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The anatomical concept of *Phana Marma*: A Review Article

Kunwar Shivangi¹, Verma Deepak²

¹Assistant Professor, Department of Sharira Rachana, Beehive Ayurvedic College and Hospital, Dehradun, Uttarakhand, India.

²Assistant Professor, Department of Sharira Rachana, Shivalik Institute of Ayurved and Research, Dehradun, Uttarakhand, India.

ABSTRACT

Anatomical Elaboration of each and every *Marma* is necessary to simplify the complexity of knowledge and to utilize it in the practical aspect. In this study we clarify the anatomical structure which can be correlated with *Phana Marma*. This study is based on the literature related to this *Marma*. We begin with the compiling the ancient *Ayurvedic* manuscript and the related modern literature. After simplify the ancient literature and comparing both aspect we concluded that the structure damaged and shows traumatic effect should be the vessels present in the postero-lateral aspect, deep in the nasal cavity i.e. Sphenopalatine Artery. We also elaborated the connection of Eustachian tube pharyngeal opening with this *Marma*.

Key words: *Phana Marma*, *Sheera*, *Sphenopalatine Artery*, *Eustachian tube*, *Sphenopalatine foramen*.

INTRODUCTION

Marma science is a unique, necessary and unavoidable part of *Ayurvedic* literature. Its references are scattered in many Indian ancient literatures but comparatively *Shamhita Grantha* are the major source of its knowledge. Among all *Shamhitas*, *Susruta Shamhita* described the detailed concept of *Marma Sharira* and mentioned *Marma* knowledge as half of the knowledge of complete *Shalya Tantra*. *Acharya Vagbhata* in *Astanga Samgraha* and *Astanga Hridayam* followed the same view about *Marma* with little bit of changes. Researchers continuously study these *Marma* and their concepts to make it beneficial in the field of *Ayurveda* and modern Surgeries. Total no. of *Marma* is

107 and one of the important head seated *Marma* among these is *Phana Marma*. It is situated deep in the nasal cavity and traumatically this *Marma* is mentioned under *Vaikalyakara Marma* (causes deformity), its injury caused smell dysfunction. Partial or complete Anosmia (loss of smell) is one of the complications during the Sinus surgeries, Pituitary surgery and other Maxillofacial surgeries. All these surgeries are approaches through the nasal cavity. In these surgeries researcher mostly conclude that the structure which injured and causes anosmia (partial or complete) is the structure of olfactory pathway (especially in between olfactory epithelium to olfactory bulb). That's why mostly the *Phana Marma* is concluded as the region included olfactory epithelium to olfactory bulb.

Phana Marma is comprises under *Sheera Marma* means the damaged structure should be the vessels, vessels which should be lying deep in nasal cavity and can cause smell disability when injured. In modern surgery literature, the structure other than olfactory region which is injured during most of the transnasal surgeries is sphenopalatine artery. It can cause severe epistaxis if injured during procedures and this severe hemorrhage can lead to smell dysfunctioning. In this study we correlate the *Phana Marma* with the sphenopalatine artery through compiling the *Ayurvedic*

Address for correspondence:

Dr. Kunwar Shivangi

Assistant Professor, Department of Sharira Rachana, Beehive Ayurvedic College and Hospital, Dehradun, Uttarakhand, India.
E-mail: shivangi1993kunwar@gmail.com

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literature related to this *Marma* and after simplify the references, we correlate the *Marma* with the sphenopalatine artery with the help of related modern anatomical and surgical literature review. Another unelaborated thing about this *Marma* is the term *Phana*, why this term is used? Here why this study has been initiated. In this study our aim is to identify the definite structure which can be co-relate with *Phana Marma* on the basis of location, clinical sign on injury, number of *Marma* and vital structure involved.

REVIEW OF LITERATURE

Ancient Literature

Phana means the wide head of snake, its shape is like *Darvi* (a concave vessel for cooking food), having concavity in it and it contracts and relaxes or its size increases and decreases.^[1]

Ghrana Marga Ubhayataha Srotomarga Pratibaddhe Abhyantartaha Phanne Tatra Gandha Agyanam (Susruta Samhita, Sharira Sthana 6/27)

Phana Marma is located in the passage of nose bilaterally; internally it is bind with or connected with a channel. Injury on this *Marma* results in loss of smell sense.

Ghranityadi Ghrana Margasya Davyoha Parsavyo Abhyantara Vivara Sambaddhe Fane (Susruta Samhita Dalhana Commentory, Sharira Sthana 6/27)

According to *Acharaya Dhalhana*, *Phana* is in both nasal passages, laterally and closely attached with the internally situated opening.

Ghrana Maarga Ubhayataha Shrotra Marga Pratibaddha Abhyantarataha Fano Tayorgandha Agyanam (Astanga Samghraha Sharira Sthana 7/37)

Phana Marma is two in number, situated either side of the nasal passage, internally it connecting with or adjoining the path for ear. Injury on *Phana Marma* results loss of smell sense.

Fano Ubhayato Ghrana Marga Srotra Pathanugo Antargala Sthito Vedhada Gandhavigyan Harino. (Astanga Hridayam Sharira Sthana 4/30)

Phana Marmas are situated on either side of nasal path; closely related to ear channel, inside the *Gala*

Pradesh. Injury on this *Marma* causes loss of perception of smell.

Fanaviva Sansthanama Rupamanayoha Fanaviti Naam. (Astanga Hridayam, Sarvanga Sundari Commentary, Sharira Sthana 4/30)

According to *Sarvanga Sundari*, *Phana Marma* have *Sansthana* (features) of *Phana* and have *Rupa* (appearance) similar to *Phana*, therefore it is termed as *Phana Marma*.

Description of *Phana Marma*^[2]

Name of <i>Marma</i>	<i>Phana</i>
Number	2
Site	<i>Ghrana Marga Ubhayataha Srotomarga Prtibaddhe Abhyantartaha</i>
Type (acc. to <i>Rachana</i>)	<i>Sira Marma</i>
Type (acc. to <i>Aaghtaja Parinama</i>)	<i>Vaikalyakara Marma</i>
Type (acc. to <i>Pramana</i>)	<i>Ardha Angula</i>
Sign if injured	Loss of perception of smell

Modern Literature

Nasal Anatomy

Nose is a respiratory as well as olfactory organ. It is divided into two parts -

- External Nose** - Outer, prominent, pyramidal skeletal framework that is partly bony and partly cartilaginous.
- Internal Nose/Nasal Cavity^[3]** - The nasal cavity is an irregular space between the roof of the mouth and the cranial base and it extends from the external nares or nostrils to the posterior nasal apertures or choanae. Nasal cavity is continuing into nasopharynx through choanae. The nasal cavity is divided by a vertical, midline osseocartilaginous septum. Each half of the nasal cavity has a vestibule, floor, roof, medial and lateral walls.

Lateral wall^[4] - The skeleton of the lateral wall is partly cartilaginous, partly bony, and partly made up only of soft tissues. The cartilaginous part is formed by the superior nasal cartilage, the inferior nasal cartilage and three or four small cartilages of the ala. The bony part is formed from before backwards by Nasal bone, Frontal process of maxilla, Lacrimal bone, Labyrinth of ethmoid with superior and middle conchae, Inferior nasal concha, Perpendicular plate of palatine bone together with its orbital and sphenoidal processes and Medial pterygoid plate of sphenoid bone. A foramen called sphenopalatine foramen is present in the posterior part of lateral wall of nasal cavity.

The sphenopalatine foramen, which is really a fissure, transmits the sphenopalatine artery and nasopalatine and superior nasal nerves from the pterygopalatine fossa (fig. 1). It is posterior to the middle meatus, and bounded above by the body and concha of the sphenoid, below by the superior border of the perpendicular plate of the palatine bone, and in front and behind by the orbital and sphenoidal processes of the palatine bone, respectively.^[3] (fig. 1)

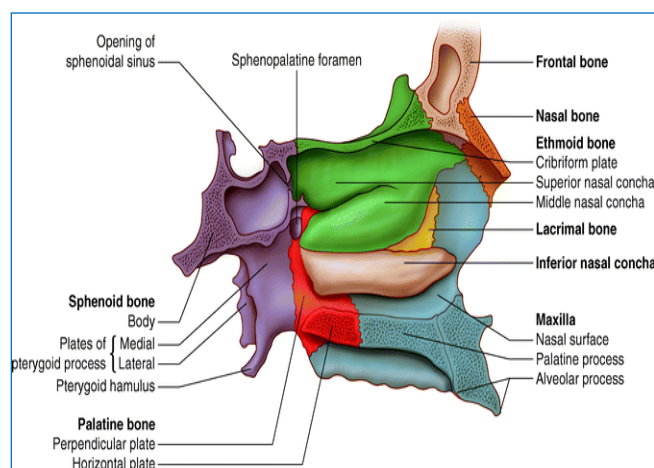


Fig. 1: Showing sphenopalatine foramen
(https://link.springer.com/chapter/10.1007/978-1-4614-1007-2_1)

It is located mostly into the superior nasal meatus, sometimes between the superior nasal meatus and middle nasal meatus and less commonly at the level of the middle nasal meatus⁵. Posteriorly, It is situated almost at the choanae. Content of sphenopalatine foramen are sphenopalatine artery, posterior superior lateral nasal nerve, nasopalatine nerve.^[5]

Nasal and olfactory mucosae^[3]

- The olfactory region (upper 1/3rd) is limited to the superior nasal concha, the opposed part of the septum and the intervening roof. It is lined by olfactory epithelium. Olfactory mucosa covers approximately 5 cm² of the posterior upper parts of the lateral nasal wall, including the upper part of the vertical portion of the middle concha. It consists of a yellowish-brown pigmented pseudostratified epithelium containing microvilli, olfactory receptor neurons, sustentacular cells and two classes of basal cell, lying on a subepithelial lamina propria containing subepithelial olfactory glands (of Bowman) and bundles of axons derived from the olfactory receptor neurons that course through the mucosa on their way to the cribriform plate. All these structures have role in the olfaction.
- The respiratory region (remaining 2/3rd) comprises the rest of the cavity. Respiratory epithelium forms most of the surface of the nasal cavity, i.e. it covers the conchae, meatuses, septum, floor and roof, except superiorly in the olfactory cleft.

Blood Supply

The sphenopalatine artery serves as the major supply of the nasal fossa.^[6] The Sphenopalatine artery branches into two major vessels, the septal artery and posterior lateral nasal artery, before exiting the sphenopalatine foramen.^[7] There are cases reported in which sphenopalatine artery is injured (pseudo aneurism) during transsphenoidal pituitary surgeries or faciomaxillary surgeries.^[8] Anterior and posterior ethmoidal arteries are major vessels supplying the ethmoid sinus, septum and anterior skull base.^[9]

The olfactory mucosa and olfactory neurons located in the postero-superior portion of the nasal cavity receive blood from an abundant vascular supply formed by branches of the external and internal carotid arteries, the sphenopalatine artery and the anterior and posterior ethmoidal arteries respectively. The anterior and posterior ethmoidal arteries originate from the ophthalmic artery, a branch of the internal carotid artery. In conjunction with the sphenopalatine artery,

the anterior and posterior ethmoidal arteries form extensive anastomotic networks supplying the olfactory mucosa.^[10] (Fig. 2)

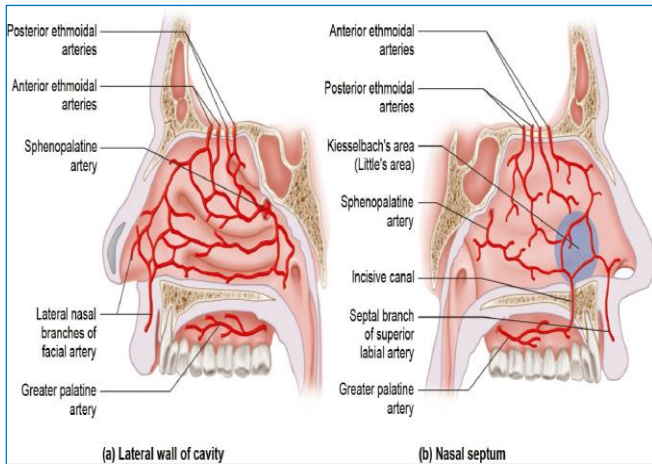


Fig. 2: Showing anastomosis between sphenopalatine artery and ethmoidal artery, <http://shining.homes/nasopalatine-artery>

Nasopharynx Anatomy^[11]

It is the upper most part of the pharynx. It lies behind the nasal cavity (started from the choanae) and extends from the base of skull to the soft palate or the level of the horizontal plane passing through the hard palate. Its Roof is formed by basisphenoid and basiocciput. Anteriorly; the Floor is formed by the soft palate but posterior there is an opening called nasopharyngeal isthmus through which nasopharynx communicates with the oropharynx. Anterior to nasopharynx there is an aperture called posterior nasal apertures or choanae which connect it with nasal cavity. Posterior wall of nasopharynx is formed by arch of the atlas vertebra.

Lateral wall - Each lateral wall presents the pharyngeal opening of Eustachian tube situated 1.25 cm behind and below the posterior end of inferior turbinate. Eustachian tube is a canal which connects the nasopharynx to middle ear. Eustachian tube opening is an important landmark for endoscopic evaluation in various middle ear and nasopharyngeal disease and for approaching the infratemporal fossa transnasally.^[12]

Surrounding Anatomy of pharyngeal opening of Eustachian tube - The tubal aperture is approximately triangular in shape, and is bounded above and behind by the tubal elevation that consists of mucosa

overlying the protruding pharyngeal end of the cartilage of the pharyngotympanic tube. A vertical mucosal fold, the salpingopharyngeal fold, descends from the tubal elevation behind the aperture and covers salpingopharyngeus in the wall of the pharynx; a smaller salpingopalatine fold extends from the antero-superior angle of the tubal elevation to the soft palate in front of the aperture^[13] (fig. 3). The tubal elevations surrounding the pharyngeal opening resembles the shape of snake hood. There are evidences present where injury to the pharyngeal portion of Eustachian tube during operative procedure causes partial deafness.^[14]



Fig. 3: Showing elevation around the pharyngeal opening of Eustachian tube in the nasopharynx. (<https://www.cureus.com/articles/136612>)

Surgical procedure such as sinus surgery, turbinectomy, adenoidectomy and maxillary advancement may cause obliteration of cartilaginous Eustachian tube. Scarring from the adjacent procedure such as adenoidectomy can affect the Eustachian tube orifice. In these surgical procedures scarring or altered anatomy may cause permanent changes in ear function as complication. Chronic middle ear effusion due to Eustachian tube obliteration may cause hearing deficiency.^[15]

DISCUSSION

Etymologically *Phana* word is derived from *Phana Dhatu*, this means "Hood of Snake". According to *Acharyas* the *Phana Marmas* are situated bilaterally inside the nasal cavity or in nasal passage. The terminology "*Abhyantarata*" mentioned by *Maharshi*

Susruta and in *Astanga Samgraha* indicates that this *Marma* is located internal in the nose but in *Astanga Hridaya* the term “*Antara Gala*” is used in place of “*Abhyantarataha*” means it is situated very deep in the nasal cavity. So, the position is very deep to the nasal passage (near the choanae) or at the beginning of nasopharynx. “*Parsava*” is indicating that this point is situated in the lateral wall of nose or nasopharynx. As we mentioned earlier that this *Marma* is a *Sheera Marma* means the vital structure at this situation is vessels. There are multiple structures in the lateral wall of nasal cavity but a posterior situated structure which should be present bilaterally near the choanae and related to a vessels is “Sphenopalatine Foramen”. This foramen transmits “Sphenopalatine Artery” into the nasal cavity.

Acharya Sushruta has mentioned the word “*Srotomarga Pratibaddhe*” similarly *Acharya Vagbhata* has stated “*Shrotra Marga Pratibaddha*” and “*Srotra Pathanugo*” regarding the location of *Phana Marma*. “*Srotomarga*” means any passage through which something goes and “*Pratibaddhe*” means ‘bound’, ‘tied’ or ‘closed’.^[4] Means this *Marma* is closely related to the passage of ear. In *Dalhana* commentary of this phrase, *Dalhana* mentioned that this *Phana Marma* is closely related to the *Vivara* (opening) which is present in deep inside on the nose in the “*Parshava*” or lateral wall. Although *Dhalhana* not mentioned ear directly but the detailing in his commentary indicates towards the Eustachian Tube opening present at the level of starting of nasopharynx. An ear connection which is situated close to nasal cavity and naso-pharynx is ‘Pharyngeal Opening of Eustachian Tube’. The main cause why *Acharya* mentioned “*Srota Marga Pratibaddha*” or indicating towards Eustachian Tube pharyngeal opening because they want to mentioned a landmark here, a landmark which should have a specific shape to identify and near location to that particular vital point (Sphenopalatine Artery). Because the Sphenopalatine Foramen and artery are situated under the mucous membrane and not visible in the superficial inspection therefore a visible nearer landmark is necessary to easily identify the area which should be protect during *Shalya Karma*.

This tube is situated just 1.25 cm behind of the posterior end of inferior nasal concha. On the basis of this distance, we can assume that Pharyngeal opening of Eustachian Tube is a neighbour structure of Sphenopalatine Foramen which is at the level of middle or superior nasal concha. On seeing Eustachian tube opening in a mid sagittal section of head and neck it is surrounded by elevations from anteriorly (Salphyngeo-Palatine Fold), superiorly (Cartilaginous Elevation) and posteriorly (Salphyngeo-Pharyngeus Fold). Due to these elevations a prominence which resembles like the shape of the hood of snake is formed around opening. That’s why this *Marma* is called *Phana Marma*. *Acharya Arundutta* mentioned in his commentary on *Astanga Hridayam* that this *Marma* has ‘*Lakshana*’ (features) and ‘*Rupa*’ (appearance) like the ‘*Phana* or snake hood’. In “*Amarkosha*”, *Acharya* mentioned the shape and features of *Phana*, that the *Phana* is shaped as concavity and it has the ability to contract (*Sankocha*) and relax (*Vistara*), when we see the elevation around the Eustachian tube opening, it arranged in concavity and because its framework is made up of muscles it had the ability to contract and expand. It indicates that term *Phana* is used to indicating a nearer landmark which had shape (concave) and movement like *Phana*. Each structure either Sphenopalatine Artery origin, Sphenopalatine Foramen and elevated margin surrounding Eustachian Tube Pharyngeal Opening are situated in lateral wall. That’s why the term “*Parsavyo*” is mentioned by the commentators. *Phana Marma* situation is in the sides of nasal cavity.

Traumatically *Phana Marma* is *Vaikalya Kara Marma* and if it is injured there is alteration of smell sensation occurred. Sphenopalatine Artery which enters nasal cavity through Sphenopalatine Foramen anastomosed with ethmoidal arteries and this collaboration supplies the whole olfactory mucosa. Sphenopalatine is major blood supply of nasal mucosa so on damage of this artery hampers the function of olfactory mucosa too, which leads to altered functioning of olfactory epithelium, olfactory glands and nerves. Ultimately it compromises smell sensation. As a *Vaikalya Kara Marma*, injury to this area may cause hearing

disturbance, due the presence of Eustachian Tube nearby.

This study fills the lacunae which are present in the knowledge of *Phana Marma* and also open a path to think of other possible causes which can leads to olfaction disturbance other than olfactory pathway damage. Further study may help surgeon to understand one more cause of olfaction loss in facio-maxillary surgeries.

CONCLUSION

On the basis of situation, number, vital structure, traumatic effect and shape, we can correlate *Phana Marma* with Sphenopalatine Artery at particular point where it transmits through sphenopalatine foramen and enters in nasal cavity. *Phana* (hood shaped) nomenclature is used to mention a landmark nearby *Phana Marma* which is hood shaped elevated margin of Eustachian Tube Pharyngeal Opening.

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