SANDHI SHARIR IN AYURVEDA AND APPLIED ANATOMY OF JOINTS- A REVIEW

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ABSTRACT

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. The concept of Sandhi is presented in several Ayurvedic Samhita in Ayurveda. The definition of Sandhi in grammatical literature is described as the union, to unite, or meeting place of two or more structures with respect to this. According to Acharya Sushruta, only Asthi Sandhi should follow the same terminology, even if there are many Sandhi in our bodies that cannot be enumerated.[⁵] The embryology, Sandhi Sankhya, and Pituja Bhava of Sandhi are presented on a broad level. Although Marma Jala Sanghata and Sandhi are connected, only Asthi Sandhi has been taken into account in Ayurveda. The shape and movement of the joint have mostly been used to classify the Sandhi. Functionally, there are two types of Sandhis: Chestavanta and Sthira. Whereas a joint disorder is known as an Arthropathy, and it is known as arthritis when one or more joints are inflamed. Arthritis is a common component of joint illnesses, however injury to joints from external physical stress is often not classified as arthritis. When multiple joints are involved, an arthropathy is referred to as polyarticular (multiarticular), and when just one joint is, it is referred to as monoarticular.
KEYWORDS: Sandhi, Dharan, Asthi Samyoga, Sandhi Sankhya, Sthira Sandhi, Cheshtavanta Sandhi, Joint, Dislocation, Injury to joint.

INTRODUCTION
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. If this definition is used, then the body has an infinite number of joints or Sandhis. To make it simpler, just Asthi Sandhi should be included; other Sandhi from Peshi, Snayu, and Sira are countless and should not be included when counting. The definition of Sandhi, according to Sharir Rachana, can be interpreted as the union of two or more bones. Sanyoga Sthana in Asthi, according to Acharya Charak. A Sandhi cannot be formed by more than two Asthi. The structures that make up a Sandhi, such as Asthi, Snayu, Slesma Dhara Kala, and Slesma, require additional support to keep them stable, support their weight, and enable the Gati. Sira, Dhamni, and Peshi. There is a wealth of information about Shareer in classical Ayurvedic works like Charaka Samhita, Sushruta Samhita, etc. Available are Nidana and Chikitsa. A complete understanding of the disease and Shareer of its connected portion is absolutely necessary for an expert Vaidya to treat a condition. But, there is no detailed description of the anatomy of the Sandhi in Ayurvedic Samhitas. The prevalence of joint problems is rising in the modern world, which is obvious. It is the most critical concern facing families and society as a whole. To diagnose and treat joint problems, one must have a full understanding of the structure and operation of the joint. Ayurveda, which can offer happiness to the cosmos, can only be known and understood by one who has a thorough understanding of Shareer (i.e., the anatomy and physiology of the human body).

Asthi - The fundamental component of any Sandhi is Asthi.

Snayu- Any Asthi can be bound by the structure known as Snayu. In the same way that a canoe made of planks could carry a bundle of ropes. Every joint in the body is connected by a variety of ligaments, allowing a person to support weight. The Pratanvati Snayu is one of several types of Snayu that are prevalent in Sandhi.
Sleshma - Slesmaka Kapha is the name of the Sleshma who seat in Sandhi. It supports the Sandhi's supply of nourishment, lubricates it, and promotes free movement. The Sleshma have a direct hand in creating the Sandhi.[1]

Peshi - The Peshi provides strength to the body's various structures, including the Sandhi, Sira Snayu Asthi Parva, and other structures.

Dhamni - Adhogata Dhamnis carrying Vata, Pitta, Kapha, Rakta, and Rasa maintained and sustained some of the components below the umbilicus that are the Pakwashya, Kati, urine, faeces, anus, bladder, penis, and leg.

**AYURVEDIC REVIEW**

Panchmahabhuta samgathan: Each object in the universe is made up of the five fundamental elements known as panchmahabhuta, and even the composition of Sandhi is founded on this idea.

1. The fact that the Sandhi is the meeting location of two Asthi and that the Asthis are dominated by Prithviguna suggests that Prithvi Mahabhuta is involved.
2. The empty space between the articular surface and the Sandhi points to the existence of Akasha Mahabhuta.
3. The presence of Jala Mahabhuta can be seen in the synovial fluid that exists between two articular surfaces.
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. This suggests that Vayu Mahabhuta is present.[4]

**Number of Asthi Sandhis**[1,2,3,4]

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

**According to shadanga**

1. In four limbs: 17 x 4 = 68
2. In trunk: 59
3. Above head and neck: 83
Classification of Sandhis

Since Susruta Samhita is regarded as the best text for anatomical approach, several Ayurveda compendia have adopted his classification theory. The primary division of sandhis are into two categories. Kriyanusar (Based on Kriya) and Rachananusar (Based on Rachana).

- **Kriyanusar Vargeekaran**: There are two categories of Sandhis based on movement.
  - Achal (Sthira Sandhi) Synarthrosis and Chal (Cheshtayukta Sandhi) Diarthrosis. The Sandhis found in the Shakhas, Kati, and Hanu are known as Cheshtayukta Sandhis, while the rest of the Sandhis are Sthira in nature. Based on how much they move, the Cheshtayukta Sandhis are further divided into two categories. They are Bahu chala (freely movable) Alpachala (slightly movable) whereas Shakhas, Kati, and Hanu's sandhi are of the Bahuchala variety, while Prushtha, etc sandhi’s are of the Alpachala variety.

- **Rachananusar Vargeekaran**: Eight different varieties of Sandhi were described by Aacharya Sushruta based on the structure.
  - Prasangya[kora, Ulukhala, Samudga, Pratara, Tunnase-vani, Vaya, Mandala, Shankhavarta. These are present in the following parts of sharir.

1. Kora Sandhi (Hinge joint) - श्रीवापूर्वमित्यः प्रासंगिकावस्तुः प्रकाशः सत्यः
2. Ulukhala Sandhi (Ball and socket joint) - कवचाकापि अस्यानि प्रकाशः सत्यः
3. Samudga Sandhi (Saddle joint) - अस्यानि प्रकाशः सत्यः
4. Pratara Sandhi (Gliding or plane joint) - श्रीवापूर्वमित्यः प्रासंगिकावस्तुः प्रकाशः
5. Tunnasevani Sandhi (Sutures) - तुननासेवनी शंधी (सूचने का गढ़ युक्त)
6. Vayastunda Sandhi (Condylar joint) - वैयास्तुंद शंधी (झोंका-झिस्सा युक्त)
7. Mandala Sandhi - मण्डलाशंधी (वर्तमान शंधी)
8. Shankhavarta Sandhi - शंकावर्ताशंधी (शंकावर्ताशंधी)

1. Kora Sandhi (Hinge joint) - कोडा शंधी (जोड़े की शंधी)

According to Haranchandra's account in the Sushrut Samhita commentary, Kapat and other items are used for Nibandhan of a unique device known as Kora, and it is known that the Kabja (hinges), Anguli (phalangeai), Manibandha (wrist joint), Gulpha (ankle joint), Janu (knee joint), and Kurpara (Elbow joint) are the locations where the Kora Sandhi is seen.

2. Ulukhala Sandhi (Ball and socket joint) – उलुक्षलाशंधी (झंडी-झंडा युक्त)

These varieties of Sandhi got their name because they resemble the stone grinders that were once used in kitchens. Three joints—Kaksha (shoulder joint), Vankshana (hip joint), and Dashana (Teeth)—belong to the Ulukhala variety.
3. Samudga Sandhi (Saddle joint) - असमृद्धिश्च भागतमेतु पासुद्भि

This type of Sandhi resembles a box. Ansapeeth (Acromioclavicular joint), Guda (Sacrum), Bhaga (Pubis), and Nitamba (Ilium) all exhibit these Samudga Sandhis.

4. Pratara Sandhi (Gliding orplane joint) - जीणायुभवंशीय नीतसा

According to Dalhana, the articulating surfaces of the Pratara Sandhi (gliding orplane joint) variety of joint are flat in nature, floating, supported by cushion, and friction is visible in between the articulating surfaces. According to Sushruta, these various joints are situated at the cervical vertebrae (Greeva), the vertebrae (Kasherukha), and the Prushthavansha (Thoracic vertebrae).
5. **Tunnasevani Sandhi (Sutures)** - त्रिशुकमयायाहू तुन्नाशेवन्य

According to commentator Gananath Sen, articulating surfaces resemble dentate edges that are held in place by being adhered together or implanted in one another.

At the Sirakapala (Skull) and Katikapala (Hipbone-sacrum, coccyx), this kind of Sandhi can be discovered.

6. **Vayastunda Sandhi (Condylar joint)** - हनुन्योश्चक्षरस्तु वयास्तुण्डः

According to Gananatha Sen, the Hanu that is located within the Shankhasthi on both sides of the chin and creates the T.M.J. (Temporo-Mandibular joint) is referred to as the Vayastunda Sandhi. Similarly, Sushruta feels the same way about Vayastunda Sandhi. Also, where the Sandhi resembles as beak of crow that is Vayastunda Sandhi.
7. **Mandala Sandhi** - कण्ठहृदयकोमलमान्यतामण्डलीय मण्डला

Sandhi that are circular or round are referred to as Mandala Sandhi, according to Dalhana. This kind of Sandhi can be found in the Clomnadi (Trachea), Kantha (Throat), Hrudaya (Heart), and Netra (Eye). The joints between five Mandalas in Netra form six Sandhis.
8. Shankhavarta Sandhi - शंकडहार्वतकेवशंकडहार्वत

According to Haranachandra, Shankhavarta Sandhis are circular in shape and resemble the shell of a snail or Shankha.\[7\] They are located in Shrotra (Ear) and Shringataka (Cavernus sinus), according to Sushruta. Here, Shankhavarta's meaning should be interpreted as an irregular construction. It should be regarded as a joint of irregular structures by Shankhavarta Sandhi (or irregular form). The term "Sandhi" is not limited to bone joints in the classical Ayurvedic literature; it can also refer to joints between two cartilages, two Peshi (muscles), two Snayu (tendons), or two Sira (vessels). Classical literature refers to Shrotra as a Shankhavarta Sandhi. As a result, as we continue to examine the anatomy of the ear, we discover that the Shankhavarta Sandhi in Shrotra refers to the connection between the cochlea and the ear ossicles.

![Diagram of Ear Anatomy](image)

According to Modern Anatomy types of joint

Structural classification (binding tissue) and Functional classification (movement).

1. **Structural classification**- In structural classification, joints are named and categorised based on the kind of tissue that binds the bones together.\[8\] Joints can be categorised structurally into four groups:\[9\]
   - Fibrous joint: This type of joint is made up of collagen-rich, dense regular connective tissue.\[10\]
- 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.\[10\]
- Facet joints connect two articular processes on either side of a vertebra.\[11]\[12]\n
2. **Functional classification**- According to the kind and extent of mobility they provide, joints can also be categorised functionally as follows:\[8]\[13]\ Reference is used to the fundamental anatomical planes\[14]\ while describing joint movements.
- Synarthrosis - restricts or prevents movement. Synarthrosis joints are often fibrous joints (e.g., skull sutures).
- Amphiarthrosis allows for some limited mobility. Most of the joints in amphiarthrosis are cartilaginous joints (e.g., intervertebral discs).
- A synovial joint, also referred to as a diarthrosis, is freely mobile.\[8]\[15]\[13]\n
In turn, synovial joints can be divided into six categories based on the kinds of movements they permit: plane joint, ball-and-socket joint, hinge joint, pivot joint,\[15]\[16]\ condyloid joint, and saddle joint.\[17]\n
**Anatomical**- Anatomically the joints can be grouped as

The joints may be classified anatomically into the following groups.

1. Joints of hand
2. Elbow joints
3. Wrist joints
4. Axillary joints
5. Sternoclavicular joints
6. Vertebral articulations
7. Temporomandibular joints
8. Sacroiliac joints
9. Hip joints
10. Knee joints
11. Articulations of foot

**Clinical significance**

Joint dislocations and osteoarthritis can result from harming the articular cartilage in joints or the bones and muscles that support them. The joints can benefit greatly from swimming training while suffering little harm.

A joint disorder is known as an arthropathy, and it is known as arthritis when one or more joints are inflamed. Arthritis is a common component of joint illnesses, however injury to joints from external physical stress is often not classified as arthritis. When multiple joints are involved, an arthropathy is referred to as polyarticular (multiarticular), and when just one joint is, it is referred to as monoarticular. The main cause of impairment in adults over 55 is arthritis. Arthritis can take many distinct forms, and each type has a unique aetiology. Osteoarthritis, also known as degenerative joint disease, is the most prevalent type of arthritis. It can develop after an injury to the joint, after an infection of the joint, or just as a result of ageing and the degradation of articular cartilage. Additionally, there is mounting evidence that osteoarthritis may develop early due to aberrant anatomy. Rheumatoid arthritis and psoriatic arthritis are autoimmune disorders in which the body attacks itself and are other types of arthritis. Joint infection is the primary cause of septic arthritis. Uric acid crystals build up in the joint, which then becomes inflamed, to induce gouty arthritis. In addition, there is a less typical type of gout that develops when calcium pyrophosphate crystals take the shape of rhombicoids. Pseudogout is the name for this type of gout. The jaw joints are affected by the condition known as temporomandibular joint syndrome (TMJ), which can result in a variety of symptoms including facial pain, jaw clicking, and restricted jaw movement.

**Applied aspect of joints**

1. **Shoulder joint** - it’s dislocation is very common because its socket is quite shallow.
   - Usually the head of humerus becomes displaced inferiorly.
   - Rotator cuff injury is a common injury.
   - Shoulder tip pain.

2. **Elbow joint**
   - Dislocation of the elbow is usually posterior aspect.
   - A partial dislocation of the head of the radius present in children.
- Tennis elbow - Transverse fracture, sprain of radius collateral ligament.

3. Wrist joint - The wrist joint is commonly involved in rheumatoid arthritis.
   - Wrist drop is indicated radial nerve injury.

4. Hip joint - Fracture of the neck of femur are common in old age also called senile degeneration.
   - Dislocation of the hip joint. The sciatic nerve may be damage in posterior dislocation.
   - Congenital dislocation is more common in the hip.
   - Osteoarthritis is a disease of old age.
   - Disease of the hip (like T.B.) may cause referred pain in the knee because of the common nerve supply of the joint.

5. Knee joint - Dislocation of the knee joint is rare.
   - Injury to cruciate ligament.
   - Injury to menisci.
   - Injury to collateral ligament.

6. Ankle joint - Dislocation of the ankle joint.
   - Sprains of the ankle joint.
   - Foot drop - Injury to common peroneal nerve.
   - Injury to the tibia and fibula in the region of the ankle are referred to as Pott's fracture.
   - Injury to medial ligament.
   - Injury to interosseus tibio-fibular ligament.
   - Fracture of malleoli.

7. Temporo-mandibular joint (T.M.J.) - Dislocation of mandible - During excessive opening of the mouth or during a convulsion.
   - Derangement of the articular disc may result from any injury, like over closure or malocclusion.

**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. There are many Aacharyas and commentators who have divergent views on Sandhi Sankhya. There are disagreements over the number of Sandhis, but regrettably there is no comprehensive description of those who have been counted except in sushruta Samhita. Also, According to Ayurveda – in Sushruta Samhita chikitsasthana bhaganchikitsitam adhyaya the basic principles are told to fix these deformities like.

Four Principles of Treatment are\(^{[18]}\)
1. Anchan- To apply traction
2. Pidana- Manipulation by local pressure

And a special treatment is told in case of T.M.J. dislocation in Sushruta Samhita.\(^{[19]}\)

In case of the dislocation of the mandible, the area is carefully fomented after which the mandible is properly lowered to its proper position and Panchangi Bandha is used as support. Nasya should be treated with Grittha that has been medicated with Madhura (Kakolyadi Gana) and Vataghana (Chavyadi Gana).

**CONCLUSION**

Not only are joints important from an anatomical and structural standpoint, but medical research also requires understanding of joints. The most typical lifestyle problems seen in clinical practise are joint disorders. Their prevalence is steadily rising in accordance with evolution. Sandhis are the homes of Kapha, especially Shleshakakapha, which keeps them
integrated and functioning as well as providing good lubrication. Additionally, Sandhis are Marmas, or significant delicate points or sensitive structures, whose harm causes mortality (destruction, degeneration, or deformity). To address their pathology, one must have a complete understanding of the Sandhis' structural and functional makeup. Based on the age-old knowledge of the Ayurvedic seers and instructors, Sandhi Sharira, or the study of joints, is a branch of Ayurveda. Although their method of observing and categorising joints appears to be odd, it deserves praise nonetheless because it was the first attempt to comprehend the most significant bodily structures. The core of all these fundamentals that were presented in the timeline long ago is the anthropology of contemporary anatomy. The purpose of this essay was to describe the Ayurvedic approach to studying bony joints.

REFERENCES