MEDICAL RECORDS-International Medical Journal

Research Article

The Immediate Effect of Graston Technique on Ankle Range of Motion and Vertical Jump Performance in Athletes

Ismail Uysal[1], Zehra Yilmaz[2], Irem Cetinkaya[2], Fatih Ozden[3]

[1]Muğla Sıtkı Koçman University, Fethiye Vocational School of Health Services, Department of Health Care Services, Muğla, Türkiye
[2]Haliç University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye
[3]Muğla Sıtkı Koçman University, Köyceğiz Vocational School of Health Services, Department of Health Care Services, Muğla, Türkiye

Abstract

Aim: A limited number of studies have demonstrated the effects of Graston and static stretching on different muscle groups and sports performance. The study aimed to investigate the immediate effect of the Graston technique on vertical jump performance and ankle range of motion in athletes.
Material and Method: A quasi-experimental study included 30 participants aged 18-40 among active, licensed basketball players between January 2023 and May 2023. The 30 participants were divided into a graston group (n=15) and a static stretching group (n=15). A vertical jump test was performed for performance after the ankle joint range of motion was measured with a goniometer. Behind the first assessment session, a Graston or static stretching was applied to the groups. Thereafter, the vertical jump performance and goniometer measurement was repeated.
Results: Graston and static stretching had similar results in vertical jump performance ($p<0.05$). Graston on the gastrocnemius, soleus muscles and Achilles tendon was superior to static stretching, particularly in left foot dorsiflexion ($p<0.05$).
Conclusion: Graston application can be preferred to increase vertical jumping and ankle range of motion performance in athletes with similar and superior effects to static stretching. Including Graston and static stretching in the rehabilitation protocols can provide an effective range of motion and jumping performance.

Keywords: Athletes, instrument-assisted mobilization, jump, stretching

INTRODUCTION

Limitations in ankle range of motion (ROM) are essential in lower extremity injuries. In particular, limited ROM can lead to ankle re-injury (1). Ankle dorsiflexion (DF) may predispose to abnormal biomechanics during dynamic activities, which has been linked to the risk of knee injuries (2). Clinicians perform various interventions to increase ankle DF, such as manual therapy, stretching, ultrasound, electrotherapy and exercises. However, the intervention most effectively improves ankle DF has not yet been identified (1,3).

Stretching techniques are one of the treatments used to increase muscle extensibility to improve ROM. It can help prevent injury in sports, reduce muscle pain, and improve muscle capacity and athletic performance (4). Stretching increases joint flexibility and minimizes muscle-tendon junction stiffness, specifically during pre-exercise warm-up (5,6), thus ensuring optimum performance (7).

Passive stretching is a safe way to perform dynamic and static balance exercises (8). It can be used to regain both the joint's range of motion and the ability to balance on complex tasks in individuals returning from a previous injury. Sport-specifically, it proves that passive stretching can be performed before balance tasks, when necessary, without compromising their final performance (9).

One essential performance that requires balance in sports is the vertical jump. Vertical jump (VJ) is the difference between the height reached by standing and jumping (10). In basketball, VJ height and height are critical (11). One study stated that the gastrocnemius muscle is involved

CITATION
Uysal İ, Yilmaz Z, Cetinkaya I, Ozden F. Knowledge Levels of Child Abuse and Neglect Among a Group of Turkish Dentistry Students. Med Records. 2025;7(1):223-8. DOI:1037990/medr.1543935

Received: 17.09.2024 **Accepted:** 07.01.2025 **Published:** 15.01.2025
Corresponding Author: Ismail Uysal, Muğla Sıtkı Koçman University, Fethiye Vocational School of Health Services, Department of Health Care Services, Muğla, Türkiye
E-mail: ismailuysal@mu.edu.tr

in powerful and rapid movements and plays an integral role in running and jumping by significantly participating in the plantar flexion (PF) of the foot (12). The amount of ankle DF plays a vital role in the cause of lower limb injuries. Restriction of DF may predispose to re-injury of the ankle. Clinicians perform various therapeutic interventions such as stretching, manual therapy, electrotherapy, ultrasound and exercises to increase ankle DF. However, the intervention or combination of interventions most effectively improves ankle DF has yet to be specified (1).

The Graston technique is an essential application that improves lower extremity range of motion and jump performance. Groston is an instrumented soft tissue mobilization technique. The stainless-steel instrument, designed to adapt to the curves and various tissues of the body, is used to detect and release scar tissue, adhesions and fascial restrictions. Graston was developed as an alternative to manual therapy for transverse friction. Graston acts like a diapason when in contact with fibrotic tissue. A reverberation within the device occurs at the moment of contact and is transmitted through the device to the physiotherapist's hands (13). Graston can improve ROM without affecting the mechanical and neurological properties of the muscles that are the focus of treatment (14).

The effectiveness of graston combined with stretching exercise has not been investigated so far. The objective of our study was to compare and contrast the relative merits of static stretching and the Graston technique and to examine the impact of both methods on ankle range of motion and vertical jump performance. The study's hypothesis was determined as follows: The Graston technique has a more immediate effect than static stretching in improving ankle range of motion and vertical jump performance.

MATERIAL AND METHOD

Participants and Setting

A quasi-experimental study was conducted between January 2023 and May 2023. Thirty participants aged 18-40 were selected among clients who applied to Athlete and Orthopedic Clinic “Fizyomove”. The study was carried out in accordance with the ethical principles and the Helsinki Declaration. Informed consents of the patients were obtained. The study protocol was approved by the ethics committee of Muğla Sıtkı Koçman University (No: “141”).

The inclusion criteria were as follows: (1) the participant was voluntary and had consented to participate in the study, (2) the participant was between the ages of 18 and 40, and (3) the participant was able to perform the squatting movement pattern. The exclusion criteria of the study were as follows: (1) the participant's trunk exhibited excessive stability, (2) the participant had a health condition that would significantly impair their mobility, (3) the participant had undergone a surgical procedure involving the ankle and knee within the previous six months, (4) the participant had sustained an ankle sprain and ligament injury within the previous six months, (5) the participant demonstrated kinesiophobia in squatting, (6) the participant had a neurological diagnosis, was pregnant, had sustained an acute lower extremity injury, or had metatarsal stress fractures.

Data collection

Demographic information (e.g., age, height, weight) and information such as license status, previous surgical operation, and sports branch of interest were obtained from the individuals who participated in our study. VJ performance and range of motion were evaluated before and after the intervention. The evaluations were performed face-to-face in the sports club and orthopaedic clinic environment.

Vertical Jump Test

VJ is a test with a high-reliability rate for determining the jumping power of the athlete. In this method, a tape measure is attached to the wall in the test. Participants stand upright with their feet shoulder-width apart and their dominant side against the wall. The highest point they can reach on the tape measure without lifting their feet off the floor is marked. When ready, they are asked to bend down by bending their hips and knees and using their arms and legs to mark the highest point they can reach with their hands. The distance difference between the point they reach and the point they jump is determined. The test is repeated thrice, and the best result is recorded in centimeters (15).

ROM Measurement

The range of motion of the ankle was quantified using a goniometer. The subject is positioned supine with the knee extended and the ankle hanging over the edge of the table. In goniometric measurement, the 90-degree right angle between the fifth metatarsal and fibula is accepted as the reference point for the measurement of ankle range of motion, with 0 degrees representing the neutral position for dorsi and plantar flexion. The goniometer is positioned with its pivot point on the lateral malleolus. The fixed arm is maintained in a parallel position to the lateral midline of the fibula. The movable arm is aligned with the lateral midline of the fifth metatarsal bone. It is imperative that the foot remains stationary throughout the measurement process, neither inverting nor everting.

In order to obtain measurements for inversion and eversion, the subject should assume a prone position with the knee flexed at 90 degrees. The pivot point of the goniometer is positioned at the midpoint of the calcaneus. The fixed arm is initially maintained in a parallel position with respect to the midline of the sole between the second and third toes, while ensuring that its parallelism with the ground is maintained at the outset of the movement. The movable arm is aligned with the midline of the sole and positioned between the third toes (16).

Intervention

Graston group

In the aforementioned application, the objective was to enhance the performance of the gastrocnemius and soleus muscles. To this end, the Graston technique was employed at an angle of 45° parallel to the muscle fibres for a duration of approximately 20 seconds. Subsequently, the device was applied to the muscles in a direction perpendicular to the same muscle fibres at a 45° angle with the Graston for 20 seconds (Figure 1). An increase in temperature and a relaxation of the dermal tonus were observed on the skin surface (17) (Figure 2).

Figure 1. Graston method application on gastrocnemius and soleus

Figure 2. Statical stretching application on gastrocnemius and soleus

Statical stretching group

Static stretching is a widely employed method that serves to elongate muscle tissue by means of autogenic inhibition, which in turn stimulates the Golgi tendon organ. This technique entails passively stretching a specific antagonist muscle by positioning it in a maximum stretch position and maintaining that position for an extended duration. The participant's ankle was positioned in a DF position, and the gastrocnemius, soleus and Achilles muscles were placed in the most stretched position. The measurement was repeated on four occasions, with a holding time of 30 seconds applied in each instance (18) (2). A bilateral application was performed.

Statistical Analysis

IBM Statistical Package for Social Sciences Version 22 statistical program was used for data analysis. Continuous variables were given as mean±standard deviation and qualitative variables as number and percentage (%). Paired samples t test (dependent paired sample t-test) was used before and after data comparisons, and $p<0.05$ was considered significant for all analyzes.

RESULTS

Of the 30 participants who voluntarily participated in the study, 28 (93.3%) were male, and 2 (6.7%) were female. The mean age of the Graston group was 19.33±4.62 (min: 18, max: 36) years. The mean age of the static stretching group was 18.8±4.05 years (min: 18, max: 26). The mean age of all groups was 19.4±3.74 years (min: 18, max: 36).

There was no significant difference between the graston and static stretching groups in terms of VJ performance ($p=0.86$). When we analyzed the ROMs according to the methods applied, a significant result was found between the groups in left DF ($p<0.48$). No significant difference was found in other ROMs ($p>0.05$) (Table 1).

Graston technique had a significant effect on VJ performance ($p=0.0001$). The effectiveness of Graston was also significant for right DF ($p=0.007$) and left DF ($p=0.0001$). Graston was not effective in right PF ($p=0.683$), right EV ($p=0.337$), and right IN ($p=0.068$). On the other hand, left PF ($p=0.512$), left EV ($p=1$), and left IN ($p=0.060$) were not significant for the efficacy of Graston (Table 2).

Static stretching technique had a significant effect on VJ performance ($p=0.002$). Static stretching technique had a significant effect on right and left DF ($p<0.05$). Static stretching technique had no significant effect on right and left PF ($p>0.05$). The effect of static stretching technique on right EV ($p=0.005$) and right IN was significant ($p=0.026$). On the other hand, static stretching technique was effective for left foot EV ($p=0.022$), while its effect on left IN was not significant ($p=0.270$) (Table 3).

Table 1. The post-intervention results between the Graston and stretching groups

	Graston group (n=15) Mean±SD	Stretching group (n=15) Mean±SD	p
VJ performance	0.46±0.09	0.45±0.16	0.862
DF-right	16.33±5.40	17.80±4.69	0.434
DF-left	19.73±4.33	16.33±4.65	**0.048**
PF-right	36.33±9.48	32.53±7.80	0.241
PF-left	35.87±13.40	33.07±7.11	0.481
EV-right	14.33±5.09	15.47±4.56	0.526
EV-left	14.00±4.76	13.80±4.37	0.906
IN-right	14.07±5.36	14.07±4.94	1.000
IN-left	14.60±5.28	12.80±3.98	0.301

n: the number of participants, SD: standard deviation

Table 2. The results of the Graston technique (in-group changes)

	Graston group (n=15) Change score (Mean±SD)	p
VJ performance	-0.46±0.28	**0.0001**
DF-right	-3.53±4.35	**0.007**
DF-left	-4.80±2.93	**0.0001**
PF-right	-0.46±4.34	0.683
PF-left	-1.40±8.06	0.512
EV-right	-1.20±4.67	0.337
EV-left	0.00±3.91	1.000
IN-right	-0.80±1.56	0.068
IN-left	-1.93±3.65	0.060

n: the number of participants, SD: standard deviation

Table 3. The results of the Stretching technique (in-group changes)

	Stretching group (n=15) Change score (Mean±SD)	p
VJ performance	-0.03±0.30	**0.002**
DF-right	-3.86±3.60	**0.0001**
DF-left	-2.73±3.45	**0.008**
PF-right	2.13±6.72	0.240
PF-left	-1.73±8.11	0.422
EV-right	-4.40±5.18	**0.005**
EV-left	-2.53±3.79	**0.022**
IN-right	-2.00±3.11	**0.026**
IN-left	-1.33±4.49	0.270

n: the number of participants, SD: standard deviation

DISCUSSION

This study aimed to investigate the immediate effects of the Graston technique and static stretching on ankle range of motion and VJ performance in athletes. The results proved that Graston and static stretching applied to the gastrocnemius, soleus muscles, and Achilles tendon had significantly similar effects on VJ performance. Graston application was superior to static stretching, especially in left foot DF.

Loss of ROM is a common functional impairment in physically active people. It is one of the causes of musculoskeletal injury. Factors such as low flexibility, previous injuries, and sedentary time can lead to loss of ROM. Studies have suggested that ankle DF ROM deficit is a factor that increases the likelihood of a wide range of lower extremity injuries (19). In addition, the methods used to assess ankle range of motion have differed significantly regardless of gender due to geographical and cultural differences based on individuals' activities of daily living (20). Ankle ROM varies as the significant muscles acting over the joint absorb shock or generate force during standing posture (21). Adequate flexibility and range of motion of the ankle joint are essential for performing activities that require balance, such as running and squatting (22). An ankle ROM impairment caused by muscle tension during gait can affect the ankle-foot complex and the rest of the joints of the lower extremities (23). Movement restriction in the DF direction also increases the risk of ankle sprains (24). Restricted DF in the ankle joint can lead to acute or chronic injuries in the ankle and knee (19). Therefore, our study aimed to provide the effect of soft tissue mobilization technique that might improve ankle range of motion and physical performance.

Clinicians use soft tissue mobilization techniques to restore fascial mobility and reduce pain by addressing myofascial restrictions within the triceps surae (19). Grieve et al. (2011), in their study of 20 healthy individuals (5 males and 15 females) with restricted ankle DF with an average age of 27.7±2.1 years, it was observed that DF range of motion increased by applying myofascial trigger point to the soleus muscle (25).

The current study examined the effect of Graston and static stretching on hamstring muscle extensibility and pain intensity in patients with low back pain were examined. Twenty-four patients, 12 in the Graston and 12 in the static stretching group, were included in the study. Hamstring extensibility was recorded using the sit and lie test, and a visual analog scale was used to measure pain intensity. The Graston technique group showed significantly more improvement in hamstring extensibility than the static stretching group (26).

A recent scoping review in 2024 states that Graston is effective for foot and ankle pathologies when combined with other therapeutic interventions but emphasizes that the limited number of studies reduces the level of evidence (27).

Since the early 1980s, static stretching has been widely promoted before performing physical activity to prevent injury and improve physical performance (28). It has become a prominent routine incorporated into the warm-up for exercise, as the slow, controlled movement is believed to allow stretching to be performed quickly and safely, with less risk of injury compared to other forms of stretching (29).

Some studies have shown that static stretching before exercise may increase the risk of injury (28). VJ capacity depends on lower limb muscle strength and is used as a standard test of strength performance and to estimate muscle fiber composition. A higher vertical velocity at take-off is required to improve VJ performance. This performance can be achieved by a higher contraction velocity or muscle strength of the trunk, hips and lower limbs extensor muscles. If the muscle becomes shortened and strained, it negatively affects VJ performance (10).

Studies on the effects of Graston and static stretching on different muscle groups and performance parameters are limited in the literature. In general, when the literature is reviewed, the study results show that Graston and static stretching have a performance-enhancing effect. When we investigated the superiority of static stretching and Graston to guide clinicians, we found that they similarly improved DS performance. There is also a difference in ankle DF. Since we worked on the gastrocnemius, soles muscles and Achilles tendon, the improvement in the range of motion of the DF was realized to the extent we expected.

Limitations

One of the limitations of our study may be that the number of participants was 30. A higher number of participants may strengthen the statistical results. We included all athletes in our study without homogeneity regardless of the sports branch, mainly basketball. Since each sport has specific positions, the dominant muscle group that should be used also differs. Future studies can be strengthened by diversifying the sports branch and homogeneous distribution. We think that our other limitations are gender and the presence of a license. The fact that 2 of our 30 participants were women and 3 of our 30 participants were unlicensed reduces the homogeneity of our study. Future studies can improve the literature by considering gender and license status.

CONCLUSION

The Graston technique increases DS performance and ankle range of motion. There is no superiority between Graston and static stretching in DS performance. In terms of the results of our study, it will benefit sports and health professionals who are engaged in team sports such as volleyball, basketball and soccer, where jump performance is essential and will contribute to the literature. Including Graston and static stretching in the treatment protocols for athletes, health rehabilitation will strengthen the treatment process. Regularly performing Graston or static stretching, even without injury, will strengthen the preventive rehabilitation modality. It will not only result in success for the physiotherapist but also increase the success of the coach, conditioning and doctor as a team.

Key Findings

The Graston technique increases DS performance and ankle range of motion. There is no superiority between Graston and static stretching in DS performance.

Financial disclosures: *The authors declared that this study has received no financial support.*

Conflict of interest: *The authors have no conflicts of interest to declare.*

Ethical approval: *The study was carried out in accordance with the ethical principles and the Helsinki Declaration. Written informed consents of the patients were obtained. The study protocol was approved by the ethics committee of Muğla Sıtkı Koçman University (No: 141).*

REFERENCES

1. Terada M, Pietrosimone BG, Gribble PA. Therapeutic interventions for increasing ankle dorsiflexion after ankle sprain: a systematic review. J Athl Train. 2013;48:696-709.
2. Haines M, Murray AM, Glaviano NR, et al. Restricting ankle dorsiflexion does not mitigate the benefits of external focus of attention on landing biomechanics in healthy females. Human Movement Science. 2020;74:102719.
3. Shashua A, Flechter S, Avidan L, et al. The effect of additional ankle and midfoot mobilizations on plantar fasciitis: a randomized controlled trial. J Orthop Sports Phys Ther. 2015;45:265-72.
4. Kim D-H, Kim T-H, Jung D-Y, Weon J-H. Effects of the Graston technique and self-myofascial release on the range of motion of a knee joint. J Korean Soc Phys Med. 2014;9:455-63.
5. Behm DG, Kay AD, Trajano GS, Blazevich AJ. Mechanisms underlying performance impairments following prolonged static stretching without a comprehensive warm-up. Eur J Appl Physiol. 2021;121:67-94.
6. Morse CI, Degens H, Seynnes OR, et al. The acute effect of stretching on the passive stiffness of the human gastrocnemius muscle tendon unit. J Physiol. 2008;586:97-106.
7. Behm DG, Blazevich AJ, Kay AD, McHugh M. Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: a systematic review. Appl Physiol Nutr Metab. 2016;41:1-11.
8. Costa PB, Graves BS, Whitehurst M, Jacobs PL. The acute effects of different durations of static stretching on dynamic balance performance. J Strength Cond Res. 2009;23:141-7.
9. Coratella G, Longo S, Rampichini S, et al. Passive stretching decreases muscle efficiency in balance tasks. Plos One. 2021;16:e0256656.

10. Perez-Gomez J, Calbet J. Training methods to improve vertical jump performance. J Sports Med Phys Fitness. 2013;53:339-57.

11. Çankaya C, Arabacı R, Kurt E, et al. Examining the effects of the pliometric (jump squat) exercise on vertical jump in female volleyball players. European Journal of Physical Education and Sport Science. 2018;5:115-24.

12. Chtourou H, Aloui A, Hammouda O, et al. Effect of static and dynamic stretching on the diurnal variations of jump performance in soccer players. PloS One. 2013;8:e70534.

13. Black DW. Treatment of knee arthrofibrosis and quadriceps insufficiency after patellar tendon repair: a case report including use of the graston technique. Int J Ther Massage Bodywork. 2010;3:14-21.

14. Ikeda N, Otsuka S, Kawanishi Y, Kawakami Y. Effects of instrument-assisted soft tissue mobilization on musculoskeletal properties. Med Sci Sports Exerc. 2019;51:2166-72. Erratum in: Med Sci Sports Exerc. 2020;52:524.

15. Klavora P. Vertical-jump tests: a critical review. Strength & Conditioning Journal. 2000;22:70.

16. Konor MM, Morton S, Eckerson JM, Grindstaff TL. Reliability of three measures of ankle dorsiflexion range of motion. Int J Sports Phys Ther. 2012;7:279-87.

17. Lee J-H, Lee D-K, Oh J-S. The effect of Graston technique on the pain and range of motion in patients with chronic low back pain. J Phys Ther Sci. 2016;28:1852-5.

18. Lempke L, Wilkinson R, Murray C, Stanek J. The effectiveness of PNF versus static stretching on increasing hip-flexion range of motion. J Sport Rehabil. 2018;27:289-94.

19. Stanek J, Sullivan T, Davis S. Comparison of compressive myofascial release and the graston technique for improving ankle-dorsiflexion range of motion. J Athl Train. 2018;53:160-7.

20. Grimston SK, Nigg BM, Hanley DA, Engsberg JR. Differences in ankle joint complex range of motion as a function of age. Foot Ankle. 1993;14:215-22.

21. Brockett CL, Chapman GJ. Biomechanics of the ankle. Orthopaedics and trauma. 2016;30:232-8.

22. Spink MJ, Fotoohabadi MR, Wee E, et al. Foot and ankle strength, range of motion, posture, and deformity are associated with balance and functional ability in older adults. Arch Phys Med Rehabil. 2011;92:68-75.

23. Youdas JW, McLean TJ, Krause DA, Hollman JH. Changes in active ankle dorsiflexion range of motion after acute inversion ankle sprain. J Sport Rehabil. 2009;18:358-74.

24. Pope R, Herbert R, Kirwan J. Effects of ankle dorsiflexion range and pre-exercise calf muscle stretching on injury risk in Army recruits. Aust J Physiother. 1998;44:165-72.

25. Grieve R, Clark J, Pearson E, et al. The immediate effect of soleus trigger point pressure release on restricted ankle joint dorsiflexion: a pilot randomised controlled trial. J Bodyw Mov Ther. 2011;15:42-9.

26. Moon JH, Jung J-H, Won YS, Cho H-Y. Immediate effects of Graston technique on hamstring muscle extensibility and pain intensity in patients with nonspecific low back pain. J Phys Ther Sci. 2017;29:224-7.

27. Tedeschi R. An overview and critical analysis of the Graston technique for foot-related conditions: a scoping review. Manuelle Medizin. 2024;62:22-8.

28. Shrier I. When and whom to stretch? Gauging the benefits and drawbacks for individual patients. Phys Sportsmed. 2005;33:22-6.

29. Smith CA. The warm-up procedure: to stretch or not to stretch. A brief review. J Orthop Sports Phys Ther. 1994;19:12-7.