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A Critical Review on *Sandhi Sharir* with special reference to *Upamana Pramana*

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ABSTRACT

Ayurveda, the Ancient Medico Holistic Science, which is comprised of numerous fundamental concepts with basic doctrines. Ayurveda along with its concepts is eternal (*Shaswata*), and have their own identity which does not require other science to indulge in between. Such fundamental concepts are literally better understood, analysed and merely utilized in clinical practice only with the proper utility of *Pramanas*. *Pramanas* in Ayurveda are means of true knowledge. *Acharya Sushruta* describe four *Pramanas* and among the four *Pramanas* i.e. *Pratyaksha* (Direct perception), *Agama* (Teaching of scriptures), *Anumama* (Inference), *Upamana* (Analogy) - *Upamana Pramana* is used widely in *Ayurvedic* literatures. *Upamana* or *Aupamya* give the knowledge or idea of an object by similar comparison. The meaning of word *Sandhi* is "the meeting point of two or more structures." According to modern, joint is a point where two or more bones articulates with each other. *Aacharya Sushruta* hasquoted that although there are numerous *Sandhi* in our body which cannot be counted so only *Asthi Sandhi* should be considered while enumerating *Sandhis*. To make the concept of *Sandhi Sharir* (Joints) clearer or to make it understand in a better and simpler way *Acharya Sushruta* has described it by comparing with one or more objects or to the day today available things by using the *Upamana Pramana*. The examples mentioned are not only meant for better understanding but also anatomically fit with structures and some extent to functions. A thorough knowledge of the structure and function of the joint is required to diagnose and treat the diseases of joints. So, the knowledge of anatomy of joints should be known.

Key words: *Pramana, Upamana Pramana, Sandhi Sharir, Asthi, Anatomy.*

INTRODUCTION

Our life is evolved on the art of locomotion. The human kind has evolved being wanderers and hunters in constant search of a stable piece of Earth and amenities for living. Life would not have been easy if we could not have moved around, thanks for the wonderful anatomy and designing of the human body. We move on our joints, the junctions of bones well supported by soft tissues like muscles, ligaments and tendons. The flexibility and wide range of movements specialized and programmed in different ways in different bony joints makes our life movements possible.[1]

In Ayurvedic literature *Atreya*, *Dhanvantari* and all other communities have made it important that the knowledge of body to have undoubtedly for the sake of knowledge.

- *Sandhi* = Bony joints of the body
- *Sharira* = Study of body and its parts

Sandhi Sharira means the study of joints (bony Joints) of the body. *Sandhi Sharira* can be simulated with Ayurvedic Arthrology (Arthrology = study of joints)[2]

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The term *Sandhi* means *Samyoga* or junction or union or meeting place or association in this context *Sandhi* means *'Asthisamyogasthaana'* or the place where bones meet. Thus, *Sandhi* or joint is formed when 2 or more bony ends meet at a place. According to other opinions (*Sharangadhara Samhita*), *Sandhis* are also the meeting place of any two structures in the body. Such *Sandhis* are held together by *Kapha*. In general, for the purpose of understanding, only *Asthi-Sandhi* or bony joints are considered under the term *Sandhi* or *Sandhis* (plural). Other joints like the joints between muscles, blood vessels, ligaments, tendons, etc. are usually not considered for counting and description.

According to *Aacharya Sushruta* only *Asthi Sandhi* should be taken into account where asother *Sandhi* of *Peshi*, *Snayu* and *Sira* are innumerable and should be excluded while counting.[3]

In various Ayurvedic classics different *Aacharyas* have mentioned different numbers of *Sandhi*. According to *Aacharya Sushruta Sandhis* are 210 in number, which are responsible for various movements, and are distributed throughout the body. In Ayurvedic Samhitas the description of anatomy of *Sandhi* (joints) in detail is not found. It is observed that the incidence of joints disorders is increasing in today's world. It is the burning problem for both families and society. A thorough knowledge of the structure and functionof the joint is required to diagnose and treat the diseases of joints.

Pramanas in Ayurveda are means of true knowledge. *Acharya Sushruta* have described four *Pramanas* i.e.

1) *Pratyaksha* (Direct perception),

2) *Agama* (Teaching of scriptures),

3) *Anumama*(Inference),

4) *Upaman*(Analogy).[4]

Upaman Pramana is used widely in Ayurvedic literatures.

उपमितिकरणमुपमानम् । (त. सं.) [5]

उपमिती = resemblance or similarity.

The cause by which the knowledge is obtained by similarity or resemblance is known as *Upamana*.

Enlightening the features of an unmanifested thing with a familiar or manifested thing based on similarities is known as *Upaman Pramana*.[6]

Upamana is having its own importance. *Upamana* or *Aupamya* give the knowledge or idea of an object by similar comparison. *Acharya Charak* has not included *Upaman Praman* under *Pramanas* but he has described it under *Vada Marga* i.e. technical terms used in *Sambasha* by *Vaidya - Samuha* and ultimately helps in attaining valid knowledge, but more than being used in *Sambasha, Upamana* is having its clinical utility.

Upamanas are the analogies or similes that bridge the known to the unknown and after the conceptual system of existing knowledge by modifying and strengthening its associations. The prime intention of such *Upamana* is incorporating open-ended, forced and visual similes to teach complex concepts and involving students in a creative dynamic though process to enhance understanding of such complex medical concepts. But we have to be very careful about understanding such analogies, otherwise it may lead to wrong concepts. As said, that "An Analogy is like a car, if you take it too far, it breaks down". So here a sincere effort has been made to evaluate and analyse the *Sandhi Sharira* with special reference to *UpamanaPramana* in a simple way.[4]

As *Upaman Pramana* explains the meaning of the word that creates the required enhancement i.e. it makes the less known or unknown factor/concept recognizable with the help of any well recognizable factor/ concept.

To make the concept of *Sandhi Sharira* (Joints) clearer or to make it understand in a better and simpler way *Acharyas* has described the knowledge of *Sandhi Sharira* (Joints) by comparing it with one or more objects or to the day to day available things by using the *Upamana Pramana*.

The examples mentioned are not only meant for better understanding but also anatomically fit with

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structures and some extent to functions. To prove this correlation most effectively was the aim of the study.

AYURVEDIC REVIEW

According to *Acharya Sushruta* only *Asthi Sandhi* should be taken into account where as other *Sandhi* of *Snayu*, *Peshi* and *Sira* are innumerable and should be excluded while counting.

Classification of *Sandhi* - Main classification is of two types.[6]

1. *Kriyanusar* (Based on *Kriya*)
2. *Rachananusar* (Based on *Rachana*)

1. *Kriyanusar Vargeekaran* (Based on Movement): The *Sandhis* are of two types

a) *Chal (Cheshtayukta Sandhi)* - Diarthorosis

b) *Achal (Sthira Sandhi)* - Synarthrosis

The *Sandhis* which are situated in the *Shakhas*, *Kati* and *Hanu* are *Cheshtayukta Sandhi* while all the remaining *Sandhi* comes under the *Sthira* in nature.

The *Cheshtayukta Sandhis* are further classified into two types based on their extent of movement.[3]

They are -

1. Bahuchala (freely movable)

2. Alpachala (slightly movable)

The *Sandhi* of *Shakhas*, *Kati* and *Hanu* are of *Bahuchala* variety and the *Sandhi* of *Prushtha* etc. are *Alpachala* variety.[7]

2. *Rachananusara Sandhi Vargeekaran* (Based on structure)

Acharya Sushruta performed dissections on regular basis and at thesame time treated the patients with injury in wrestling, wars and suffering from all types of joint diseases.

He described 8 types according to looks of it while moving in live person and restrictions in movements during joint diseases and confirmed the look again with the help of dissection.

They are *Kora, Ulukhala, Samudga, Pratara, Tunnasevani, Vayastunda, Mandala* and *Shankhavarta*.[7]

A) *Kora Sandhi* (Hinge joint)

As per the description of Haranchandra in commentary of *Sushrut Samhita*, *Kapat* etc. is taken for *Nibandhan* of a special devise called Kora is known that the *Kabja* (hinges).[8] The *Kora Sandhi* is seen in the following region - *Anguli* (phalangeai), *Manibandha* (wrist joint), *Gulpha* (Ankle joint), *Janu* (Knee joint) and *Kurpara* (Elbow joint).[9]

B) *Ulukhala Sandhi* (Ball and socket joint)

These types of *Sandhi* look like stone grinder used in the kitchen in olden days that"s why it is named so.[8] The *Ulukhala* variety of joints is foundat *Kaksha* (Shoulder joint), *Vankshana* (Hip joint) and *Dashana* (Teeth).[9]

C) *Samudga Sandhi* (Saddle joint)

This variety of *Sandhi* looks like a box. This variety of *Sandhi* looks like a box.[8] These *Samudga Sandhis* is seen at *Ansapeeth* (Acromio-clavicular joint), *Guda* (Sacrum), *Bhaga* (Pubis) and *Nitamba* (Ilium).[10]

D) *Pratara Sandhi* (Gliding or plane joint)

According to *Dalhana*, the articulating surfaces of this variety of joint are flat in nature and floating, supported by cushion and friction is seen in between the articulating surfaces.[8] In Sushruta"s opinion this variety of joints are located at *Greeva* (Cervical vertebrae), *Kasherukha* (Vertebrae) and *Prushthavansha* (Thoracic vertebrae).[10]

E) *Tunnasevani Sandhi* (Sutures)

The commentator Gananath Sen has opined that articulating surfaces resembles dentate edges which are supported and stucked together or embedded into one other.[8] This type of *Sandhi* is found at *Sirakapala* (Skull) and Katikapala (Hipbone-sacrum, coccyx).[11]

F) *Vayastunda Sandhi* (Condylar joint)

According to Gananatha Sen the *Hanu* which is situated within *Shankhasthi* both side of chin and

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creat T.M.J. (Temporo - Mandibular joint) is considered as *Vayastunda Sandhi*.[8] Even *Sushruta* has got similar opinion about *Vayastunda Sandhi*.[11]

G) *Mandala Sandhi*

According to *Dalhana* the *Sandhi*, which are oval or round are called as *Mandala Sandhi*.[8] This type of *Sandhi* is present in *Kantha* (Throat), *Hrudaya* (Heart) and *Netra* (Eye) *Clomnadi* (Trachea).[10]

H) *Shankhavarta Sandhi*

According to Haranachandra, these are circular in nature which resembles the circles of a snail or *Shankha*.[8] According to *Sushruta* they are found in *Shrotra* (Ear) and *Shringataka* (Cavernus sinus).[9]

***Sandhi Sankhya*:** According to *Aacharya Charaka* - 200 *Sandhi* in body. According to *Aacharya Sushruta* - Body comprises 210 *Sandhi*. Of these sixty-eight are in the four extremities; fifty-nine in the trunk (*Koshtha*); and eighty-three in the neck and the region above it.

MODERN REVIEW

Joints (articulations) are unions between two or more bones or rigid parts of the skeleton. Joints exhibit a variety of forms and functions. They are constructed to allow for different degrees and types of movement.

Definition

- Joint is a junction two or more bones or cartilages.[8]
- An articulation is a point of contact between bones between cartilages and bones, or between teeth and bones.[12]

Classification of joints[13]

Joints are classified structurally, based on their anatomical characteristics, and functionally, based on the type of movement they permit. Functionally, joints are classified as one of the following types:

(I) Structurally Classification of joints

Structully, joints are classified as one of the following types:

1. Fibrous Joints

There is no synovial cavity, and bones are held together by fibrous connective tissue. Fibrous joints permit little or no movement. The three types of fibrous joints are sutures, syndesmoses and interosseous membranes

Example - Suture of skull, teeth-jaw, lower end of tibia and fibula.

2. Cartilaginous Joints

Like a fibrous joint, there is no synovial cavity and the bone are held together by cartilage and allows little or no movement. Here the articulating bones are tightly connected by either hyaline cartilage or fibrocartilage. The two types of cartilaginous joints are primary cartilaginous and secondary cartilaginous joint.

Example - pubis symphysis, diaphysis and epiphysis, first costal cartilage and manubrium sterni.

3. Synovial Joints

Synovial joints have certain characteristics that distinguish them from other joints. The unique characteristic of a synovial joint is the presence of a space called a synovial (joint) cavity between the articulating bones. Because the synovial cavity allows a joint to be freely movable, all synovial joints are classified functionally as diarthroses. The bones at a synovial joint are covered by a layer of hyaline cartilage called articular cartilage. The cartilage covers the articulating surface of the bones with a smooth, slippery surface but does not bind them together. Articular cartilage reduces friction between bones in the joint during movement and helps to absorb sock.

Example - Shoulder joint and hip joint.

(II) Functional classification of joints

- Synarthrosis: An immovable joint.
- Amphiarthrosis: A slightly movable joint.
- Diarthrosis: A freely movable joint.

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[1] Synarthrosis (Immovable)

1. Suture (seem) - Found only between bones of the skull; articulating bones united by a thin layer of dense fibrous connective tissue.

Example - Coronal suture between frontal and parietal bones.

[2] Gomphosis (To bolt together) - Cone shaped peg fits into a socket; articulating bones united by periodontal.

Example - Roots of teeth in alveolo (Socket)

[3] Syndesmosis (Bend or ligament) - Articulating bones united by dense fibrous connective tissue.

(II) Amphiathrosis (Slighty movable)

1. Synchondrosis (Together-cartilage) - Primary cartilaginous joint.

Connecting materials is hyaline cartilage.

Example - Temporary joint Between the diaphysis and epiphysis of a long bone.

2. Symphysis (Growing-together) - Secondry cartilaginous joint. Connecting material is a broad, flat disc of fibrocartilage.

Example - Intervetebral discs and pubic symphysis.

(III) Diarthrosis (Freely movable)

1. Gliding (Arthrodial joint) - Articulating surfaces usually flat,

Example -

a. Intercarpal and intertarsal joint.

b. Gliding joint between the navicular and II, III cuneiforms of the tarsal bone.

2. Hinge (Ginglymus joint) - Convex surface fits into a concave surface.

Example -

a. Elbow ankle and interphalangeal joint.

b. Hinge joint Between the trochlea of humerus and trochlear notch of ulna at the elbow.

3. Pivot (Trochoid (wheel) joint) - Rounded or pointed surface fits into a ring formed partly by bone and partly by a ligament.

Example -

a. Joint between atlas and axis, joint at proximal ends of radius and ulna.

b. Pivot joint between head of radius and radial notch of ulna.

4. Condyloid (Ellipsoidal joint) - Oval shaped condyle fits into an elliptical (round) cavity of another bones.

Example

a. Joint between radius and carpals (scaphoid and lunate).

b. T. M. J. (Temporo mandibular joint)

c. Knee joint

5. Saddle (Sellar joint) - Articular surface of one bone is saddle shaped and the articular surface of the other bone is shaped like legs of a rider sitting in the saddle.

Example -

a. Joint between trapezium of carpus and metacarpal of thumb.

6. Ball and socket (Spheroid joint) - Ball like surface of one bone fitted in to a cuplike depression of another bone.

Example -

a. Shoulder Joint and Hip Joint.

b. Ball and socket joint between head of femur and acetabulum of the hip bone.

DISCUSSION

In Ayurvedic classics *Sandhis* have been classified into eight types by taking account of shapes of *Sandhis* mainly, movement of *Sandhis* has not been considered whereas in modern science, the classification of *Sandhis* has been done by taking account of both structure and function (movement).

त एते सन्धयोऽष्टविधा: - कोरोलुखल सामुद्र प्रतर तुन्नसेवनि वायसतुन्ड मन्डल शङ्खावर्ता: | (सु. शा.५/२७) [14]

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Here *Acharya Sushrut* has explained the various types of joint by comparing them to the day to day useful things which are similar to the structure/movement of the joints.

A) *Kora Sandhi*

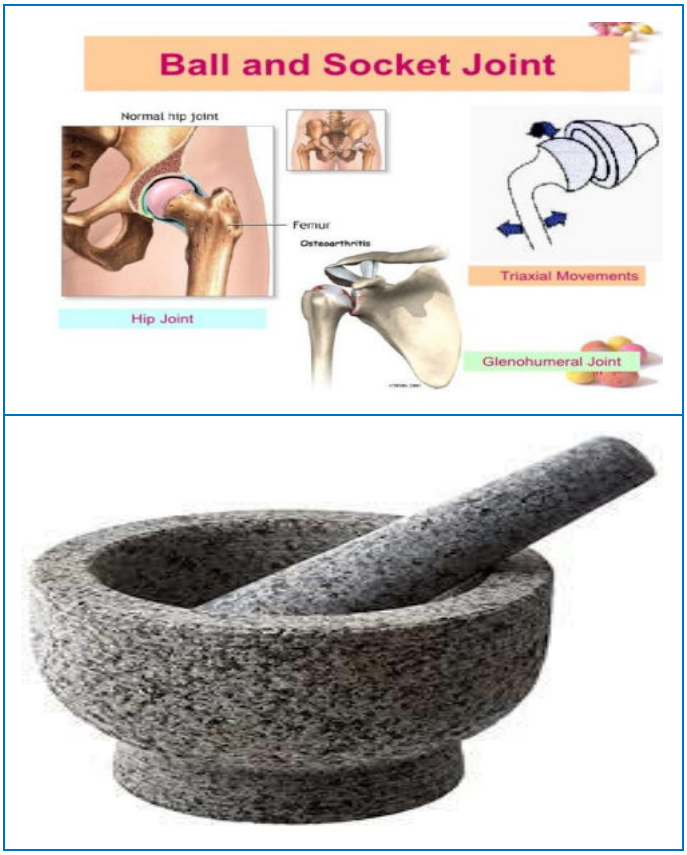
तेषामङ्गुलिमणिबन्धगुल्फजानुकूर्परेषु कोराः | (सु. शा.५/२७) [14]

***Kora Sandhi* (Hinge Joint)**

Kora Sandhi is like *Garta* (pit). According to modern *Anguli Sandhi* (Interphalangeal joint), *Gulpha Sandhi* (Ankle joint), *Koorpara Sandhi* (Elbow joint) are hinge variety of synovial joint. *Manibandha Sandhi* (Wrist joint) is ellipsoid variety of synovial joint and *Janu Sandhi* (Knee joint) is Compound synovial joint, in which two condylar joints between the condyles of the femur and tibia. So, on the basis of shape of articulating surfaces hinge joint, ellipsoid joint and condylar joint can be included in *Kora Sandhi* of Ayurveda.The Joints included in *Kora Sandhi* like *Anguli* (finger), *Manibhanda* (wrist), *Gulpha* (ankle), *Janu* (knee) and *Kurpara* (Elbow) have similar movement as that of Hinge on the door.

B) *Ulukhala Sandhi*

सन्धयःकक्षावङ्क्षणदशनेषूलूखलाः | (सु. शा.५/२७) [14]



***Ullukhala Sandhi* (Ball and Socket Joint)**

In this type of *Sandhi* one bone has mortar like structure which unites with pestle like head of another bone. *Kaksha Sandhi* (Shoulder joint) and *Vankshana Sandhi* (Hip joint) are ball and socket joints. *Dashana Sandhi* is gomphosis joint. A gomphosis is a specialized fibrous joint in which a conical process or peg of one bone fits into a hole or socket in another bone. So, on the basis of shape of articulating surfaces ball and socket joint and gomphosis joint can be included in *Ulukhala Sandhi*.

The Joints included in *Ulukhala Sandhi* like *Kaksa* (axilla), *Vanksana* (hip) and *Dasana* (teeth) have similar structure as that of motar and pestle.

C) *Samudga Sandhi*

अंसपीठगुदभगनितम्बेषुसामुद्गाः | (सु. शा.५/२७) [14]

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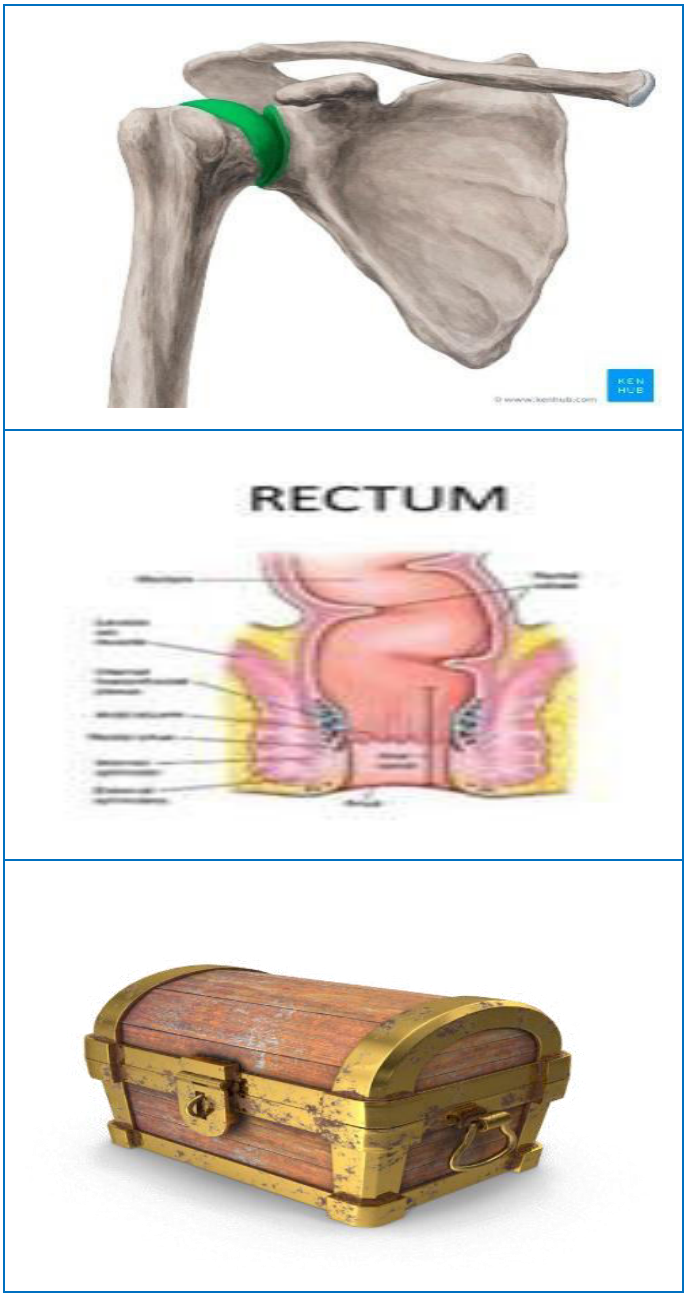
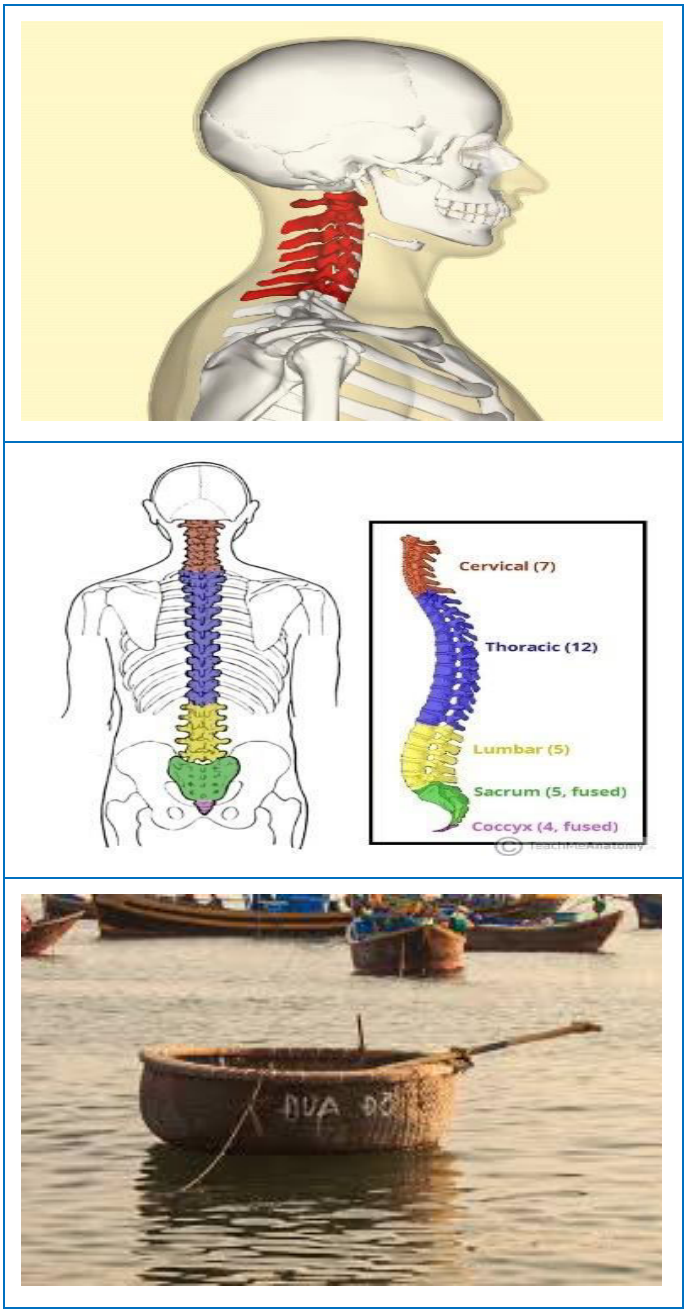


Samudga Sandhi (Amphiartroses)

These *Sandhis* have articulating ends which look like a *Samputa* (box) or an enclosed shell. *Ansapeetha* (Acromioclavicular joint) and *Nitamba* (Sacroiliac joint) are plane joints. *Guda* (Sacrococcygeal joint) and *Bhaga* (Pubic symphysis) are secondary cartilaginous joints. So, on the basis of shape of articulating surfaces plane joints and secondary cartilaginous joints can be included in *Samudga Sandhi*. The Joints included in *Samudga Sandhi* like *Amsapitha* (shoulder), *Guda* (rectum/anus) and *Nitamba* (Buttocks) have similar structure like *Samudga* (box with a lid).

D) *Pratara Sandhi*

ग्रीवापृष्ठवंशयोः प्रतराः | (सु. शा.५/२७)



Pratar Sandhi (Arthrodia)

In Ayurvedic classics has mentioned that these types of joints are formed from articulation of *Samatala* or flat part of slightly movable bony parts. *Greevavansha* and *Prushthavansha* are Intervertebral joints. The joint between the vertebral bodies is secondary cartilaginous joint. So, on the basis of shape of articulating surfaces secondary cartilaginous joints can be included in *Samudga Sandhi*. The Joints included in

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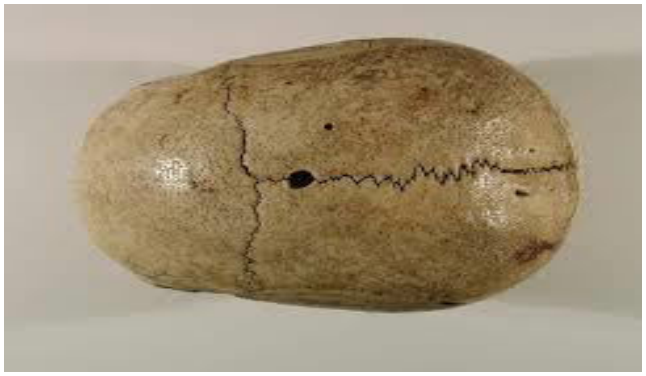
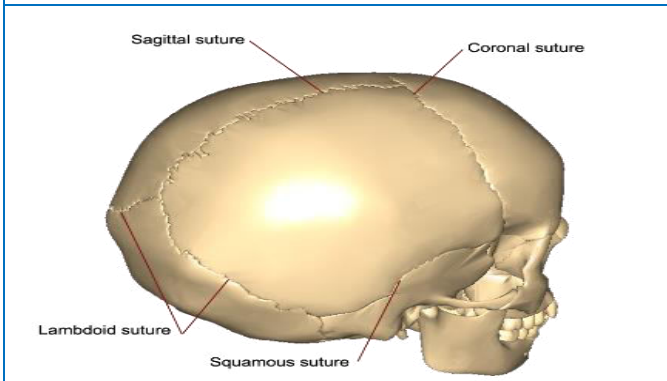
Pratara Sandhi like *Greeva* (neck) and *Prsthavamsa* (vertebral column) have similar structure like that of *Pratara* (round floating boat).

E) *Tunnasevani Sandhi*

शिर:कटिकपलेषुतुन्नसेवन्य: |(सु. शा.५/२७) [14]



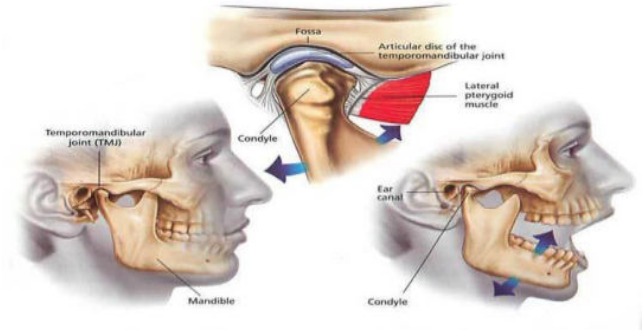


***Tunnasevani Sandhi* (Sutured Joints)**

Tunnasevani is a suture type of joint. *Shiro- kapala* and *Katikapala* have sutural joints. So, sutures can be included in *Tunnasevani Sandhi*. The Joints included in *Tunnasevani Sandhi* like *Sirahkapala* (flat bones of the head) and *Katikapala* (flat bones of pelvis) have similar structure like that of *Tunnasevani* (thread stitches on clothes).

F) *Vayastunda Sandhi*

हन्वोरुभयतस्तुवायसतुण्डा: | (सु. शा.५/२७) [14]

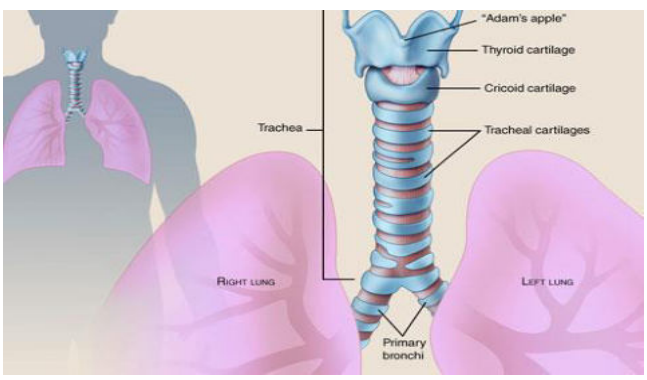


***Vayastunda Sandhi* (Ginglyoma-Arthrodial)**

Where *Sandhi* is like beak of crow is regarded as *Vayastunda Sandhi*. *Hanu Sandhi* (Temo-romandibular joint) is the condylar joint. So condylar joint can be included in *Vayastunda Sandhi*. The Joints included in *Vayasatunda Sandhi* like at the two sides of the *Hanu* (the temporo-mandibular joint) have similar structure and movement as that of *Vayasatunda* (crow beak).

G) *Mandala Sandhi*

कण्ठनेत्रहृदयक्लोमनाडीषुमण्डला: | (सु. शा.५/२७) [14]



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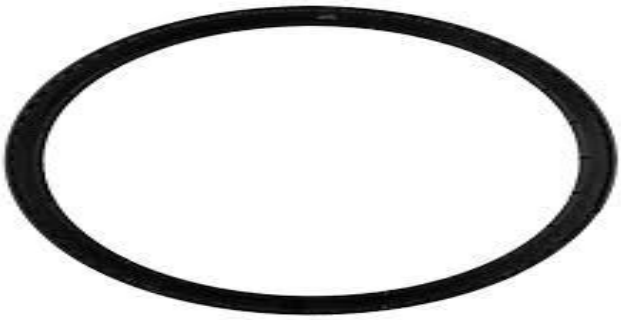
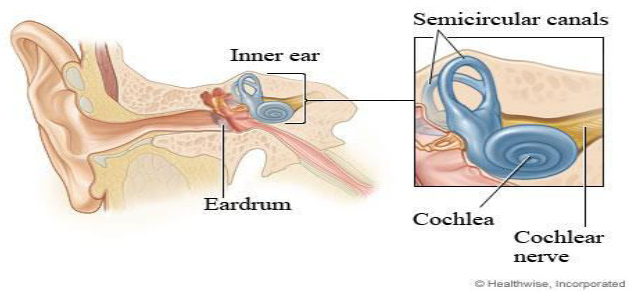


Mandala Sandhi (Round/Circular Joints)

Sushruta classified *Sandhi* into two types. Those which can be counted and are between the bones and another type of joints are countless as these are the joints or junctions between *Peshi* (muscles), *Snayu* (tendons), *Sira* (vessels). Later type of junction is present in *Kantha* (larynx), *Hrudaya* (heart), eyes and *Kloma Nadi* (trachea) as *Sandhi*. In *Netra* joints between five *Mandalas* form six *Sandhis*. The Joints included in *Mandala Sandhi* like *Nadi* (tubes) of *Kantha* (throat), *Hrudaya* (heart), *Netra* (eye) and *Kloma* (trachea) have similar structure like that of *Mandala* (circular shape).

H) *Shankhavarta Sandhi*

श्रोत्रशृङ्गाटकेषुशङ्खावर्ताः तेषांनामभिरेवाकृतयः प्रायेण व्याख्याताः | (सु. शा.५/२७) [14]



Sankhavartha Sandhi (Spiral Shaped/ Helical/ Convoluted)

Here the meanning of *Shankhavarta* should be taken as irregular structure. By *Shankhavarta Sandhi* it should be consider a joint of irregular structures (or irregular form). The word *Sandhi* in Ayurvedic classics do not focus on joints of bones only, it may be joints between two cartilages or between two *Peshi* (muscles), *Snayu* (tendons) and *Sira* (vessels). *Shrotra* is mentioned in classics as a *Shankhavarta Sandhi*. So, ongoing through the anatomy of the ear it is found that the joint of ear ossicles along with cochlea can be considered as *Shankhavarta Sandhi* in *Shrotra*. The location of *Shringataka* is not clearly described in classics. So, ongoing through the study of *Shringataka Marmas* colars have *Shringataka Marma* in nose. So, the *Sandhi* should be present in nose as conchi, which is present as irregular form like *Shankhavarta*. The joints included in *Shankavarta Sandhi* like *Srotra* (ears) and *Srngataka* (back of the nose inside the head) have similar structures like that of *Shankavarta* (Spiral shape/Helical).

CONCLUSION

Pramanas are the means of true knowledge or the tools to understand the different *padarthas*. *Upaman Praman* is necessary in understanding the *Shastra*, and important tools of gaining true knowledge. *Upaman Praman* is having wide applicability in classics, right from the level of *Sristi Utpatti* to *Mrutyu*. Joints are not only of anatomical and structural importance; their knowledge is also needed for medicinal science. Joint disorders are the most common lifestyle disorders encountered in clinical

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practice. Their incidence is increasing constantly keeping in pace with the evolution.

"I figured my body always would be able to repair itself. I think all of us believe that - until you begin to age and get hit with deteriorating joints." - Lee Majors

Sandhis are the abodes of *Kapha*, mainly *Shleshakakapha* which helps in keeping them functional and integrated along with providing good lubrication *Sandhis* are also *Marmas* or important delicate points or sensitive structures the injury of which leads to death (damage, degeneration) or deformity. A thorough structural and functional knowledge of the *Sandhis* is needed to address their pathology.

"Movement is the key for progression and success. And the joints of our body are the keys for movement. If everyone is moving forward together, then success takes care of itself" - Henry Ford

Sandhi Sharira or study of joints in Ayurveda is based on the ancient wisdom of the Ayurveda seers and teachers. Their way of seeing and classifying the joints looks different but all appreciations go its way because it was the first attempt made at understanding the most important structures of our body. Arthrology of modern-day anatomy is the essence of all these basics which were provided long back in timeline. This article was to give an account of the Ayurvedic perspective of study of bony joints.

"Man maintains his balance poise, and sense of security only as he is moving forward" - Maxwell Waltz

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