An Integrative Anatomical and Clinical Analysis of Shringataka Marma w.s.r. to Cavernous Sinus. A Scoping Review

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Abstract

Background:
Shringataka Marma, a vital point located in the head region, is described in Ayurvedic texts as a confluence of crucial channels (*Siras*, *Srotas*, and *Nadi*) responsible for the functioning of the eyes, ears, nose, and tongue. In modern neuroanatomy, the cavernous sinus—an intricate venous plexus within the cranial cavity—shares close anatomical and functional relevance with this *Marma*. Despite their respective descriptions in Ayurvedic and contemporary anatomical literature, the integrative understanding of these structures remains underexplored.

Objective:
This scoping review aims to map existing literature correlating the Ayurvedic concept of Shringataka Marma with the modern anatomical and clinical understanding of the cavernous sinus, identifying anatomical convergence, therapeutic significance, and potential clinical implications in head and neck disorders.

Methods:
A comprehensive literature search was conducted using classical Ayurvedic texts (*Sushruta Samhita*, *Ashtanga Hridaya*) and modern anatomical references. In addition, electronic databases were searched for studies, reviews, and articles published in English between 2000 and 2025. Data was charted to compare anatomical landmarks, vascular and neurological relations, and clinical conditions associated with both entities.

Results:
The review found substantial anatomical overlap between the classical description of *Shringataka Marma* and the location of the cavernous sinus, particularly in relation to cranial nerves and the internal carotid artery. Both structures are centrally involved in the coordination of sensory functions of the face and head. Ayurvedic interventions such as *Nasya*, *Shirodhara*, and *Marma* stimulation over the *Shringataka* region have shown clinical

benefits in conditions like sinusitis, optic neuropathy, and cranial nerve palsies. However, standardized anatomical correlations and clinical trials remain limited.

Conclusion:
Shringataka Marma and the cavernous sinus share a significant anatomical and functional relationship. This integrative analysis enhances the understanding of traditional Ayurvedic knowledge through the lens of modern anatomy. Further interdisciplinary research and imaging studies are needed to validate therapeutic applications and refine anatomical mapping, potentially bridging traditional and modern approaches to neurovascular disorders.

Keywords: *Shringataka Marma*, Cavernous Sinus, Ayurvedic Anatomy, Cranial Nerves, *Marma* Therapy, Scoping Review.

Introduction

The human head is home to some of the most intricate and vital anatomical structures. In Ayurvedic medicine, the head is considered a critical region governed by subtle energies and complex anatomical interrelationships. Among the various *Marma* points—vital anatomical sites described in Ayurveda—the *Shringataka Marma* holds a unique place. Situated deep within the cranial region, this *Marma* is regarded as a central junction where channels associated with vision, hearing, smell, and taste converge. Its injury is said to lead to rapid and severe physiological disruption, underscoring its vital importance.[1]

While ancient texts articulate *Shringataka Marma* in the language of channels (*srotas*) and energies (*prana*), modern anatomy offers a strikingly similar structure: the **cavernous sinus**. Embryologically,[2] the cavernous sinus develops from the primitive dural venous plexus, gradually transforming into a complex, multilayered venous structure interwoven with arachnoid trabeculae. This intricate formation may reflect the Ayurvedic understanding of *Marma*, which is described as a convergence of muscle (*mamsa*), vessels (*sira*), ligaments (*snayu*), and bone (*asthi*). The cavernous sinus, though relatively small—measuring about 2 cm in length and 1–1.5 cm in width—houses several vital neurovascular components. These include the internal carotid artery and cranial nerves III (oculomotor), IV (trochlear), V_1 and V_2 (ophthalmic and maxillary divisions of the trigeminal nerve), and VI (abducens), either coursing through its cavity or embedded within its lateral wall. Together, these structures facilitate essential functions such as cerebral blood flow and the motor and sensory regulation of the eyes, face, and jaw—functions closely aligned with those attributed to *Shringataka Marma*, which governs the activity of the sensory organs in classical Ayurvedic anatomy.[3] Located on either side of the sella turcica, the cavernous sinus is a dural venous sinus that houses crucial neurovascular structures, including cranial nerves as well as the internal carotid artery. Its proximity to the optic chiasma and pituitary gland, and its communication with facial and ophthalmic venous systems, make it a central anatomical and clinical landmark. Pathologies affecting this area, such as thrombosis or trauma, can present with multisystem symptoms—visual impairment, ophthalmoplegia, facial numbness, or altered

consciousness—that intriguingly reflect the classical descriptions of *Shringataka Marma* injury.[4]

This scoping review[5] explores the structural and clinical correlation between *Shringataka Marma* and the cavernous sinus. Rather than merely drawing parallels, this study investigates the deeper anatomical reasoning and potential clinical relevance that emerges when classical Ayurvedic knowledge is re-examined through the lens of contemporary neuroanatomy. The relevance of this comparative inquiry is twofold. First, it offers a framework for integrating traditional anatomical wisdom with modern medical understanding. *Marma* points, though ancient in origin, are conceptually rich and may guide a more cautious and respectful approach to specific anatomical zones during surgery, diagnosis, and trauma management. Second, this exploration contributes to the emerging field of integrative medicine, where insights from traditional systems are increasingly being incorporated into modern clinical practice for a more holistic approach to health and healing.

Importantly, this review does not claim a one-to-one anatomical equivalence between *Shringataka Marma* and the cavernous sinus. Instead, it recognizes overlapping characteristics in structure, function, and clinical outcomes—prompting a renewed appreciation for the intuitive anatomical acumen present in early Ayurvedic literature. By tracing classical references, reviewing modern anatomical research, and examining clinical manifestations of cavernous sinus involvement, this study attempts to build a conceptual bridge between two distinct yet intersecting knowledge systems. In doing so, it encourages interdisciplinary dialogue and offers a fresh perspective on how ancient anatomical classifications may still inform and enrich current medical understanding.

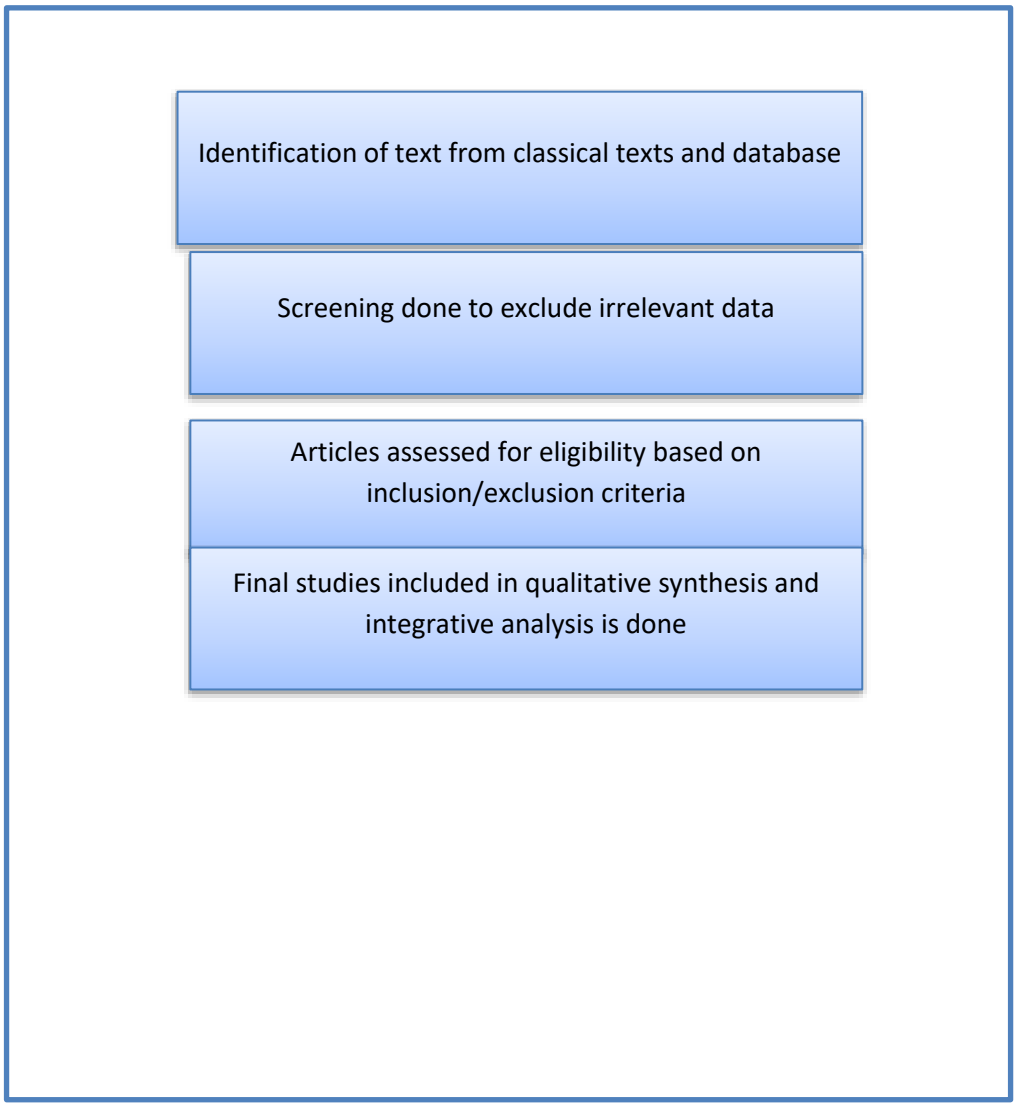
Methodology

This study was designed as a **scoping review**[5] to explore and integrate anatomical and clinical correlations between *Shringataka Marma* as described in Ayurvedic texts and the *cavernous sinus* in contemporary anatomy.

The central research question was "What are the anatomical and clinical correlations between *Shringataka Marma* and the cavernous sinus, and how can this understanding inform integrative therapeutic approaches?"

The inclusion criteria for this scoping review comprised classical Ayurvedic texts that describe *Shringataka Marma*, as well as peer-reviewed modern anatomical and clinical studies discussing the cavernous sinus, published between the years 2000 and 2025, in the English language, and relevant to the anatomical, physiological, or therapeutic aspects of the cranial region. Studies were excluded if they were non-English publications without accessible translations, animal-based research not directly relevant to cavernous sinus anatomy, editorials, opinion pieces, non-peer-reviewed sources, or duplicate records that did not contribute unique data or perspectives to the topic.

A comprehensive literature search was performed using both traditional Ayurvedic scriptures like *Sushruta Samhita* and *Ashtanga Hridaya*, and modern scientific databases using PubMed, Google Scholar, AYUSH Research Portal, Scopus, and ResearchGate. Relevant articles and textual references were extracted, organized and analyzed for a qualitative scoping review.



Discussion

The understanding of *Shringataka Marma* within the Ayurvedic framework goes far beyond structural identification—it represents a vital junction where sensory integration, physiological balance, and consciousness converge. When viewed through the lens of contemporary anatomy, particularly in relation to the **cavernous sinus**, this *Marma* offers an intriguing intersection of traditional wisdom and modern neurovascular science.

The *Shringataka Marma* is traditionally understood as a site from which the channels (*srotas*) of the eyes, ears, nose, and tongue emerge or merge. This suggests a centralized anatomical location deeply embedded in the cranial cavity. Although ancient Ayurvedic texts did not

possess the tools of dissection and microscopic visualization available today, their descriptions were grounded in clinical observation and intuitive mapping. When this classical understanding is compared to the **cavernous sinus**, a venous plexus located in the middle cranial fossa, a profound functional correlation becomes apparent.[6]

The cavernous sinus, though compact in size, acts as a central conduit for both venous drainage and neural communication in the cranial region. Housing cranial nerves responsible for ocular motion, facial sensation, and vascular regulation, this sinus serves as a neurological and circulatory hub. This structural-functional correspondence offers a credible foundation to suggest that ancient descriptions of *Marma* were not merely symbolic or philosophical, but rather empirical in nature—guided by a keen observation of clinical effects following trauma or disease.[7]

What makes this comparison particularly compelling is the **functional integration** observed in both systems. In Ayurveda, *Shringataka Marma* is not only anatomically critical but also physiologically central to the coordination of sensory perception. Likewise, the cavernous sinus and its associated neurovascular components manage the fine balance between motor control and sensory reception in the upper face and skull. Disorders affecting the cavernous sinus—such as cavernous sinus thrombosis, aneurysms, or trauma—often lead to a cluster of symptoms like ophthalmoplegia, ptosis, facial pain, diplopia, and visual disturbances. These effects are strikingly consistent with classical descriptions of *Marma abhighāta* (Marma injury), which is said to cause instant unconsciousness, dysfunction of sense organs, or even death depending on the type of *Marma*.[8,6]

Furthermore, the embryological development of the cavernous sinus—from a primitive dural venous plexus to a multi-layered structure enclosed by connective tissue and trabeculae—also mirrors Ayurvedic theory. The Ayurvedic characterization of *Marma* as a confluence of *mamsa* (muscle), *sira* (vessels), *snayu* (ligaments), and *asthi* (bones) implies an appreciation for the composite nature of these vital spots. This layered developmental process suggests a dynamic interplay between structure and function that transcends the limitations of either system when considered in isolation.[2,6]

From a therapeutic perspective, understanding the correlation between *Shringataka Marma* and the cavernous sinus can enhance integrative clinical strategies. For instance, certain Ayurvedic treatments—like *nasya* (nasal drug administration), *shirodhara* (continuous oil dripping on the forehead), or head-based *marma chikitsa*—are designed to influence the cranial sensory organs. Modern neuroanatomical understanding of perivascular drug delivery and dural venous system access could be integrated with these approaches, opening avenues for complementary therapies targeting migraine, trigeminal neuralgia, or even intracranial pressure disorders. [9]

Among Ayurvedic therapies affecting the head region, *nasya* karma stands out for its specificity and effectiveness. Classical references prescribe *nasya* for disorders involving *urdhwajatrugata* organs including the Brain, eye, ear, tongue, nose and paranasal sinuses,

shringataka marma is one of the key regions influenced by this therapy. Modern science supports this approach. The *nasa*l route allows for direct brain delivery via olfactory and trigeminal pathways, bypassing the blood-brain barrier. This makes it ideal for treating CNS conditions where traditional systemic therapies are ineffective. Intranasal absorption is enhanced by the rich vascularity of the nasal mucosa and its proximity to the cavernous sinus.[1]

Common Nasya formulations like *anu taila* which contains *bala*, *yashtimadhu*, *jivanti* herbs known for their anti-inflammatory and neuroprotective properties and *shadbindu Taila* contains *brahmi*, *tagara*, *jatamansi* recognized for their nootropic, anxiolytic, and cholinergic modulating actions.[10,11]

The effectiveness of *nasya karma* in influencing *shringataka marma* through intra*nasa*l drug delivery mirrors pharmacokinetic models of nose-to-brain transport. Modern research shows that the olfactory and trigeminal nerve routes can facilitate direct entry of molecules into the brain by passing the blood-brain barrier.[12] Studies suggest that lipid-based carriers like medicated *ghrita* (clarified butter) significantly improve CNS bioavailability, prolong half-life, and reduce systemic toxicity.[13] These findings reinforce ayurvedic concepts, where unctuous *nasya* agents are used to lubricate, nourish, and restore function to depleted cranial pathways. Applying *nasya* over the nasal mucosa and the *shringataka marma* zone reflects a synergy with modern nasal pharmacokinetics and neurotherapeutics. Clinical evidence supports its efficacy in epilepsy, sinusitis, headache, facial paralysis, parkinson's disease, multiple sclerosis, vascular dementia, and psychosomatic disorders—underscoring its targeted action on *marma points* and cranial neurovascular systems.[14, 15]

Contemporary understanding affirms that the cavernous sinus is an epicenter of neurovascular convergence, where even slight trauma or infection may lead to complex neurological deficits or rapid systemic deterioration. Cranial nerve palsies, vision loss, and cavernous sinus thrombosis are direct examples of such dysfunction.[16] The pathophysiological cascades seen in these conditions echo the Ayurvedic warning that trauma to *shringataka marma* can disturb the flow of *prana*, impair sensory perception, and cause sudden death. This cross-validation of fatal consequence underscores the need to integrate *marma* insights into modern surgical and diagnostic strategies.

This comparison also holds significant educational value. In the evolving landscape of integrative medicine, there's a pressing need to develop teaching models that synthesize traditional knowledge with biomedical science. Introducing *marma* science into medical curricula may enhance a physician’s spatial awareness during cranial surgeries or maxillofacial interventions. It would also reinforce safety consciousness when operating near anatomical danger zones as it is a site of convergence for multiple cranial nerves, venous sinuses, and the internal carotid artery, making it vulnerable. Simultaneously, Ayurvedic practitioners could benefit from understanding MRI or CT-based anatomy for precise localization of *marma* and individualized therapy planning By aligning *Shringataka Marma* with the cavernous sinus, anatomy educators and clinicians can foster a deeper, more holistic

appreciation of the head region—both in terms of structural precision and energetic significance.[2,17]

However, it is important to approach such correlations with critical balance. While the overlap is compelling, there remain epistemological differences between the two systems. Ayurveda conceptualizes the body as a living field of energies and functions (*dosha*, *prana*, *ojas*), while biomedicine focuses on measurable anatomical and physiological parameters. Rather than trying to make one system fit entirely into the mold of the other, the goal should be **complementarity**, where insights from both traditions enrich understanding and improve patient care.[18]

To sum up with these insights, the relationship between *Shringataka Marma* and the cavernous sinus is not merely anatomical—it is a convergence of function, vulnerability, and systemic integration. This scoping review affirms that ancient Ayurvedic descriptions of vital points possess a surprising depth of anatomical intuition, aligning well with modern neurovascular frameworks. Future research should explore these overlaps through imaging studies, cadaveric dissection, and clinical trials to validate and expand upon this interdisciplinary bridge.

Conclusion

The *Shringataka Marma*, as described in classical Ayurvedic texts, represents a vital anatomical nexus where multiple sensory and vascular pathways converge. Through an integrative anatomical and clinical analysis, this review highlights its striking correlation with the cavernous sinus in modern neuroanatomy. The structural proximity of *Shringataka Marma* to critical cranial nerves and blood vessels mirrors the intricate neurovascular complexity of the cavernous sinus. Clinically, injuries or pathologies in this region, such as cavernous sinus thrombosis or cranial nerve palsies, result in symptoms that parallel *Marma-abhighata* (trauma to vital points) outcomes described in Ayurveda. This scoping review thus bridges classical Ayurvedic wisdom with contemporary anatomical understanding, reinforcing the relevance of *Marma* science in modern clinical practice. Further interdisciplinary research is warranted to explore the diagnostic, prognostic, and therapeutic implications of such anatomical parallels in integrative healthcare.

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