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A Critical Interpretation on *Sandhi Sharir*

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Abstract: ***Sandhi Sharir, the study of joints within Ayurvedic anatomy, is a fundamental aspect of the musculoskeletal system. Understanding the classification, structure, function, and pathology of Sandhis (joints) provides essential insights into both traditional and modern medical practices. The bone that does Dharan of the body serves as the primary support for the human body. These bones are attached to one another by a variety of joints, which allows them to hold the body in the right position. Only the joints allow the body to move, therefore understanding the Sandhi's structure and function is crucial for a better understanding of the Sandhi. Aacharya Sushruta has quoted that although there are numerous Sandhi in our body which cannot be counted so only Asthi Sandhi should be considered while enumerating Sandhi. The definition of Sandhi in various Ayurvedic literature are given as "Asthi Samyoga Sthaaana" or "to unite" or "the meeting point of two or more structures counted so only Asthi Sandhi or bony joints should be considered under the term Sandhis.A thorough knowledge of the structures and functions of the joint is required to diagnose and treat the disease of joints.***
Keywords: Sandhi sharir, Joints, Anatomy, Asthi Samyoga, Sandhi Sankhya

I. INTRODUCTION

Ayurveda is the most ancient science of medicine in the world. It is considered as the intimate part of *Athraveda*. In ancient text of Ayurveda like *Sushruta Samhita, Charaka Samhita* and *Ashtang Sangraha* the knowledge of *Sharir Sthan* is important for the treatment of human being. The detail study of human body (*Sharir)* is described in *Sushruta Samhita*. *Sandhi* means - union. *Sandhi* is the junction of bones and is seat of *Shelshak kapha* which help to keep the body parts together. The word "*sandhi*" is derived from the root *Sam+Dha+Ki,* which means holding together, joining, and binding (*Sandhana-Miti*). *Sandhis* are the seat of *Kapha* and are located at the bone joint. The *Sandhi*, which can be interpreted as the intersection or union of two or more structures, assists in holding the body components together. They are integral to facilitating a wide range of bodily motions, supporting structural integrity, and maintaining the overall functionality of the skeletal framework.

Joints, or articulations, are the physical connections between bones in the human body. They are essential for providing both stability and mobility, allowing the skeleton to move in various ways while also maintaining its structural integrity. Without joints, the rigid bones of the skeleton would be unable to perform the complex movements necessary for everyday activities such as walking, running, and grasping objects.

II. AIMS AND OBJECTIVES

1) Study of *Sandhi* according to Ayurveda
2) Study of *Sandhi* according to Modern

III. MATERIAL & METHODS

1) *Ayurvedic Literature:* Comprehensive review of classical texts focusing on the classification, structure, and function of joints as described in *Ayurveda.*
2) *Modern Medical Literature:* Review of contemporary anatomical texts, research articles, and clinical guidelines to understand the current scientific perspective on joints.

IV. LITERATURE REVIEW

A. *Ayurvedic View*

Each object in the universe is made up of the 5 fundamental elements known as *Panchmahabhuta* considering the concept of *Panchmahabhuta samgathan*, and thus composition of *Sandhi*can be interpreted as:-

1) *Sandhi* is the meeting location of two *Asthi&Asthis* are dominated by *Prithviguna* suggests that *Prithvi Mahabhuta* is involved.

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2) The space between the articular surface and the *Sandhi* points to the existence of *Akasha Mahabhuta.*
3) Synovial fluid between 2 articular surfaces shows the presence of *Jala Mahabhuta* .
4) The temperature increase that follows the articulation of the bony ends reveals the presence of *Agni Mahabhuta.*
5) *Vata* is responsible for the different ways that *Sandhi* moves and performs and hence Vayu *Mahabhuta* is present.

B. Number of Asthi Sandhis

- *Susruta Samhita* – 210
- *Charak Samhita* – 200
- *Astanga Hridaya* – 200
- *Astanga Samgraha* – 210
- *Kasyapa Samhita* - 381

1) According to Shadangas(Total-17x4=68)

- *Anguli* (in finger and toes) 3x4=12
- *Angushta* (thumb, big toe) -02
- *Janu sandhi* (knee joint)-01
- *Gulpha* (ankle joint)-01
- *Vankshana* (hip joint)-01

2) Koshtanga sandhi (joints of trunk) (Total – 59)

- *Katikapala / shroni* (hip, pelvis)-03
- *Prushtavansha* (spine)-24
- *Parshaw* (side of trunk)-24
- *Uras* (chest)-08

3) Urdhwa jatru sandhi (joints located in the head and neck) (Total-83)

- *Greeva* (Neck)-08
- *Kantha* (Throat)-03
- *Hridya/Kloma nadi* (Heart/Trachea)-18
- *Dantamula* (Roots of teeth)-32
- *Kakalaka*-01
- *Nasa* (Nose)-01
- *Vartma mandal* (orbit, eye brow)-02
- *Ganda* (Maxillae)-02
- *Karna* (ear) *Shankha* (temples)-04
- *Hnu sandhi* (Mandibular joint), *Bhru* (eye brow) *Shanka upari* (above temples) - 06
- *Shiraha kapala* (cranial sutures)-05
- *Murdha* (Head)-01

V. CLASSIFICATION OF *SANDHI*

A. Based on range of movements (Kriyanusaar)

1) Cheshtavanta or Chestha Yukta Sandhi (Joints or Diarthroses)

These are the joints which permit free movements. These joints are flexible and able to move in multi directions. They are found in *Shakha* (limbs) *Hanu* (jaw) and *Kati* (pelvis).

Sub types of *Cheshtavanta Sandhi:*

a) ***Bahu-cheshtayukta Sandhi***- These joints allow wide range of movements and found in limbs (elbow, knee shoulder joint) and lower jaw (tempo- mandibular joint).

b) ***Alpa cheshtayukta sandhi***- These comes under movable joints too but allows only a small range of movements (in comparison to *Bahu cheshtayukta sandhi*) like *Prasthvansha* (vertebral column).

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2) Sthira Sandhi or Acheshta Sandhi (Immobile joints)

These joints are stable and do not allow movements. All the other joints apart from those explained in *Cheshtavanta Sandhi* are considered as *Sthira Sandhi.*

B. According to structure of joints (Rachanausaar)

On the basis of structure and shape of joint, *Sandhis* are of 8 types

1) Kora Sandhi (Hinge joint or gingimus joint)

These posses the shape of hinge and are freely mobile in one direction while partially mobile in the opposite direction. Examples of such *Sandhi* are seen in the joints of *Anguli Sandhi* (joints of the fingers, inter-phalanges joints) *Manibandha Sandhi* (wrist joint) *Gulpha Sandhi* (ankle joint) *Janu Sandhi* (knee joint) and *Kurpura Sandhi* (elbow joint). These *Sandhi* are compared to hinge joint in modern science

2) Ulukhala Sandhi (Ball and socket joints)

These types of *Sandhi* look like stone grinder used in the kitchen in older days that why it is named so. The *Ulukhula* variety of joints is found at *Kaksha, Vankshana* and *Dashana*

a) Samudaga Sandhi (saddle joint)

These joints are of box shaped or plate shaped (bowl). Examples of *Samudaga Sandhi* are the joints found in *Amsapeetha* (glenoid cavity of scapula) *Guda* (coccygeal) and *Nitamba* (iliac) regions. These joints can be correlated to cavity *Kantha* joints

b) Pratra Sandhi (Gliding or plain joint)

These are just plain type of joint wherein one surface of bone articulates with the other surface ofanother bone example of *Pratra Sandhi* can be found in the joints of *Greeva vamsha* (cervical vertebrae) and *Prustha vamsha* (dorsal or thoracic vertebrae) i.e., articulation in 2 vertebrae or inter-vertebral joints. These joints are correlated to plain joints.

c) Tunna Sevani Sandhi (sutures)

These joints are in the forms of stitches or sutures between two bones i.e. one feels as if two bones have been stitched with each other. Examples of *Tunna Sewani Sandhi* can be found in the joints of *Shiraha kapala* (sutures of the skull) and *Kati Kapala* (sutures joints of pelvic bones). These joints can be compared to sutural joints.

d) Vayasa Tunda Sandhi (Condylar joint):

Shape of these joint resembles with the shape of the beak of a crow example of *Vayasa Tunda Sandhi* is found in the joints of *Hanu Sandhi* (Tempo-mandibular joint). These joints can becorrelated to crow beak joints.

e) Mandal Sandhi (Annular joints)

These joints are fixed in nature and cartilaginous joints found in some parts of the body. Example of *Mndala sandhi* is found in (throat) *Hrudya* (heart) *Netra* (eye) and *Klomanadi* (trachea).

f) Shankhavarta Sandhi

These joints are in form and shape of spiral windings of a conch. Example of *Shankavarta Sandhi* can be seen in the joints of *Srota* (ear) and *Sringataka* regions. These joints can be correlated with the spiral and cartilaginous or membranous and fixed joints. Synchondroses are temporary joints which are only present in children, up until the end of puberty. For example epiphyseal plates present in long bones. Symphesis joints are everlasting cartilaginous joints, for example pubic symphysis.

C. Modern Review

Arthrology is the branch of science which deals with the study of anatomy, function, dysfunction and treatment of joints and articulations. The prefix "arthro-" means joints, which derived from the Greek word arthron. Joints are classified on the basis of anatomical characteristics and their type of movement i.e structural classification (binding tissue) and Functional classification (movement).

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VI. CLASSIFICATION OF JOINTS

A. Structural classification

In structural classification, joints are named and categorised based on the kind of tissue that binds the bones together.Joints can be categorised structurally into four groups:

- Fibrous joint: This type of joint is made up of collagen-rich, dense regular connective tissue.
- Cartilaginous joint: Cartilage connects bones in a cartilaginous joint. Primary cartilaginous joints made of hyaline cartilage and secondary cartilaginous joints made of hyaline cartilage covering the articular surfaces of the involved bones with fibrocartilage connecting them are the two types.
- Synovial joint - not directly linked - the bones are joined by the dense, erratic connective tissue that forms the articular capsule, which is typically accompanied with supplementary ligaments. The bones contain a synovial cavity.
- Facet joints connect two articular processes on either side of a vertebra.

B. Functional classification

According to the kind and extent of mobility they provide, joints can also be categorised functionally as follows:.

1) Fibrous Joints (Synarthroses)

Restricts or prevents movement. Synarthrosis joints are often fibrous joints (e.g., skull sutures).

- Structure: These joints are connected by dense connective tissue, primarily collagen.
- Types:

▪ Sutures: Found between the bones of the skull, these joints are immovable and fuse over time.
▪ Syndesmoses: Joints where bones are connected by a ligament or an interosseous membrane, allowing for slight movement (e.g., the distal tibiofibular joint).
▪ Gomphoses: A peg-in-socket fibrous joint, such as the connection between teeth and their sockets in the jawbone.

- Clinical Significance: Disorders like craniosynostosis, where sutures fuse prematurely, can affect skull shape and brain development. Syndesmotic injuries, common in ankle sprains, involve damage to the syndesmosis ligament.

2) Cartilaginous Joints (Amphiarthroses)

Amphiarthrosis allows for some limited mobility. Most of the joints in amphiarthrosis are cartilaginous joints (e.g., intervertebral discs).

- Structure: These joints are connected entirely by cartilage (hyaline or fibrocartilage).
- Types:

▪ Synchondroses: Bones joined by hyaline cartilage, allowing for very little movement (e.g., the epiphyseal plates in growing bones).
▪ Symphyses: Bones joined by fibrocartilage, providing strength with flexibility (e.g., the pubic symphysis and intervertebral discs).

- Clinical Significance: Conditions such as herniated discs result from the displacement of the nucleus pulposus in the intervertebral discs, causing pain and nerve compression. Symphysis pubis dysfunction is a common issue during pregnancy, affecting pelvic stability.

3) Synovial Joints (Diarthroses)

A synovial joint, also referred to as a diarthrosis, is freely mobile.

- Structure: These joints have a fluid-filled synovial cavity, articular cartilage, a joint capsule, and supporting ligaments.
- Types:

▪ Plane Joints: Allow gliding movements (e.g., intercarpal joints of the wrist).
▪Hinge Joints: Permit flexion and extension (e.g., elbow and knee joints).
▪ Pivot Joints: Allow rotational movement (e.g., the atlantoaxial joint in the neck).
▪ Condyloid Joints: Permit movement in two planes (e.g., the radiocarpal joint in the wrist).
▪ Saddle Joints: Allow movement in two planes, similar to condyloid joints but with a saddle shape (e.g., the carpometacarpal joint of the thumb).
▪ Ball-and-Socket Joints: Allow the most freedom of movement in all axes and planes (e.g., shoulder and hip joints).

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VII. DISCUSSION

In *Sharir Sthana, Aacharya Sushruta* provides accurate and sufficient understanding of *Sandhi*and its classification. Only *Asthi Sandhi* should be considered, although other *Sandhi* from *Peshi Snayu* and *Sira* are countless and should be disregarded when counting, according to *Aacharya Sushruta.* After carefully reading conceptual literature, we see that the idea and significance of *Sandhi* are comparable to those of contemporary anatomy. The body is moving in a variety of ways thanks to the *Sandhi*. *Sandhis* are made of *Panchmahabhuta* and are descended from *Pitraja-Bhava,* much like any other component of the body.*Ayurveda* provides a detailed classification of joints based on their structure and function, which parallels modern anatomical classifications. The division into *Cheshtavanta* and *Sthira-sandhi* reflects a sophisticated understanding of joint mechanics. Similarly, the structural classification into types such as *Kora sandhi, Ulukhala sandhi*, and *Samudga sandhi* highlights the diverse forms and functions of joints within the body. The study of *Sandhi Sharir*, or the anatomy of joints, offers a unique opportunity to integrate ancient Ayurvedic knowledge with contemporary scientific understanding. This integration not only enhances our appreciation of joint anatomy and function but also provides an *Ayurvedic* approach to the diagnosis and treatment of joint disorders.

VIII. CONCLUSION

The study of *Sandhi Sharir,* which focuses on the anatomy and function of joints, bridges ancient *Ayurvedic* knowledge and modern scientific understanding. Joints are vital for mobility, stability, and overall skeletal health. In *Ayurveda* detail of *Sandhi Sharir* and joints are close to each other on the basis of function and structure of joints. Their prevalence is steadily rising in accordance with evolution. *Sandhis* are the homes of *Kapha,* especially *Shleshaka kapha,* which keeps them integrated and functioning as well as providing good lubrication.To address their pathology, one must have a complete understanding of the *Sandhis* structural and functional makeup.

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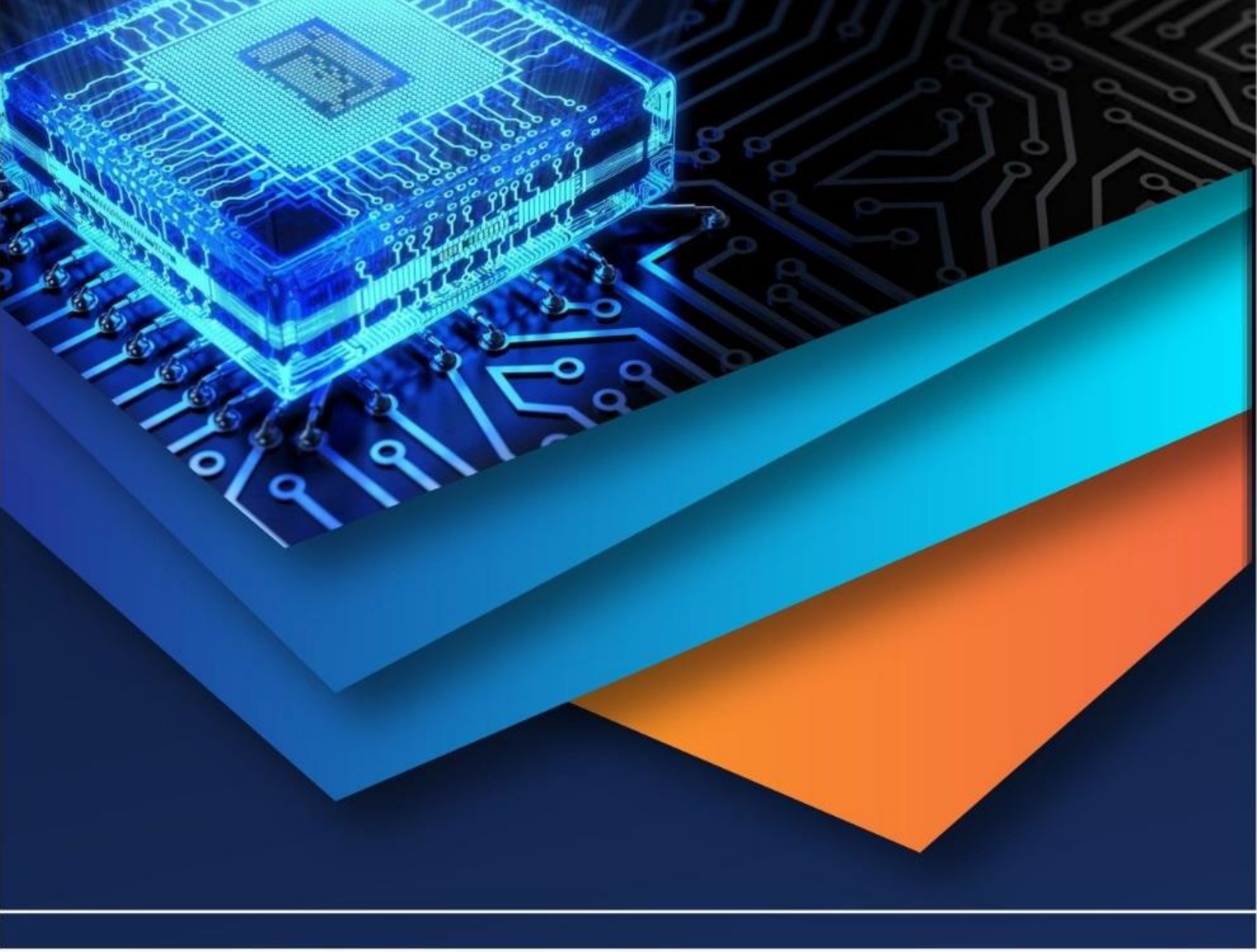

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