

ANATOMICAL STUDY ON AGE RELATED CHANGES IN JANU SANDHI

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ABSTRACT

Sandhi is given as the union or to unite or meeting point of two or more structure in the body. *Sandhi* is explained as “*Asthi sanyoga sthaana*” that clearly means the meeting point of two *asthi*. According to ayurveda, body is made up of various structures. *Sandhi* is essential body part for the movement and for stabilization of the body. Every bone is united by joints and covered by muscles and gets blood supply by different *Sira* and *Dhamani*. These bones joined to form *Asthi Sandhi*. The structures which are associated with *sandhi-sharir* has some influence in the anatomical and clinical aspect of *sandhi*. Hence, a thorough understanding of the clinic-anatomical characteristics of *Sandhi* is essential during the diagnosis and treatment of joint disorders, as it contributes significantly to improved clinical outcomes. Aging is an inevitable process, and

is associated with functional impairment of various organs and tissues. Degeneration is defined as the structural and functional failure of the tissue, while aging is defined as a result of time- dependent accumulation of molecular and cellular damage. The knee joint (*janu sandhi*) is the largest and complex joint of the body. It allows the lower leg to move relative to the thigh while supporting the body's weight. In this article we will discuss about the impact of aging on the structural integrity of the knee joint.

INTRODUCTION

Sandhi is considered as where two *Asthi* get united or merge with each other. According to *acharya Sushruta Sandhi* are 210 in number.^[1] They classified *Sandhi* (210) in 2 types- 1)

Cheshtayukta (Chal Sandhi) 2) Sthira Sandhi (Achal Sandhi).^[2] The *Cheshtayukta Sandhi* are two types- *Bahucheshtayukta* (freely movable joint) and *alpacheshtayukta* (slightly movable joint). *Shakaha, Hanu Pradesh* and *Kati* region has *Cheshtayukta Sandhi*. Other remaining has *Sthir sandhi*.

Rachnananusaar Sandhi Vargeekaran (based on structure)

Acharya Sushruta has described 8 types of *Sandhi*. They are *Kora, Ulukhala, Samudga, Pratara, Tunnasevani, Vayastunda, Mandala and Shankhavarata*.^[3]

Kora Sandhi (Hinge Joint)- As per *Acharya Sushruta*, *Kora sandhi* exhibits a hinge-like structural configuration, analogous to the hinge mechanism of door or window. This type of joint is found in the finger (*Anguli*), wrist (*Manibandha*), ankle (*Gulpha*), Knee (*Janu*) and elbow (*Kurpura*), where it primarily facilitates movement in a single plane. As per description of *Haranchandra* in commentary of *Sushruta Samhita*, “*Koro Naam Kapaataadinibandhanartho Yantrabhed Kabja*” which means the term *Kora* refers to the hinge (*Kabja*) employed for fastening the shutters of doors and windows. Based on its structural and functional resemblance to the hinge mechanism, the corresponding joint is termed as *Kora Sandhi*.

Janu Sandhi

Janu means Knee. *Jan* means to produced (motion). *Janu Sandhi* are 2 in number present in lower extremities.^[4] *Janu Sandhi* is a type of *Kora sandhi*. It is also a type of *Chestavanta Sandhi*.

Pramaan (dimension)

Acharya Charak Mentioned Length of *Janu* is 4 *Angula* and its circumference is 16 *Angula*.^[5]

Shleshmadhara Kala

Fourth number of *Kala* is *Shleshmadhara Kala* which is situated in all joints and provide free movement and lubricating axis, joints also function properly by the help of *Kapha*.^[6]

Janu Sandhi as the vital point

The *Janu Sandhi* (knee joint) is regarded as one of the *Marma* (vital points) of the human body in Ayurveda. It is classified under the *Sandhi Marma* (joint type of *Marma*) and is further categorized as a *Vaikalyakara Marma*, indicating that injury to this structure results in

permanent deformity or functional disability. Trauma to the *Janu Marma* may lead to *Khanjata* (lameness or limping), reflecting significant impairment of locomotion."

The knee is the largest and most complex joint of the body. The complexity is the result of fusion of three joints in one. It is formed by fusion of the lateral femorotibial, medial femorotibial, and femoro-patellar joints. It is condylar synovial joint, incorporating two condylar joints between the condyles of the femur and tibia, and one saddle joint between the femur and the patella. It is also a complex joint as the cavity is divided by the menisci.

Articular Surfaces

- 1 The condyles of the femur.
- 2 The patella
- 3 The condyles of the tibia.

Ligament- Knee joint is supported by Fibrous ligament, ligamentum patellae tibial collateral ligament, fibula collateral ligament, oblique popliteal ligament, arcuate ligament, anterior cruciate ligament, posterior cruciate ligament, medial meniscus, lateral meniscus., transverse ligament.^[7]

MENISCI- The knee joint contains two crescent-shaped menisci between the femoral condyles and the tibial plateau. They are peripherally thick and taper centrally to a thin margin. They deepen the articular surfaces of the condyles of the tibia, and partially divide the joint cavity into upper and lower compartment. Flexion and extension take place in upper compartment whereas rotation take place in lower compartment. Although the foetal meniscus is fully vascularized, there is a gradual decrease in vascularity during development. In young person, the peripheral 25%-33% of the meniscus is vascularised. The remaining part of the meniscus receives its nutrition from synovial fluid.

Synovial membrane- the synovial membrane of the knee joint lines the capsule. The synovium's surface can be smooth or covered in projections that resembles finger like projection called villi. The synovial membrane of the knee joint is the largest and most extensive synovial membrane in the human body. It lines the inner surface of the fibrous capsule but does not cover the articular cartilage or the menisci. The synovial membrane secretes synovial fluid, which lubricates the articular surfaces, reduces friction during movement, and provides nutrition to the avascular articular cartilage.^[8]

According to ayurveda

In Ayurveda, ageing (Jara) is considered a natural process characterized by the gradual predominance of *Vata Dosha*, particularly during *vridha Avastha* (old age). The knee joint (*Janu Sandhi*) undergoes degenerative changes due to *Dhatu Kshaya* (tissue depletion) and aggravated *Vata*.

The principal age- related changes include

Vata prakopa- increased Vata causes dryness (*Rukshata*), roughness (*Khara Guna*), and degeneration of joint structures.

Asthi Dhatu Kshaya: Degeneration of bone tissue results in weakening of the knee joint (*Sandhishethilyam*).^[9]

Majja Dhatu Kshaya: Reduction in bone marrow and nourishing tissues diminishes joint strength and lubrication (*Asthini durbalaani*).

Shleshaka Kapha Kshaya: Depletion of *Shleshaka Kapha*, which provides lubrication and stability to joints, leads to increased friction and restricted movement.

Sandhigata Vata: Aggravated Vata localizes in the knee joint, producing pain (*Shoola*), swelling (*Shotha*), stiffness, crepitus (*Atopa*), and painful flexion-extension (*Prasarana-Akunchana Vedana*).

Agnimandya- Diminished digestive and metabolic *agni* in old age may impair proper nourishment of dhatu, accelerating degenerative changes.

Reduced mobility: Progressive degeneration results in difficulty walking, climbing stairs, and performing daily activities. Functional impairment due to *vata* and *sandhigata vata*.

According to Modern review

Ageing is associated with progressive structural and functional changes in the knee joint, predisposing individuals to degenerative conditions such as osteoarthritis. The major age-related changes include:

Articular cartilage degeneration: Progressive loss of cartilage thickness and osteophytes^[10], decreased proteoglycan content, reduced water retention, and increased collagen cross-linking result in reduced elasticity and impaired shock absorption. Reduced chondrocyte

density and regenerative capacity.

Subchondral bone changes: Increased bone sclerosis, formation of osteophytes at joint margins, and development of subchondral cysts occur as adaptive responses to cartilage degeneration.

Synovial alterations: Reduced production and altered composition of synovial fluid decrease joint lubrication and nutrient supply to cartilage. Decreased vascularity.

Meniscal degeneration: The menisci become less elastic, more brittle, and susceptible to tears due to decreased vascularity, decreased shock absorbing capacity.

Ligament and tendon changes: Loss of collagen elasticity and increased stiffness reduce joint stability and flexibility.

Muscle weakness: Age-related sarcopenia, particularly of the quadriceps muscle, compromises knee stability and increases the risk of falls or impaired dynamic stabilization of the knee joint.

Reduced bone mineral density: Osteoporotic changes weaken the supporting skeletal structures.

Functional consequences: Joint pain, stiffness, crepitus, reduced range of motion, impaired balance, and decreased mobility become increasingly common with advancing age.

Neurovascular Changes: Decreased proprioception due to degeneration of mechanoreceptors, Reduced vascular supply to periarticular tissues, Delayed tissue repair and regeneration.

Functional Consequences: Reduced range of motion, Joint stiffness, Crepitus during movement, Impaired shock absorption, Decreased joint stability, Reduced walking efficiency.

DISCUSSION

The knee joint (*Janu Sandhi*) is the largest synovial joint of the human body and plays a crucial role in weight bearing, locomotion, and maintaining postural stability. Anatomically, it is a modified hinge joint formed by the articulation of the femur, tibia, and patella. Its stability is maintained by the coordinated action of the articular cartilage, menisci, ligaments,

joint capsule, synovial membrane, surrounding muscles, and subchondral bone. These structures work together to facilitate smooth movement, absorb mechanical stress, and maintain joint congruity.

According to modern anatomy, advancing age results in progressive structural and functional alterations in each component of the knee joint. Degeneration of articular cartilage, remodeling of subchondral bone, reduced synovial fluid production, meniscal degeneration, ligamentous stiffness, and muscle weakness collectively impair joint biomechanics and increase susceptibility to degenerative disorders such as osteoarthritis. These changes are primarily attributed to cellular senescence, extracellular matrix degradation, chronic low-grade inflammation, and reduced tissue regenerative capacity. The prevalence of OA rises strikingly with age, being uncommon in adults aged <40 and highly prevalent in those aged >60. It is also a disease that, at least in middle-aged and elderly persons, is much more common in women than in men.

Ayurveda explains these age-related changes through the concept of *Jara* (ageing), a natural physiological process associated with the predominance of Vata Dosha during *Vardhakya Avastha*. Aggravated *Vata* causes *Rukshata* (dryness), *Khara Guna* (roughness), and *Dhatu Kshaya*, particularly affecting *Asthi*, *Majja*, and *Mamsa Dhatu*. Simultaneously, depletion of *Shleshaka Kapha*, which is responsible for lubrication and stability of the joints, results in increased friction, restricted movement, and gradual degeneration of the *Janu Sandhi*. These changes eventually manifest as *Sandhigata Vata*, characterized by pain, stiffness, crepitus, swelling, and limitation of joint movements.

A comparative analysis reveals a close correlation between the two systems. The degeneration of articular cartilage described in modern medicine resembles *Shleshaka Kapha Kshaya*, while subchondral bone changes correspond to *Asthi Dhatu Kshaya*. Muscle wasting and ligamentous degeneration may be correlated with *Mamsa Dhatu Kshaya* and *Snayu Daurbalya*, respectively. Furthermore, the age-related predominance of *Vata Dosha* provides a holistic explanation for the progressive degenerative changes observed in the knee joint.

Thus, although modern medicine and Ayurveda differ in their conceptual frameworks, both recognize ageing as a progressive degenerative process affecting the structural integrity and functional efficiency of the knee joint. Integrating these perspectives provides a comprehensive understanding of the anatomy, physiology, and pathogenesis of age-related

degeneration of the *Janu Sandhi*, thereby supporting a rational approach to its prevention and management.

CONCLUSION

The *Janu Sandhi* (knee joint) is a highly specialized synovial joint that plays a vital role in weight bearing, locomotion, and maintaining postural stability. Ageing leads to progressive anatomical and functional changes in these components, resulting in reduced joint stability, impaired mobility, and an increased predisposition to degenerative conditions such as osteoarthritis. From the Ayurvedic perspective, these age-related changes can be explained by the predominance of *Vata Dosha* during *Vardhakya*, along with *Dhatu Kshaya* and *Shleshaka Kapha Kshaya*, which collectively contribute to degeneration of the *Janu Sandhi*. These changes correspond closely with the modern understanding of cartilage degeneration, bone remodelling, reduced joint lubrication, and soft tissue deterioration.

Therefore, a comprehensive understanding of the normal anatomy of the knee joint and its age-related changes from both modern and Ayurvedic perspectives provides a strong foundation for understanding the pathogenesis of *Sandhigata Vata* (osteoarthritis) and supports the development of appropriate preventive and therapeutic strategies.

REFERENCES

1. Kavirajan Ambikadutta Shastri, SUSHRUTA SAMHITA of Maharsi- Sushruta, edited by AYURVEDA-TATTVA-SANDIPIKA, Part-1, Chaukhambha Sanskrit Sansthan Varanasi, Edition: reprint, 2017; Sharir Sthan, Chapter 5/ 27, 61.
2. Kavirajan Ambikadutta Shastri, SUSHRUTA SAMHITA of Maharsi- Sushruta, edited by AYURVEDA-TATTVA-SANDIPIKA, Part-1, Chaukhambha Sanskrit Sansthan Varanasi, Edition: reprint, 2017; Sharir Sthan, Chapter 5/ 26, 60.
3. Kavirajan Ambikadutta Shastri, SUSHRUTA SAMHITA of Maharsi- Sushruta, edited by AYURVEDA-TATTVA-SANDIPIKA, Part-1, Chaukhambha Sanskrit Sansthan Varanasi, Edition: reprint, 2017, Sharir Sthan, Chapter 5/ 31 61.
4. Pt. Kasinath Sastri, Dr. Gorakh Nath Chaturvedi, Pt. Rajeshwara Datta Sastri (Editor), CHARAK SAMHITA of AGNIVESA, REVISED BY CHARAK and DRIDHBALA, Part-1, Chaukhambha Bharati Academy Varanasi, Reprint year-2015, Sharira Sthan Chapter 7/6, 912.
5. Pt. Kasinath Sastri, Dr. Gorakh Nath Chaturvedi, Pt. Rajeshwara Datta Sastri (Editor), CHARAK SAMHITA of AGNIVESA, REVISED BY CHARAK and DRIDHBALA,

- Part-1, Chaukhambha Bharati Academy Varanasi, Reprint year-2015, Vimaan Sthan, Chapter 8/117, 779.
6. Kavirajan Ambikadutta Shastri, SUSHRUTA SAMHITA of Maharsi- Susruta, edited by AYURVEDA-TATTVA-SANDHIPIKA, Part-1, Chaukhambha Sanskrit Sansthan Varanasi, Edition: reprint, 2017, Sharir sthan, Chapter 4/ 14-15, 40.
 7. Krishna Garg (Chief editor), BD CHAURASIA'S HUMAN ANATOMY Vol-2, CBS Publishers and distributors, Seventh Edition., 2015; Chapter-12, 152.
 8. Standring S, ed. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42nd ed. London: Elsevier, 2021.
 9. Pt. Kasinath Sastri, Dr. Gorakh Nath Chaturvedi, Pt. Rajeshwara Datta Sastri (Editor), CHARAK SAMHITA of AGNIVESA, REVISED BY CHARAK and DRIDHBALA, Part-1, Chaukhambha Bharati Academy Varanasi, Reprint year-2015, SUTRA STHAN Chapter 17/67, 349.
 10. Loscalzo, Fauci, Kasper, Hauser, Longo, Jameson (editors), HARRISON'S PRINCIPLES OF INTERNAL MEDICINE, Vol-1 Mc Graw Hill, 21st Edition., Sect-3; 2855.