compared IASTM and conventional therapy in 30 frozen shoulder patients aged 35-60 years. In the IASTM group, they applied conventional treatment with the Edge Mobility Tool to the glenohumeral capsule, pectoral fascia, and deltoid fascia with myofascial release. They applied 10 minutes of hydrocollator pack, grade III and IV Maitland mobilizations, pectoral stretching, posterior capsule stretching, wand exercises, and Codman's exercises to the conventional therapy group. At the end of the treatments they applied for 4 weeks, 3 days a week, they found that there was a greater increase in both passive and active ROMs of the shoulder in the IASTM group[28].

Kaya Mutlu et al. compared IASM and joint mobilization in 30 phase 2 frozen shoulder patients aged 39-65 years. 2 days a week for 6 weeks to 30 phases. They applied IASTM plus manual stretching to the IASTM group for 6 weeks, 2 days a week, and joint mobilization plus manual stretching to the mobilization group. At the end of 6 weeks, they determined that there was a significant increase in shoulder ROMs in both groups, but there was a greater increase in shoulder abduction in the mobilization group. However, the information on which area and for how long the IASTM technique was applied could not be reached [29].

Fousekis and Mylonas applied the Ergon® IASTM Technique with 8 sessions of stretching to a 62-year-old frozen shoulder patient. They found that passive internal rotation ROM of the painful shoulder, which was initially 50° at 90° abduction, increased to 78° and 85° after the 4th and 8th treatments, respectively. However, the information on which area and for how long the IASTM technique was applied could not be reached[30].

Conclusion and Recommendations

As a result of the literature review, it was seen that the effects of IASTM in frozen shoulder were investigated only in case study and randomized clinical trials without placebo or no treatment control group. Other limitations of these studies are that the frozen shoulder phases of the study samples are not clearly given, the number of cases is small, and the treatment groups are not homogeneous. In addition, the lack of detailed explanation of IASTM techniques in some studies does not make it possible to compare IASTM techniques within themselves and to suggest which technique can be used most appropriately. However, the limited data obtained about IASTM, which has just started to increase in use in frozen shoulder, seems to be promising for ROM increase. Further studies with higher quality and larger samples are needed to confirm this view and recommend the appropriate IASTM technique for frozen shoulder.

REFERENCES

1. Dueñas L, Balasch-Bernat M, Aguilar-Rodríguez M, Struyf F, Meeus M, Lluch E. A manual therapy and home stretching program in patients with primary frozen shoulder

contracture syndrome: A case series. *J Orthop Sports Phys Ther*. 2019;49(3):192-201. doi:10.2519/jospt.2019.8194.

2. Nevaiser TJ. Adhesive capsulitis of the shoulder: A study of the pathological findings in periarthritis of the shoulder. *J Bone Joint Surg*. 1945;27:211-222.
3. Page P, Labbe A. Adhesive capsulitis: Use the evidence to integrate your interventions. *N Am J Sports Phys Ther*. 2010;5(4):266-273.
4. Nakandala P, Nanayakkara I, Wadugodapitiya S, Gawarammana I. The efficacy of physiotherapy interventions in the treatment of adhesive capsulitis: A systematic review. *J Back Musculoskelet Rehabil*. 2021;34(2):195-205. doi:10.3233/BMR-200186.
5. Seffrin CB, Cattano NM, Reed MA, Gardiner-Shires AM. Instrument-assisted soft tissue mobilization: a systematic review and effect-size analysis. *J Athl Train*. 2019;54(7):808-821. doi:10.4085/1062-6050-481-17.
6. Aksan Sadikoglu B, Analay Akbaba Y, Taskiran H. Effects of ischemic compression and instrument-assisted soft tissue mobilization techniques in trigger point therapy in patients with rotator cuff pathology: Randomized controlled study. *Somatosens Mot Res*. 2022;39(1):70-80. doi:10.1080/08990220.2021.2005015.
7. Segmüller HE, Taylor DE, Hogan CS, Saies AD, Hayes MG. Arthroscopic treatment of adhesive capsulitis. *J Shoulder Elbow Surg*. 1995;4:403–408. doi:10.1016/S1058-2746(05) 80030-8.
8. Codman E. Rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa. *The shoulder. Boston*, MA: Thomas Todd; 1934.
9. Lewis J. Frozen shoulder contracture syndrome – aetiology, diagnosis and management. *Man Ther*. 2015;20:2-9. https://doi.org/10.1016/j. math.2014.07.006.
10. Boyle-Walker KL, Gabard DL, Bietsch E, Masek-Van Arsdale DM, Robinson BL. A profile of patients with adhesive capsulitis. *J Hand Ther*. 1997;10:222-228.
11. Hand GC, Athanasou NA, Matthews T, Carr AJ. The pathology of frozen shoulder. *J Bone Joint Surg Br*. 2007;89:928-932.
12. Kelley MJ, Shaffer MA, Kuhn E, et al. Shoulder pain and mobility deficits: Adhesive capsulitis: Clinical practice guidelines linked to the international classification of functioning, disability, and health from the orthopaedic section of the American Physical Therapy Association. *J Orthop Sports PhysTher*. 2013;43:A1–A31. doi:10.2519/jospt.2013.0302.

13. Satpute K, Reid S, Mitchell T, Mackay G, Hall T. Efficacy of mobilization with movement (MWM) for shoulder conditions: A systematic review and meta-analysis. *J Man Manip Ther*. 2022;30(1):13-32.

14. Noten S, Meeus M, Stassijns G, Van Glabbeek F, Verborgt O, Struyf F. Efficacy of different types of mobilization techniques in patients with primary adhesive capsulitis of the shoulder: A systematic review. *Arch Phys Med Rehabil*. 2016;97(5):815-825.

15. Atici E, Aydin G, Gulsen M, Sürenkök Ö. Effects of subscapularis muscle soft tissue mobilization on pain and functionality in shoulder dysfunction. *Turk J Physiother Rehabil*. 2021;32(2):148-154. doi:10.21653/tjpr.785838.

16. Guler-Uysal F, Kozanoglu E. Comparison of the early response to two methods of rehabilitation in adhesive capsulitis. *Swiss Med Wkly*. 2004;134:353-358.

17. Nambi G, Walid K. Additional effect of trigger point therapy and myofascial release on second stage frozen shoulder among industrial workers. *SANAMED*. 2017:93-100.

18. Yatheendra Kumar G, Sudhakar S, Sudhan SG et al, Effectiveness of active release technique and muscle energy technique in adhesive capsulitis. *Int. J. Res. Pharm. Sci.* 2017;8(4):693-696.

19. Cyriax J. Textbook of Orthopaedic Medicine. London, United Kingdom: Bailliere-Tindal; 1984.

20. Hammer WI. The effect of mechanical load on degenerated soft tissue. *J Bodyw Mov Ther*. 2008;12(3):246-256.

21. Davidson CJ, Ganion LR, Gehlsen GM, Verhoestra B, Roepke JE, Sevier TL. Rat tendon morphologic and functional changes resulting from soft tissue mobilization. *Med Sci Sports Exerc*. 1997;29(3):313–319.

22. Baker RT, Nasypany A, Seegmiller JG, et al. Instrument-assisted soft tissue mobilization treatment for tissue extensibility dysfunction. *Int J Athl Ther Training*. 2013;18(5):16-21.

23. Lee JJ, Lee JJ, Kim do H, et al. Inhibitory effects of instrument-assisted neuromobilization on hyperactive gastrocnemius in a hemiparetic stroke patient. *Biomed Mater Eng*. 2014;24(6):2389-2394.

24. Bitra M, Sudhan SG. Instrument assisted soft tissue mobilisation in the management of musculoskeletal pain: A literature review with implications for clinical practice guidelines. *Journal of Clinical & Diagnostic Research*. 2019;13(12):1–5. https://doi.org/10.7860/JCDR/2019/42687.13356.

25. Howitt S, Jung S, Hammonds N. Conservative treatment of a tibialis posterior strain in a novice triathlete: A case report. *J Can Chiropr Assoc*. 2009;53(1):23-31.

26. Strunk RG, Pfefer MT, Dube D. Multimodal chiropractic care of pain and disability for a patient diagnosed with benign joint hypermobility syndrome: A case report. *J Chiropr Med*. 2014;13(1):35-42.

27. Amin FS, Abdel-Aal NM, Ali NS, Moharram AN. Effect of instrument assisted soft tissue mobilization on hand grip strength in patients with subacromial impingement syndrome: A randomized controlled study. T*ürk Fizyoterapi ve Rehabilitasyon Dergisi/Turkish Journal of Physiotherapy and Rehabilitation*. 2021;32(3):17898-17909.

28. Aggarwal A, Saxena K, Palekar TJ, Rathi M. Instrument assisted soft tissue mobilization in adhesive capsulitis: A randomized clinical trial. *J Bodyw Mov Ther*. 2021;26:435-442. doi:10.1016/j.jbmt.2020.12.03.

29. Kaya Mutlu E, Birinci T, Kılıc S. AB1310-HPR Effects of instrument-assisted soft tissue mobilization on frozen shoulder: A randomızed controlled trial. *Annals of the Rheumatic Diseases*. 2020;79:1945.

30. Fousekis K, Mylonas K. Treatment of adhesive capsulitis with Ergon® IASTM technique and stretching exercises: A case study. *J Nov Physiother*. 2017;7:5(Suppl). doi:10.4172/2165-7025-C1-018.