DOI: 10.7860/JCDR/2026/81357.23909

Effect of Active Release Technique versus Graston Technique on Pain, Function and Range of Motion in Recreational Runners with Medial Tibial Stress Syndrome: A Research Protocol for a Randomised Controlled Trial

ARJAVI PAKHAN[1], SUBRAT SAMAL[2]

ABSTRACT

Introduction: Medial Tibial Stress Syndrome (MTSS), commonly known as shin splints, is a common overuse injury characterised by pain along the medial border of the tibia, often seen in runners. It occurs due to repetitive stress on the tibial periosteum and surrounding soft-tissues, leading to discomfort and restricted movement. Manual therapy is often used to address these soft-tissue changes. The Active Release Technique (ART) reduces symptoms by releasing muscle tension through movement-based pressure. The Graston technique (GT) uses instrument assisted strokes to break adhesions and improve myofascial mobility.

Need of the study: MTSS is a prevalent overuse injury that leads to considerable pain and functional impairment in athletes, often affecting their performance and delaying recovery. Although both the ART and GT are used to manage soft-tissue dysfunctions, limited research directly compares their effectiveness in MTSS. The comparison aims to provide evidence-based treatment strategies and enhance the effectiveness of physiotherapy management for individuals with MTSS.

Aim: The study aims to evaluate the effect of ART and GT on pain, function and Range of Motion (ROM) in recreational runners with MTSS.

Materials and Methods: A randomised controlled trial will be conducted at Acharya Vinobha Bhave Rural Hospital, Datta Meghe Higher Education and Research, Ravi Nair Physiotherapy College, Sawangi (Meghe), Wardha, Maharashtra, India, from June 2025 to June 2026. A total of 66 participants will be included. The outcome parameters to be assessed will include the Visual Analogue Scale (VAS), Lower Extremity Functional Scale (LEFS), and ROM. The collected data will be statistically analysed using Student's t-test and Chi-square test in Statistical Package for the Social Sciences (SPSS) version 27.0, with a p-value of <0.05 considered statistically significant.

Keywords: Active release technique, Graston technique, Physical therapy, Shin splints

INTRODUCTION

The MTSS, commonly referred to as shin splints, is a frequent overuse injury that exhibits pain on the inner side of the shin (tibia). However, it is especially common in athletes, runners, and military recruits who engage in activities of repetitive weight-bearing movements [1]. A significant number of lower limb injuries occur due to the MTSS; rates reported are 4-35% in the physically active [2]. MTSS is considered as a debilitating condition that indeed affects performance and daily activities, prompting many people to limit or discontinue their training. However, MTSS is a complex condition with multiple causes and complex pathways to be understood that is still being worked on extensively [3]. MTSS is caused by a combination of biomechanical, muscular, and bone factors refers to straining or repetitive strain on the tibia, causing small injuries to the outer layer of bone (cortical bone) and the membrane around it (periosteum) [4]. Advanced imaging techniques such as Magnetic Resonance Imaging (MRI) provide evidence for periosteal oedema and bone marrow abnormalities in chronic condition, demonstrating that MTSS is a cumulative rather than acute damage [5]. Pain often extends along the posteromedial border of the tibia, and sometimes there is mild swelling or tightness of the surrounding musculature. MTSS pain is much more widespread along the shin than focal tenderness seen with stress fractures [6]. Clinically, MTSS management primarily aims to reduce pain and recurrence. Rest is crucial during the acute period, along with cryotherapy and non-steroidal anti-inflammatory medicines to alleviate symptoms. The biomechanical abnormalities are addressed by physiotherapy exercises such as stretching of tight calf muscles and strengthening of weak muscle groups such as hip abductors. It is advised that people prone to excessive pronation should wear shock-absorbing insoles or orthotics so that tibial stress is decreased. There are also gradual return-to-activity protocols implemented to minimise reinjury risk [7]. Improving the ability of these muscles to withstand load without overstraining the tibia will be aided by strengthening exercises for these muscles. Another important part of physiotherapy management is the correction of biomechanical abnormalities [8]. ART is a movement-based manual therapy that reduces pain, breaks up scar tissue and adhesions in muscles and soft-tissues, and restores normal function and ROM through precise pressure combined with active patient movement [9]. The GT uses stainless steel tools to apply pressure and friction, breaking down dense scar tissue and increasing blood flow to enhance healing and mobility [10]. Both techniques aid in pain reduction, functional improvement, and increased ROM by promoting soft-tissue healing and restoring normal tissue glide.

REVIEW OF LITERATURE

The MTSS is a frequently encountered overuse condition in physically active individuals, particularly runners, and presents as pain along the medial aspect of the tibia. The condition is commonly associated with repetitive loading, muscular tightness, altered lower limb biomechanics, and myofascial dysfunction. Conservative physiotherapy plays a central role in the treatment of MTSS, with increasing clinical use of manual therapy and instrument- assisted soft-tissue techniques to address pain, improve joint mobility, and enhance functional performance. Interventions targeting myofascial restrictions and soft-tissue impairments have been shown to positively influence symptoms and functional limitations associated with MTSS [4,5].

Deshmukh N and Phansopkar P examined the effects of instrument-assisted soft-tissue mobilisation and dynamic cupping therapy in recreational runners diagnosed with MTSS. The study demonstrated that both interventions were effective in reducing pain and improving functional ability over a four-week treatment period. Participants in each group showed meaningful improvements in pain scores and functional test performance, indicating the overall benefit of soft-tissue based approaches in MTSS rehabilitation. Notably, the cupping therapy group experienced greater pain reduction and better functional improvements compared to the Instrument-Assisted Soft Tissue Mobilisation (IASTM) group. Gains in muscle strength and joint ROM were also observed in both groups, suggesting enhanced lower-limb function following treatment. These findings highlight the potential value of manual and adjunct soft-tissue therapies in managing MTSS and support further research comparing different therapeutic techniques for optimal outcomes in recreational runners [10].

Jain NM et al., explored the effects of two commonly used soft-tissue techniques-ART and Positional Release Therapy (PRT)-in recreational runners with gastrosoleus trigger points. Their findings showed that both treatments were effective in reducing pain and improving ankle dorsiflexion ROM, highlighting the importance of addressing soft-tissue restrictions in runners. Participants in both groups experienced meaningful improvements after intervention, indicating that targeted manual therapy can positively influence muscle function and movement. However, PRT produced greater improvements in both pain relief and ankle dorsiflexion compared to ART. The authors therefore suggested that PRT may be a more effective option than ART for managing gastrosoleus trigger points in recreational runners [11]. Similarly, Ikeda N et al., examined the immediate effects of instrument-assisted soft-tissue mobilisation on ankle joint mobility and tissue properties in healthy individuals. The study found that a short session of IASTM led to a noticeable increase in ankle dorsiflexion ROM, along with a reduction in ankle joint stiffness. These changes suggest that IASTM can enhance joint mobility without placing excessive mechanical stress on the surrounding tissues. Interestingly, the intervention did not produce significant changes in muscle stiffness or passive torque of the plantar flexor muscles, indicating that the observed improvements in ROM were not associated with alterations in the mechanical or neural properties of the muscles [12].

Vijayakumar DM et al., investigated the effectiveness of compressive myofascial release and instrument-assisted soft-tissue mobilisation in active adults presenting with calf muscle trigger points and restricted ankle dorsiflexion. The study demonstrated that both interventions were successful in reducing pain and improving ankle dorsiflexion ROM following treatment. While compressive myofascial release produced slightly greater improvements in joint ROM, instrument-assisted soft-tissue mobilisation was more effective in reducing pain levels. Participants also reported better comfort and tolerance with IASTM, suggesting greater acceptability of the technique. Importantly, the beneficial effects of both interventions were maintained for at least 24 hours, indicating a short-term carry-over effect. These findings support the clinical relevance of both CMR and IASTM in managing pain and mobility limitations associated with calf muscle trigger points [13]. Stanek J et al., concluded that compressive myofascial release is an effective short-term intervention for improving ankle dorsiflexion and may be especially useful for individuals presenting with dorsiflexion deficits [14].

Therefore, the present study aimed to compare the effect of the ART and the GT on pain, function, and ROM in recreational runners with MTSS.

Primary objectives:

1. To evaluate the effect of ART on pain, function, and ROM in recreational runners with MTSS;
2. To evaluate the effect of GT on pain, function, and ROM in recreational runners with MTSS.

Secondary objectives:

1. To compare the effects of conventional physiotherapy when combined with ART and GT in improving outcomes among individuals with MTSS.

Hypotheses

Null hypothesis (H_0)

There will be no significant difference between the ART and the GT in improving pain, function, and ROM in recreational runners with MTSS.

Alternative hypothesis (H_1)

There will be a significant difference between the ART and the GT in improving pain, function, and ROM in recreational runners with MTSS.

MATERIALS AND METHODS

The present randomised controlled trial study will be conducted at Acharya Vinobha Bhave Rural Hospital, Datta Meghe Higher Education and Research, Ravi Nair Physiotherapy College, Sawangi (Meghe) Wardha, Maharashtra, India, from June 2025 to June 2026. The Institutional Ethics Committee permission has been obtained with registration No. DMIHER(DU)/IEC/2025/607. The trial is prospectively registered on Clinical Trial Registry-India with CTRI/2025/04/084528. Before participation, all eligible recreational runners will be provided with a detailed explanation of the study procedures, and written informed consent will be obtained from each participant.

Inclusion criteria:

- Recreational runners who have been experiencing symptoms for over two weeks
- Both male and female;
- Aged 20-30 years;
- Pain present on the anteromedial and posteromedial side of the shin with local tenderness (grade I or II);
- On palpation pain across 5 cm or more on the posteromedial side of the lower 1/3rd of the leg with absence of unique symptoms [10].

Exclusion criteria:

- Fractures in the lower limb and any old surgical history around the knee and ankle joint;
- Any previous bone pathology around the knee and ankle;
- Genu varus or valgus deformity or hyperextended knee;
- History of trauma in lower part of leg;
- Any neurological diseases.
- Systemic illnesses, including metabolic, metastatic, or infective disorders.

Sample size calculation:

$$n = \frac{z^2 P(1-P)}{d^2}$$

Z: statistic for a level of confidence (for the level of confidence of 95%, which is conventional, the Z value is 1.96)

P: expected prevalence of MTSS in physically active individuals, taken as 0.185 (18.5%)

d: desired margin of error, taken as 0.10 (10%)

Z=1.96

P=Proportion of overuse injuries, such as shin splints, accounts for 18.5%

=18.5%=0.185

d=Desired error of margin=10%=0.10

$$n = \frac{1.96^2 * 0.185 * (1 - 0.185)}{0.10^2}$$

=57.92

=60 participants

Total number of subjects: 60 (10)

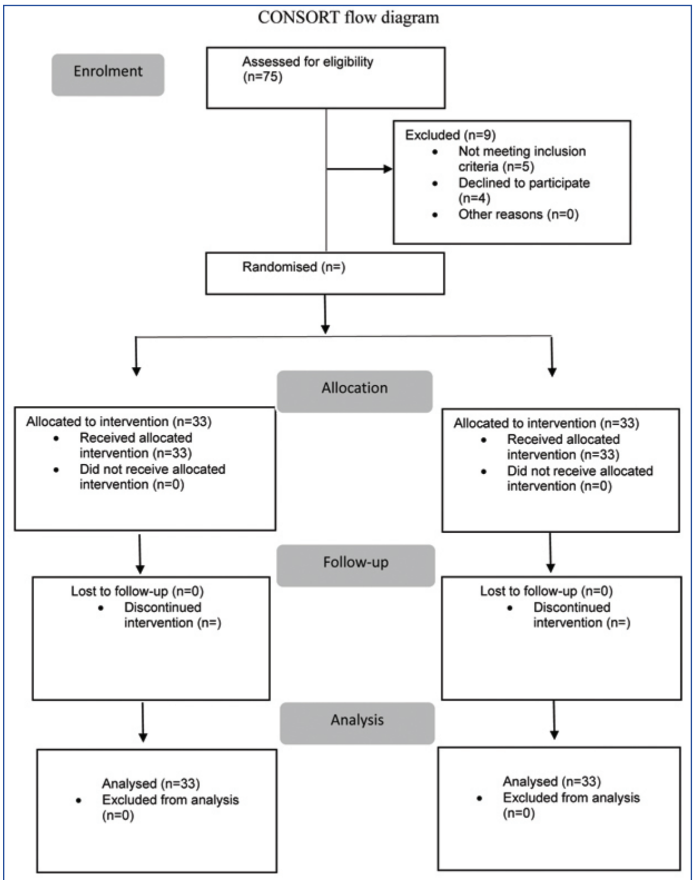
Considering 10% drop out

10% of 60=6

Therefore, total number of subjects will be: n=60+6=66

Study Procedure

Following the baseline assessment, recreational runners fulfilling the inclusion criteria will be randomly selected using simple random sampling and divided into Group A and Group B in a 1:1 ratio, generated by a computer sequence. Allocation concealment will be ensured using the Sequentially Numbered, Opaque, Sealed, and Stapled Envelopes (SNOSE) method. Blinding of participants and therapists is not feasible due to the distinct nature of the intervention. However, the outcome assessor will remain blinded to group allocation to minimise assessment bias. Each group will have 33 participants [Table/Fig-1].



[Table/Fig-1]: CONSORT flow chart.

Group A (experimental group) - ART+conventional therapy [Table/Fig-2,3] [11,15] , [16,17,18].

The intervention protocol for Group A outlines the specific procedure, positioning, and duration for each muscle treated using the ART [Table/Fig-2] [11,15].

Group B (control group)- GT+conventional therapy [Table/Fig-4] [10].

Conventional therapy: The intervention consists of strengthening exercises, stretching exercises, and cryotherapy, all aimed at reducing pain, improving ankle dorsiflexion ROM, and enhancing lower-limb muscle function. Strengthening exercises target the gastrocnemius, soleus, and tibialis anterior muscles to improve muscle strength, endurance, and dynamic control of the ankle. Stretching exercises are included to address muscle tightness and soft-tissue restrictions, thereby improving flexibility and joint

Muscle	Position	Technique	Duration
Gastrocnemius Muscle	The subject will lie in a prone position with the knee flexed to 90 degrees and the ankle maintained in a plantarflexed position	The therapist will locate the trigger point in the gastrocnemius muscle and will put deep manual pressure on it. This pressure is maintained while the subject simultaneously extends their knee and dorsiflex their ankle	This process will be repeated for 4 days a week and performed for15 repetitions. So that each motion is under the same consistent pressure
Soleus Muscle	The subject will be lying prone with the knee extended and the ankle plantar flexed outside the plinth	The therapist will find and press the trigger point on the soleus muscle, using firm manual pressure. With this continued pressure, the subject will be actively dorsiflexing their ankle through its ROM while doing it with enough force to fully engage and stretch the muscle	This technique is to be performed for 15 repetitions with the attention focused on proper alignment during the procedure [11]
Tibialis Anterior Muscle	The subject will be lying in supine	Trigger point is identified by the therapist which is the point found near knee which is pressed with deep manual pressure utilising the firm contact of fingers or thumbs. The subject will actively dorsiflex and plantarflex their foot with the muscle still under this pressure, and will engage it through its ROM.	The procedure will be repeated for 15 repetitions while ensuring proper alignment of the foot during each movement [15]

[Table/Fig-2]: Active Release Technique (ART) [11,15].

Type	Exercise/ Modality	Position	Technique	Duration
Strengthening Exercises [16]	Toe raises	Stand with feet shoulder width apart	Rise onto your toes, lifting your heels off the ground as high as possible	10-15 repetitions for 2-3 sets for 4 days a week
	Heel walking	Stand upright	Walk on your heels for about 30 seconds, keeping your toes off the ground to engage the tibialis anterior muscle effectively	Repeat this exercise 2-3 times
	Resistance band dorsiflexion	Sit on a chair with a resistance band looped around an object and around the top of one foot	dorsiflex the ankle towards you against the resistance of the band, then return slowly to the starting position	10-20 repetitions for 2-3 sets
	Calf Raises (for Gastrocnemius and Soleus)	Stand on a step or elevated surface with just the balls of your feet on it	Raise your heels above the step level, then lower them back down below step level to stretch both calf muscles effectively	10-15 repetitions for 2-3 sets

Stretching Exercises [17]	Gastrocnemius stretch	Stand facing a wall with your hands braced against it	Straighten one leg behind you, keeping the heel pressed into the floor while bending the front knee. Slightly turn your back foot inward	Hold for 20-30 seconds and repeat three times for each leg
	Soleus Stretch	Stand with one foot behind the other, feet flat and pointed straight ahead	Bend your front knee while keeping your back knee straight and your back heel down. This will stretch the lower part of your calf	Hold for 30 seconds, repeating 2-3 times
	Tibialis Anterior Stretch (Toe Drag)	Stand upright with knees slightly bent	Curl the toes of one foot so that they press against the floor while keeping the heel raised. This stretches the front of the shin	Hold for 15-30 seconds before switching to the other foot
	Kneeling Shin Stretch	Kneel on a mat with your buttocks over your heels and tops of your feet flat on the floor	Gently lean back to increase the stretch in your shins	Hold for 15-30 seconds
Cryotherapy [18]	Ice pack	Patient in relaxed position (supine or sitting)	Apply an ice pack over the affected area. Ensure a towel layer between skin and ice pack.	15-20 minutes

[Table/Fig-3]: Conventional therapy [16-18].

Treatment stage	Procedure	Duration
Stage 1 Evaluation	A thorough evaluation of the individual's current condition to identify specific needs and areas requiring attention. This will be followed by a 10-15-minute warm-up.	-
Stage 2 Warm-up	Stationary cycling, gentle running, or using an upper body ergometer	10-15 minute
Stage 3 Graston technique	Apply a thin layer of cream over the affected area. Using the graston instrument at the angle of 45-degree, tolerable pressure will be applied in strokes across targeted area. The patient may experience sensations described as "gritty," "gravelly," or "sandy" during treatment, which indicates targeted tissue engagement [10]	40 to 120 seconds per session

[Table/Fig-4]: Graston technique in the control group [10].

mobility. Cryotherapy is used as an adjunct modality to manage pain, minimise post-exercise inflammation, and facilitate recovery [Table/Fig-3] [16-18].

Study Outcomes

1. **Visual Analogue Scale (VAS):** is used for measuring subjective experiences, particularly pain intensity, by asking individuals to mark their level of discomfort on a line of 10 cm. It has excellent reliability, with Intraclass Correlation Coefficients (ICCs) ranging from 0.85 to 0.95, ensuring consistent results across repeated measurements. The VAS also demonstrates strong validity, correlating well with other pain assessment tools [19].
2. **Lower Extremity Functional Scale (LEFS):** is a patient-reported outcome measure designed to evaluate functional status in individuals with lower extremity musculoskeletal conditions. Comprising 20 questions. The LEFS demonstrates excellent test-retest reliability, with an ICC of 0.94, and a high internal consistency indicated by a Cronbach's alpha of 0.96 [20].
3. **Range Of Motion (ROM):** The goniometer will be used to evaluate joint ROM. ROM refers to the extent of movement a joint can achieve in different directions, such as flexion, extension, abduction, or rotation, and it is a key indicator of joint health and mobility.

   Pre- intervention data will be collected during the participant's first visit, and post-intervention data will be obtained on the last day of the fourth week.

STATISTICAL ANALYSIS

All statistical analysis will be conducted using SPSS version 27.0. Continuous variables such as scores from the VAS, LEFS and ROM will be expressed as mean±Standard Deviation (SD). Between-group comparisons will use independent t-tests or Mann-Whitney U tests, depending on data distribution. Within-group changes from baseline to post-intervention will be assessed using paired t-tests or Wilcoxon signed-rank tests. A p-value of <0.05 will be considered statistically significant.

REFERENCES

[1] McClure CJ, Oh R. Medial Tibial Stress Syndrome. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Jan 18]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK538479/.

[2] Reshef N, Guelich DR. Medial tibial stress syndrome. Clin Sports Med. 2012;31(2):273-90.

[3] Physiopedia [Internet]. [cited 2025 Jan 18]. Medial tibial stress syndrome. Available from: https://www.physio-pedia.com/Medial_Tibial_Stress_Syndrome.

[4] Tibial Stress Syndrome (Shin Splints) - Knee & Sports - Orthobullets [Internet]. [cited 2025 Jan 18]. Available from: https://www.orthobullets.com/knee-and-sports/3108/tibial-stress-syndrome-shin-splints.

[5] Alfayez SM, Ahmed ML, Alomar AZ. A review article of medial tibial stress syndrome. J Musculoskelet Surg Res. 2017;1:2.

[6] Franklyn M, Oakes B. Aetiology and mechanisms of injury in medial tibial stress syndrome: Current and future developments. World Journal of Orthopedics. 2015;6(8):577-89.

[7] Ramteke SU, Jaiswal PR. Physical therapy perspectives for medial tibial stress syndrome in a novice runner: A case report. Cureus. 2024;16(8):e67647.

[8] Smith W, Winn F, Parette R. Comparative study using four modalities in shinsplint treatments. Journal of Orthopaedic & Sports Physical Therapy. 1986;8(2):77-80.

[9] Dane AB, Fenech M, Carmody D, Obst SJ, Pajaczkowski J, Vitiello AL, et al. Active release techniques® reduces stiffness in the medial gastrocnemius measured using elastography. J Back Musculoskelet Rehabil. 2026 Jan;39(1):187-96.

[10] Deshmukh NS Jr, Phansopkar P. Effect of the Graston Technique and Cupping Therapy on Pain and Functions in Individuals With Medial Tibial Stress Syndrome: A Randomized Clinical Trial. Cureus. 2023;15(11):e48246.

[11] Jain NM, Zore L, Kumar A. Comparison of active release technique and positional release therapy for gastrosoleus trigger point release in recreational runners. Int J Health Sci Res. 2020;10(7):35-41.

[12] Ikeda N, Otsuka S, Kawanishi Y, Kawakami Y. Effects of Instrument-assisted Soft-tissue Mobilization on Musculoskeletal Properties. Med Sci Sports Exerc. 2019;51(10):2166-72.

[13] Vijayakumar DM, Jaideep A, Khankal R, Gazbare DP, Abraham B. Effectiveness of compressive myofascial release vs instrument assisted soft-tissue mobilization in subjects with active trigger points of the calf muscle limiting ankle dorsiflexion. International Journal of Health Sciences. 2019;9(4):98-106.

[14] 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(2):160-67.

[15] Tibialis Anterior Release • Peak Physio [Internet]. Peak Physio. [cited 2025 Dec 1]. Available from: https://www.peak-physio.com.au/exercise/tibialis-anterior-release/.

[16] Fletcher JP, Bandy WD. Unique positioning for using elastic resistance band in providing strengthening exercise to the muscles surrounding the ankle. N Am J Sports Phys Ther. 2007;2(1):51-54.

[17] Deshmukh NS, Phansopkar P. Medial tibial stress syndrome: A review article. Cureus. 2022;14(7):e26641.

[18] Galbraith RM, Lavallee ME. Medial tibial stress syndrome: Conservative treatment options. Curr Rev Musculoskelet Med. 2009;2(3):127-33.

[19] Fähndrich E, Linden M. Reliability and validity of the Visual Analogue Scale (VAS). Pharmacopsychiatria. 1982;15(3):90-94. Available from: https://www.researchgate.net/publication/16099315_Reliability_and_validity_of_the_Visual_Analogue_Scale_VAS.

[20] Binkley JM, Stratford PW, Lott SA, Riddle DL, North American Orthopaedic Rehabilitation Research Network. The Lower Extremity Functional Scale (LEFS): Scale development, measurement properties, and clinical application. Physical Therapy. 1999;79(4):371-83.

PARTICULARS OF CONTRIBUTORS:
1. Junior Resident, Department of Musculoskeletal Physiotherapy, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
2. Professor, Department of Musculoskeletal Physiotherapy, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Arjavi Pakhan,
Junior Resident, Department of Musculoskeletal Physiotherapy, Datta Meghe Institute of Higher Education and Research, Sawangi, Wardha-442107, Maharashtra, India.
E-mail: arjavipakhan1@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 04, 2025
- Manual Googling: Feb 07, 2026
- iThenticate Software: Feb 10, 2026 (1%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 18, 2025**
Date of Peer Review: **Oct 06, 2025**
Date of Acceptance: **Feb 12, 2026**
Date of Publishing: **Jul 01, 2026**