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Sandhi (Joint) - Ayurvedic & Modern Perspectives

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ABSTRACT

Joint is a common anatomical entity encountered in a day to day practice. But this dates back to several thousand years during the period of *Acharya Sushruta*. It highlights that knowledge of joints were known to ancient people. During ancient days they used to term *Sandhi* for joints. According to ayurveda, *sandhis* are classified as *Cheshtavanta* and *sthira* again these are classified as *Kora*, *Ulukhala*, *Samudga*, *Pratara*, *Tunnasevani*, *Vayustunda*, *Mandala*, *Shankhaavarta*. Modern texts classifies joints as synarthrosis (immobile joints), amphiarthrosis (slightly mobile joints) & diarthrosis (freely mobile joints). Joints can be classified differently as fibrous joints, cartilaginous joints & synovial joints. Classification of joints described in ancient text is similar to classification of joints in modern text. The following article presents a brief review on joints in ayurvedic & contemporary aspects.

KEYWORDS

Sandhi, Sandhi Bheda, Sandhi Marma, Joint



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INTRODUCTION

The point at which two or more than two articular surfaces of bones are fused together is known as *sandhi*. In modern anatomical view a joint is made up of two separate elements. *Sandhi* binds various structures and are covered by *kapha* according to *Sharangdhara*¹.

Sandhi are responsible for transmission of forces and are responsible for movement. The science of *Sandhi Sharir* is known in modern language as arthrology. When more than two bones are placed together to make a joint it is termed as *Sanghatin* Ayurveda. The *asthi* does the *dharana* of *shareera* and those are joined together with the help of *mamsa*, *sira* and *snayu*. All these are collectively called as a *sandhi*.

Acharya Sushrut has defined the term *Sandhi* as a point at which any two resembling structures meet each other, like, *Asthi Sandhi* (bony joint), *Sira Sandhi* (venous joint) or *Peshi Sandhi* (muscular joint). *Acharya Sushrut* further explains that total number of bony joints have been enumerated here, but joints of *Peshi*, *Snayu* and *Sira* are innumerable (Hence can't be calculated)².

Acharya Sushruta has mentioned a total number of 210 *sandhis* in the *shareera*. Out of these 68 are present in four

shakhas, 59 in the *Antaradhi* or *koshtha* and 83 in *Shirogreeva* (head and neck)³.

SANDHINIRUKTI

The *sandhi* word is derived from the root word *Sam + Dha + Ki*. 'Sam' *upasarga* had been used. It is originated by 'Dha' *dhatu* and 'Ki' *pratyaya* is used. The word *sandhi* means *sandhanam* i.e. holding together, joining or binding.

TYPES OF SANDHI

Acharya Sushruta had classified *sandhi* into two groups depending upon their function.

1—*Cheshtavanta* (movable)

2—*Sthira* (immovable)⁴.

Those joints which are present at all four extremities and also in the *Kati* and *Hanu* are movable; remaining are known as immovable by the learned⁵.

Further he divided *sandhis* into 8 different classes (named after the objects which they respectively resemble in shape.)

Kora, *Ulukhala*, *Samudga*, *Pratara*, *Tunnasevani*, *Vayustunda*, *Mandala*, *Shankhaavarta*⁶.

1. ***Kora Sandhi*** (Hinge joint):-

Freely mobile *Sandhi*, seen in *Anguli*, *Manibandha*, *Gulf*, *Janu* and *Kurpar*.

2. ***Ulukhala Sandhi*** (Ball & Socket):-

Wide range of action, present in *Kaksha* and *Vankshana*.

3. ***Samudg Sandhi*** (Saddle joint):-



Samudga shaped *Sandhi* present in *Ansapeetha, Guda, Bhaga* and *Nitamba*.

4. **Pratar Sandhi** (Gliding Joint):-

It is slightly movable joint present in *Greeva&Prithavansha*.

5. **Tunnasevani Sandhi** (Sutured joint):-

Such type of *Sandhi* is formed by teeth like structure in interlocking way, seen in *Sira, Kati&Kapala*.

6. **Vayasatunda Sandhi** (Condylar joint):-

It looks crow beak in shape, seen in-between *Hanwashthi&Sankhasthi*.

7. **Mandala Sandhi** (Circular joint):-

It is circular in shape, found in *Kantha, Hridaya&Netra*.

8. **Shankhavarta Sandhi** (Couch Shape)

It resembles the shape of *Sankha* present in *Shrotra* and *Sringataka*.

PANCHABHAUTIKATA OF SANDHI

Meeting point of two *asthis* is mainly considered as *Sandhi* by *Acharya Sushruta*. *Asthi isprithvi guna pradhana*. Thus we can assume that *prithvi mahabhoota* is present in it. The void between the articular surfaces can be termed as *Aakasha mahabhoota*. The synovial fluid present in between the articular surfaces could be termed as *Aap mahabhoota*. The heat which is perceived at the joint after movements can be due to *Agnimahabhoota*. The various

movements of the joints responsible for its functions are due to *Vayu mahabhoota*.

SANDHI AND GARBHA BHAVAS

Sandhis can be considered as *Pitrija bhava* because it is formed by the *Asthis*. *AcharyaCharak* has mentioned *Asthi* as *pitrijabhava*⁷.

SANDHI MARMA

Based on the anatomical structures, *Marma* are classified into four types by *Acharya Sushrut*. *Sandhi marma* is one among those types. *Sandhi marma* are 20 in number. They are *Janu*(02), *Karpura*(02), *Simanta*(05), *Adhipati*(01), *Gulpha*(02), *Manibandha*(02), *Kukundara*(02), *Avarta*(02) and *Krikatika*(02)⁸. Out of these *sandhi marma* 10 are *vaikalyakara*, 5 are *kalantara pranahara*, 4 are *arerujakara* and 1 is *sadyapranahara*.

SANDHI AND DOSHA

Shleshaka kapha is present in all the *sandhis* and it avoids rubbing of bony surfaces⁹.

SANDHI AND KALA

The fourth *kala* is the *Shleshmadhara kala*. It is located in the *sandhis*¹⁰.

SANDHIRACHANA

Two or more *asthis* cannot form a *sandhi* independently. However, it requires other structures which assist in connecting and



maintaining the *Asthis* to one another. Thus stabilizing and bearing weight at the joint.

Structures that form a Sandhi are stated as follows:-

1. *Asthi*
2. *Snayu*
3. *Shleshma Dhara Kala*
4. *Shleshma*
5. *Peshi*
6. *Sira*
7. *Dhamani*

1) **ASTHI**

Asthi is the elementary structure of any *sandhi*.

The main function of *asthi* is *dharan* of *sharir*¹¹.

The *vat dosha* is *ashrit* in *Asthi* and having *ashrayaashrayi bhava sambandh* i.e. when the *asrit* gets *vrudhhi*, the *ashrayi* also undergoes *vrudhhi* and vice versa. Unlike others, here when *Vata* gets *vrudhhi*, the *Asthi kshaya* takes place and vice versa¹².

In *Sandhigata Vata* the *prakupita vata* causes *Asthi kshaya*. *Vata* is only one, but based on *sthana* and *karma* it gets five different names as follows. *Prana*, *Udana*, *Samana*, *Vyana* and *Apana*. The *Vyana Vata* is called *krisna deha charah* i.e. it moves all over the body, but based on its function of *gati* or movement we may

assume *Sandhi* as one of its *adhithana*(site)¹³.

2) **SNAYU**

Asthi, *Mamsa* and *Meda* are bound together by *Snayu*¹⁴.

All joints in the body are tied with many ligaments. Ligaments impart strength to the joints. Any injury to the *snayu* can cause disturbed joint movements and can handicap the daily activities.

Out of all the different types of *Snayu*, the *pratanavati Snayu* is present in the *Sandhi*¹⁵.

3) **SHLESHMA DHARA KALA**

Fourth kala is *Shleshmadharakala* which is present in all joints of a human being. As machine works smoothly when its intricate gears are lubricated properly, joints also function properly if supported by *kapha*¹⁶.

4) **SHLESHMA**

The *shleshma* that is present in *sandhi* is named as *shleshakkapha*. It offers easy movements of *sandhi* and lubricates it simultaneously¹⁷.

The structures *asthi*, *snayu*, *shleshmadharakala* and *shleshma* are directly involved in the formation of *Sandhi*.

5) **PESHI:**

The *peshi* covers the many important structures of the body such as *Sira*, *Snayu*, *Asthiparva* and *Sandhi* and offers strength to these structures.



6) *SIRA*

Kaphavahasiras carrying normal *kapha* produces firmness in joints, and increases its strength¹⁸.

Raktavahasiras carrying normal blood does *dhatupurana*¹⁹.

This function is applicable for *Asthidhatuposhana* also.

7) *DHAMANI*

Poshana of body is done by *Urdwagata & Adhogata Dhamanis* carrying *vata, pitta, kapha, rakta* and *rasa*. All *Sandhis* get nourishment from them²⁰.

JOINTS

The meeting point of two or more bones, whether it is mobile or immobile, is known as joint or articulation²¹. Joints of the body help in performing the various movements and functions of the body.

CLASSIFICATION OF JOINTS

A) STRUCTURAL CLASSIFICATION

B) FUNCTIONAL CLASSIFICATION

A) **STRUCTURAL CLASSIFICATION**²²

Joints are classified according to connective tissues that are present between the bones. They are

- 1) Fibrous joints
- 2) Cartilaginous joints
- 3) Synovial joints

B) **FUNCTIONAL CLASSIFICATION**²³

The functional classification is based upon the degree of movements they permit.

They are

- 1) Synarthrosis
- 2) Amphiarthrosis
- 3) Diarthrosis.

A) **STRUCTURAL CLASSIFICATION:**

1) **FIBROUS JOINTS**

The articulating bones of the fibrous joints are united by fibrous tissue as synovial cavity is absent there. The length of the fibers uniting the articular bones is responsible for the range of movements in fibrous joints. Three types of fibrous joints e.g. suture, syndesmosis & Gomphosis.

a) *SUTURES*

In this type of joint bones are joined together, either interlocking or overlapping e.g. sutures of the cranium.

b) *SYNDESMOSIS*

In syndesmosis type of joint, bones are united with a thin sheet of fibrous tissue, it may be ligamentous or a fibrous membrane. This joint is partially movable. eg Interosseous membrane which joints radius and ulna.

c) *GOMPHOSIS*

A gomphosis (socket) or dentoalveolar syndesmosis is a fibrous joint in which a dowel like process of one bone fits into a socket of another bone e.g. articulation



between the root of the tooth and alveolar process of the jaw.

2) *CARTILAGENOUS JOINT*

In cartilaginous the articulating surfaces are united by hyaline cartilage or fibrocartilage. Cartilaginous joints are classified in synchondroses & symphysis

a) *SYNCHONDROSES*

In Synchondroses or primary cartilaginous joints the hyaline cartilage unites bones, which allows slight bending during early life. e.g.-the epiphyseal plate which joints the bony epiphysis and the shaft during the early development of long bones. The growth in length of the bone is permitted by joints. When fully grown epiphyseal plate converts to bone and the epiphysis fuses with the diaphysis.

b) *SYMPHYSIS*

The Symphysis or secondary cartilaginous joints are slightly movable & strong. They are united by fibro cartilage e.g.-the fibro cartilaginous intervertebral disc in between the vertebrae consists of binding connective tissue that joints the vertebrae together. These joints work as a shock absorber increase strength and flexibility of the vertebral column.

3) *SYNOVIAL JOINTS*

In synovial joints joint (articular) capsule forms articular cavity. The articular cavity contains a small amount of lubricating synovial fluid, secreted by synovial

membrane. Inside the capsule, articular cartilages cover the articular surfaces of the bones, all other internal surfaces are covered by the synovial membrane. This joint provides unrestricted movement between the bones. Synovial joints are usually reinforced by extrinsic & intrinsic accessory ligaments.

On the basis of the shape and the structure of the joint synovial joints are again classified into six categories. The type of movements permitted by the joint is affected by the shape of the joint. These joints are Planar, Hinge joint, Saddle joint, Condylod joint, Ball & Socket joint and Pivot joint.

a) *PLANAR JOINTS*

Planar joints are formed by flat or slightly curved articulating surfaces. The joints are also called as gliding joints because these joints allow for gliding movements. The movements are limited and do not involve rotation. Planar joints are present in the carpal bones in the hand and the tarsal bones in the foot & Acromio-clavicular joint.

b) *HINGE JOINT*

In hinge joint the slightly hollow end of one bone is fitted with the slightly rounded end of another bone. In this way, one bone remains stationary and other moves to the hinge of a door e.g. elbow joint.

c) *SADDLE JOINTS*



In this joint each bone with concave and convex portions that fit together like saddle. Saddle joints permit angular movements but with a greater range of motion e.g. the thumb joint. Thumb joint can move freely up and down & back and forth.

d) CONDYLOID JOINTS

This is also called as ellipsoidal joint. Condylod joints consists of an oval-shaped end of one bone is fitted into a similarly oval-shaped hollow of another bone. This type of joint allows angular movements like side to side and up and down e.g. metacarpophalangeal joints.

e) BALL-AND-SOCKET JOINTS

In Ball-and-socket joints a rounded, ball-like end of one bone is fitted into a cup-like socket of another bone. All movement types are possible in all directions e.g. shoulder and hip joints.

f) PIVOT JOINTS

In Pivot joint the rounded end of one bone is fitted into a ring formed by the other bone. This structure permits rotational movement around own axis e.g. joint of the first and second vertebrae of the neck.

B) FUNCTIONAL CLASSIFICATION OF JOINTS

The functional classification of joints is based on mobility found between the articulating bones. Joints are functionally

classified as synarthrosis, amphiarthrosis and diarthrosis.

1) SYNARTHROSIS

Synarthrosis joint is immobile or nearly immobile joint. This types of joints provide protection for internal organs e.g. sutures of the skull.

2) AMPHIARTHROSIS

An amphiarthrosis is a joint has limited mobility. Cartilaginous joint that unites the bodies of adjacent vertebrae is an example. An intervertebral disc fills the gap between the vertebrae. Intervertebral disc permits limited movement. Another example is the pubic symphysis of the pelvis. This cartilaginous joint articulates right and left hip bones strongly by fibrocartilage. Normally this joint has very little movement. Mobility is increased due to increased levels of the hormone relaxin during childbirth.

3) DIARTHROSIS

Diarthrosis is freely mobile joint. All synovial joints which provide the majority of body movements are diarthrotic. Appendicular skeleton consists mostly these type of joints. These joints are further classified into three categories as uniaxial, biaxial and multiaxial joints.

Uniaxial joint: Motion in a single plane is observed only in a uniaxial joint (around a single axis) e.g. elbow joint.



Biaxial joint: Motions within two planes are found in a biaxial joints e.g. metacarpophalangeal joint (knuckle joint) of the hand. Bending or straightening of the fingers in one axis and along with spreading and closing of the fingers in another axis are observed.

Multi axial (polyaxial or triaxial joint): In this type movements are observed in several directions e.g. shoulder and hip joints. They allow movements along three axes in anterior-posterior direction, medial-lateral direction and rotation.

BOOD SUPPLY AND NERVE SUPPLY OF JOINTS²⁴

Joints are supplied by articular arteries arising from the vessels nearby. Network formed by anastomosis of arteries supplies joint in various positions. The articular veins situated in synovial membrane accompany arteries.

Joints have a rich nerve supply. The branches of cutaneous nerves of distal parts of the limb supplying the overlying skin also supplies joints nearby. Proprioception (sensation transmitted by joint) provides movement awareness of and body parts position. The synovial membrane is comparatively insensitive. Fibers for pain are abundant in the fibrous layer and ligaments, causing considerable pain when the joint is injured.

DISCUSSION

The definition of *sandhi* is given in *ayurvedic* literatures can be understood as 'The Union' of any structure. *Acharyas* have considered mainly the meeting point of place of bones as the *sandhis*. Even in modern anatomical textbooks we can get the reference of joints as meeting point of two or more bones. The meeting place of *asthi*, *mamsa*, *sira*, *snayu* etc. can be collectively considered as *sandhi*.

In Ayurveda *Sandhis* are classified functionally in to *Cheshtavanta* & *Sthira*. *Acharya Sushruta* classified *Sandhis* into 8 types based on their shape. They are *Kora*, *Ulukhala*, *Samudga*, *Pratara*, *Tunnasevani*, *Vyasatunda*, *Shankhavarta* & *Mandala*. *Sandhi* is one among 4 types of *Marma* & is 20 in number. Constitution of a *Sandhi* are *Asthi*, *Snayu*, *Shleshmadharakala*, *Shleshma*, *Peshi*, *Sira* & *Dhamani*.

Joints are classified structurally as fibrous joints, cartilaginous joints & Synovial joints. Functional classification based upon the degree of movements. They are Synarthrosis, Amphiarthrosis & Diarthrosis. The articulating bones of the fibrous joints are united by the fibrous tissue. Hyaline cartilage or fibrocartilage unites the articulating surfaces of cartilaginous joints.



Synovial joints consists articular cavity which contains lubricating synovial fluid.

CONCLUSION

Acharya Shushruta described *sandhi* as those in between two bones. *Sandhi* consists of *Asthi*, *Snayu*, *Shleshmadharakala*, *Shleshma*, *Peshi*, *Sira* & *Dhamani*.

He explained number, position & types of *sandhis* in detail. He also described enumeration of *Sandhi Marma* with its *pramana*, *sthana* and effect on injury. Even in contemporary books the classification of *sandhis* (joints) is almost similar to that in Ayurvedic classics.



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