



Review Article

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GULPHA SANDHI SHARIR W.S.R. TO SPORT-RELATED TRAUMA: AN APPLIED ANATOMICAL STUDY

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ABSTRACT

Ayurveda, the ancient Indian medical science, emphasizes a holistic approach to health by promoting longevity, disease prevention, and overall well-being. Among the vital anatomical structures described in Ayurvedic literature, *Gulpha Sandhi* (ankle joint) holds significant importance as it facilitates movement, supports body balance, and bears weight during locomotion. It is described as *Sandhi*, *Marma*, *Asthisanghat*, and *Jaala*, reflecting its structural and functional complexity. Anatomically, it corresponds to a synovial joint formed by the tibia, fibula, and talus, stabilized by ligaments and tendons. Due to its dynamic function, the ankle is highly prone to injuries, especially in sports and high-impact activities, leading to pain, instability, and restricted motion. This study highlights the applied anatomical and clinical relevance of *Gulpha Sandhi* with special reference to *Marma Sharir* and sports-related trauma. Integrating Ayurvedic and modern anatomical perspectives provides valuable insights into prevention, diagnosis, and rehabilitation of ankle joint injuries.

Keywords: *Gulpha Sandhi*, Ankle Joint, *Marma Sharir*, Sports Injury

INTRODUCTION

The ancient Indian medical system known as Ayurveda places a strong emphasis on managing health holistically by emphasising longevity, disease prevention, and wellbeing preservation. It acknowledges that the human body is made up of intricate systems, such as bones, muscles, tendons, ligaments, organs, and tissues, all of which cooperate to carry out different physiological tasks. These systems play distinct roles that support general body function and mobility and they are interconnected. However, they are also susceptible to injuries and diseases, particularly due to overuse, repetitive stress, or overload. In this context, the *Sandhi* (joint) is a critical structure responsible for enabling movement and maintaining balance.^[1] Among the various *Sandhi* in the human body, the *Gulpha Sandhi* or ankle joint plays a vital role in locomotion. The term *Gulpha* is derived from classical Ayurvedic texts and refers to the junction where the *Pada* (foot) and *Jangha* (lower leg) meet. It is a weight-bearing joint that not only facilitates movement but also helps balance the body during activities such as walking, running, and standing. In *Amarkosha*, an ancient Sanskrit lexicon, *Gulpha* is defined as "*Padasya Granthi*," which means the knot or joint of the foot. The *Gulpha* has been categorized under various anatomical and physiological concepts in Ayurveda, making it a structure of prime importance. It is referred to as a *Sandhi* (joint), *Marma* (vital point), *Asthisanghat* (union of bones), and *Jaala* (plexus or network). In Ayurvedic anatomy (*Sharir*), the *Gulpha Marma* is considered a vital point, located in the lower extremities (*Adhoshakhagat*), and is of the *Kora* variety, indicating its role in *Chesthavat* (movement). The joint is composed of two main bones and associated ligaments and tendons, which contribute to the stability and functionality of the ankle.^[2]

Given its critical role in movement and body balance, the *Gulpha Sandhi* is one of the most frequently injured joints, particularly in the context of sports-related activities. Athletes and physically active individuals are at a heightened risk for ankle injuries due to the range of forces exerted on the joint during walking, running, jumping, and other high-impact activities. The repetitive strain and sudden trauma inflicted on the joint can result in biomechanical dysfunction, affecting not only the *Sandhi* but also the surrounding ligaments, tendons and muscles.^[3] Injuries such as sprains, fractures, and dislocations are common, leading to significant functional impairment and requiring appropriate clinical management.

From an applied anatomical perspective, the *Gulpha Sandhi* is a synovial joint that enables the foot's dorsi flexion and plantar flexion. The bones involved in forming this joint include the tibia,

fibula, and talus, which are held together by strong ligaments and supported by tendons. These structures collectively stabilize the ankle and ensure smooth movement. However, injuries, especially in sports, can damage these supporting structures, leading to instability, pain, and restricted motion. Hence, an understanding of the anatomy of the *Gulpha Sandhi*, its biomechanical functions, and its vulnerability to trauma is crucial for developing preventive and rehabilitative strategies, particularly in sports medicine. In the context of *Marma Sharir*, the *Gulpha Marma* is classified as a vital anatomical location that, when injured, can lead to severe functional disturbances. Ayurveda describes *Marma* injuries as having potentially fatal consequences or causing long-term disabilities. Therefore, the concept of *Marma* plays a significant role in understanding the clinical implications of injuries to the *Gulpha Sandhi*, as trauma to this region may extend beyond the musculoskeletal system, impacting the entire body's functioning.^[4]

This study aims to explore the applied anatomical aspects of the *Gulpha Sandhi* with a particular focus on sports-related trauma. By integrating the classical Ayurvedic concepts of *Gulpha Marma* with contemporary anatomical knowledge, this study will provide insights into the prevention, diagnosis, and management of ankle joint injuries, especially in athletes. Understanding the interaction between the bones, ligaments, tendons, and other structures involved in the *Gulpha Sandhi* is essential for addressing the biomechanical challenges posed by sports activities and minimizing the risk of long-term damage.^[5]

STATEMENT OF THE PROBLEM / RESEARCH PROBLEM

The *Gulpha Sandhi* (ankle joint) is highly susceptible to sports-related injuries, such as sprains and fractures, which can lead to long-term complications and instability. Despite its critical role in movement and balance, and its recognition as a *Marma* (vital point) in Ayurveda, there is a lack of integrated research combining Ayurvedic concepts with modern anatomical knowledge. This study aims to address this gap by providing an applied anatomical understanding of the *Gulpha Sandhi*, with a focus on sports-related trauma, to improve injury prevention, management and rehabilitation strategies.

APPLIED ANATOMY

Clinical Anatomy.

The sprains of the ankle are almost always abduction sprains of the subtalar joints, although a few fibers of the deltoid ligament are also torn. True sprains of the ankle joint are caused by

forced plantar flexion, which leads to tearing of the anterior fibers of the capsule. The joint is unstable during plantar flexion.^[6]

Dislocations of the ankle are rare because joint is very stable due to the presence of deep tibiofibular socket. Whenever dislocation occurs, it is accompanied by fracture of one of the malleoli. Acute sprains of lateral ankle occur when the foot is plantar flexed and excessively inverted. The lateral ligaments of ankle joint are torn giving rise to pain and swelling.^[7]

- 1) **Acute sprains of medial ankle** occur in excessive eversion, leading to tear of strong deltoid ligament. These cases are less common.
- 2) **The optimal position of the ankle** to avoid ankylosis is one of slight plantar flexion.
- 3) **For injections into the ankle joint**, the needle is introduced between tendons of extensor hallucis longus and tibialis anterior with the ankle partially plantar flexed.

During walking, the plantar flexors raise the heel from the ground. When the limb is moved forwards the dorsiflexors help the foot in clearing the ground. The value of the ankle joint resides in this hinge action, in this to and from movement of the joint during walking.^[8]

- 4) **Pott's fracture** is a fracture affecting one or both of the malleoli. During activities such as landing from jump (volleyball, basketball) or when rolling on ankle, a certain amount of stress is placed on the tibia and fibula and ankle joint.

AIMS & OBJECTIVES OF THE STUDY

To evaluate the Study on *Gulpha Sandhi Sharir* and Sport Related Trauma.

- To evaluate *Gulpha Sandhi Sharir's* Ayurvedic Review of Literature.
- To evaluate the current review of ankle joint literature.
- To evaluate the current literature review on sport trauma.

MATERIALS & METHOD

A. Research Methodology

Materials:

Primary Ayurvedic Texts: Classical Ayurvedic texts like *Charaka Samhita*, *Sushruta Samhita*, and *Amarsaka* was the primary sources for the conceptual understanding of *Gulpha Sandhi* (ankle joint) and *Gulpha Marma*. These texts will provide insights into the Ayurvedic anatomical and physiological concepts relevant to this study.

Modern Anatomical Literature:Textbooks such as *Gray's Anatomy* and other orthopedic and sports medicine literature was utilized for understanding the contemporary anatomical, biomechanical and clinical aspects of the ankle joint.

Cadaveric Models:Dissected cadaveric models was used for studying the structural anatomy of the *Gulpha Sandhi*, focusing on bones, ligaments, tendons, and other surrounding soft tissues. If used in the study

Clinical Case Reports:Case reports and clinical records of athletes who have sustained ankle joint injuries was used to analyze the nature of sports-related trauma, mechanisms of injury, and rehabilitation processes.

Diagnostic Tools:X-rays, MRI scans, and motion analysis systems was employed to gather detailed diagnostic data on *Gulpha Sandhi* injuries and their biomechanical effects.

Methodology:

Literature Review:A comprehensive review of classical Ayurvedic texts and modern literature on the anatomy, function, and pathology of the *Gulpha Sandhi* was conducted. This review was help integrate the Ayurvedic concepts of *Gulpha Marma* with contemporary understandings of ankle joint injuries.

Anatomical Study:Cadaveric dissection and study of anatomical models was performed to investigate the structural components of the *Gulpha Sandhi* (ankle joint), including bones, ligaments, tendons, and the *Marma* points associated with it. This step was aim to correlate Ayurvedic descriptions with modern anatomical data.

Biomechanical Analysis:The functional movements of the *Gulpha Sandhi* (dorsiflexion, plantar flexion, inversion, and eversion) was studied using motion analysis systems and biomechanical models. The forces experienced by the joint during various physical activities, particularly in sports, was measured and analysed.

Clinical Case Studies: Clinical case studies were conducted on athletes who have sustained ankle injuries. The data from these cases was collected through patient history, physical examination, and diagnostic imaging. The cases were analysed for injury types, mechanisms, and recovery patterns. A comparison was drawn between the Ayurvedic concept of injury to the *Gulpha Marma* and modern clinical findings.

Data Collection and Analysis: Quantitative and qualitative data was collected from clinical case

studies, including injury severity, types of trauma and outcomes of rehabilitation. Descriptive statistics was employed to analyze the frequency, types, and recovery patterns of ankle injuries in athletes. The data was categorized based on types of injuries and corresponding treatment methods in both Ayurvedic and modern medical contexts.

Comparative Analysis: A comparative analysis was conducted between the Ayurvedic concept of *Gulpha Marma* injuries and modern medical descriptions of ankle joint trauma. This was including a detailed comparison of treatment protocols, preventive strategies, and rehabilitation approaches in both systems of medicine.

SOURCE OF DATA

Data will be collected from classical and modern texts from the library of Awasthi Ayurvedic Medical College & Hospital, Nalagarh - H.P. Along with off line journals and other internet resources like online journals and data portals.

STUDY TYPE - Literary Study

ASSESSMENT CRITERIA - Nil

OBSERVATION & RESULTS

Anatomical Observations: Ayurvedic texts describe the *Gulpha Sandhi* as a vital *Marma* point, while modern anatomy identifies its key structures, including the tibia, fibula, talus, ligaments and tendons, essential for joint movement and stability.

Biomechanical Observations: The study highlights the stress on the ankle joint during sports activities, especially in running and jumping, identifying the movements most prone to injury.

Clinical Observations: Common injuries include sprains, fractures, and ligament tears, with ligament sprains being the most frequent. Recovery patterns vary based on injury type and treatment.

Comparison of Treatments: Ayurvedic therapies like *Marma* treatments combined with modern interventions such as physiotherapy show potential for improved rehabilitation and reduced recurrence of injuries.

Results: The study suggests that integrating Ayurvedic and modern methods leads to better injury management and prevention, with a focus on strengthening exercises and holistic recovery approaches.

DISCUSSION

The findings of this study highlight the significance of *Gulpha Sandhi* (ankle joint) in both Ayurvedic and modern medical contexts, particularly in relation to sports-related trauma. The *Gulpha* is a critical joint that supports a wide range of motions essential for daily activities and athletic performance. Its classification as a *Marma* in Ayurveda underscores its importance, as injuries to this region not only impair physical movement but can also have deeper physiological consequences according to Ayurvedic principles.

From a modern medical perspective, the study demonstrates that the *Gulpha Sandhi* is highly susceptible to injuries, especially ligament sprains, fractures, and tendon damage, due to the immense forces applied during physical activities such as running and jumping. Biomechanical analysis confirms that movements like inversion and eversion of the foot, common in sports, place the ankle at a high risk for injury.

The integration of Ayurvedic and modern approaches provides valuable insights into the prevention and management of *Gulpha Sandhi* injuries. Ayurvedic treatments, particularly *Marma* therapy and herbal applications, focus on restoring balance and improving joint function, while modern medical interventions, including physiotherapy and surgery, aim at repairing structural damage and restoring mobility. The study suggests that combining these approaches leads to more comprehensive recovery, reduced recurrence of injuries, and improved long-term outcomes.

In conclusion, this study highlights the importance of an interdisciplinary approach that blends Ayurvedic wisdom with modern sports medicine for effective treatment of ankle injuries. Future research could explore further synergies between these systems to enhance injury prevention, recovery, and rehabilitation strategies, especially for athletes.

SUMMARY & CONCLUSION

This study combined Ayurvedic and contemporary viewpoints to investigate the structural and clinical importance of the *Gulpha Sandhi* (ankle joint), with a particular focus on sports-related damage. The *Gulpha* is not only crucial for movement and balance but also classified as a vital *Marma* point in Ayurveda, highlighting its importance in maintaining overall health. Modern medical literature confirms that the ankle joint is prone to frequent injuries, particularly in athletes, due to the forces exerted on it during physical activities like running and jumping.

The study found that the most common sports-related injuries to the *Gulpha Sandhi* include ligament sprains, fractures, and tendon damage, with biomechanical analysis showing that inversion and eversion are high-risk movements for injury. Clinical observations revealed that proper rehabilitation is key to preventing recurrence and ensuring full recovery.

The integration of Ayurvedic treatments, such as *Marma* therapy, with modern medical practices, including physiotherapy and surgical interventions, demonstrated improved outcomes for injury management and rehabilitation. This interdisciplinary approach offers a more holistic recovery and a reduced likelihood of reinjury.

This study concludes by highlighting the importance of integrating Ayurvedic concepts with contemporary sports medicine for *Gulpha Sandhi* injury prevention, treatment, and rehabilitation. To help athletes and the general public manage ankle joint issues, more research should concentrate on refining these integrated treatments.

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