

ROLE OF VATA DOSHA AND DHATU KSHAYA IN THE PATHOGENESIS OF
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ABSTRACT

Background: *Janusandhigata Vata* is an important *Vata*-dominant disorder affecting the knee joint and is clinically characterized by pain, swelling, crepitus and restriction of joint movements. Its clinical manifestations demonstrate substantial overlap with knee osteoarthritis (KOA), although the two conditions arise from distinct theoretical frameworks. Ayurveda attributes the development of *Sandhigata Vata* primarily to *Vata Prakopa*, *Dhatu Kshaya* and localization of aggravated *Vata* in a susceptible *Sandhi*. **Objective :** The present review aims to critically examine the role of *Vata Dosha* and *Dhatu Kshaya* in the pathogenesis of *Janusandhigata Vata* and to explore their possible conceptual relationship with contemporary understanding of knee osteoarthritis. **Materials and Methods:** Classical Ayurvedic descriptions of *Sandhigata Vata*, principles of *Vata Prakopa*, *Dhatu Kshaya*, *Ashraya–Ashrayi Bhava* and *Shleshaka Kapha* were reviewed and conceptually compared with contemporary literature concerning the pathophysiology of knee osteoarthritis, including cartilage, subchondral bone, synovium, periarticular tissues, biomechanics and pain mechanisms. **Discussion:** *Vata Prakopa* and *Dhatu Kshaya* may be interpreted as interconnected rather than independent pathogenic processes. Ageing, inadequate tissue nourishment and excessive mechanical stress may contribute to *Dhatu Kshaya* and *Vata* aggravation. In the presence of local *Kha-Vaigunya* at the *Janu Sandhi*, aggravated *Vata* may undergo *Sthana Samshraya* and produce pain, swelling, *Atopa* and restricted movement. The *Asthi–Vata* relationship provides an important conceptual framework for structural vulnerability, whereas *Shleshaka Kapha* represents the functional principle associated with smooth and stable joint movement. Contemporary evidence demonstrates that KOA is a whole-joint disorder involving complex interactions between cartilage, subchondral bone, synovium, periarticular tissues and pain pathways. Thus, the Ayurvedic model may provide a useful conceptual framework for generating hypotheses regarding degenerative joint pathology. **Conclusion:** The proposed *Vata–Dhatu Kshaya* model emphasizes a dynamic interaction between *Dosha* aggravation, tissue vulnerability and local joint susceptibility. However, Ayurvedic concepts should be interpreted as functional and theoretical constructs rather than equated directly with individual biomedical structures or biomarkers. Further clinical and translational research is required to evaluate this proposed relationship.

KEYWORDS: *Janusandhigata Vata*, *Sandhigata Vata*, *Vata Dosha*, *Dhatu Kshaya*, *Asthi Dhatu*, *Majja Dhatu*, *Shleshaka Kapha*, Knee Osteoarthritis, *Samprapti*.

1. INTRODUCTION

Knee osteoarthritis is one of the most important chronic musculoskeletal disorders and is associated with persistent pain, stiffness, restricted mobility and

progressive functional disability. Its increasing prevalence is associated with ageing populations, obesity, previous joint injury, altered biomechanics and several metabolic and lifestyle factors. Contemporary

understanding has moved away from viewing osteoarthritis merely as a disease of cartilage wear. It is now regarded as a **whole-joint disease**, involving interactions among articular cartilage, subchondral bone, synovium, menisci, ligaments, periarticular muscles and neural mechanisms.^[1]

The knee is particularly vulnerable because it is a major weight-bearing joint exposed to repeated mechanical loading. Progressive osteoarthritic changes may involve extracellular matrix disruption in cartilage, alterations in chondrocyte activity, subchondral bone remodeling, synovial changes, osteophyte formation and abnormalities of periarticular tissues. Importantly, the severity of structural changes does not always correspond directly to the intensity of pain, because pain may arise from several innervated structures, including synovium, subchondral bone, capsule, ligaments and periarticular tissues.^[2]

Ayurveda describes a clinically comparable syndrome under *Sandhigata Vata*, in which aggravated *Vata* becomes localized within a *Sandhi*. When the *Janu Sandhi* is involved, the condition is clinically described as *Janusandhigata Vata*. Classical descriptions include *Sandhi Shula*, *Sandhi Shotha*, pain during *Akunchana* and *Prasarana*, *Atopa* and impairment of joint movement.^[3] A contemporary Ayurvedic review also notes the close clinical similarity between these manifestations and osteoarthritis of the knee.

The Ayurvedic approach, however, does not describe the disorder exclusively as structural degeneration. It explains disease development through the interaction of *Dosha*, *Dhatu*, *Guna*, *Srotas*, *Kha-Vaigunya* and *Sthana Samshraya*.^[4] Among these, *Vata* has a central role because of its association with movement, while *Dhatu Kshaya* represents an important condition of tissue depletion or deterioration.

The importance of *Dhatu Kshaya* becomes particularly evident in ageing. *Vridhdhava* is considered a period of increased *Vata* predominance and progressive *Dhatu* depletion.^[5] Consequently, age-associated tissue vulnerability may provide a suitable environment for *Vata* aggravation and localization.

Recent Ayurvedic literature on *Janusandhigata Vata* has discussed both *Dhatukshaya-janya* and *Avarana-janyamechanisms*, indicating that the disease may arise through more than one pathogenic pathway.^[6]

The present review therefore focuses on the specific question of how *Vata Prakopa* and *Dhatu Kshaya* interact with the local vulnerability of the *Janu Sandhi* to initiate and perpetuate the clinical manifestations of *Janusandhigata Vata*. It is proposed that *Dhatu Kshaya* and *Vata Prakopa* should not necessarily be regarded as independent pathological events; rather, they may represent a bidirectional pathological relationship,

wherein progressive tissue vulnerability predisposes the *Janu Sandhi* to *Vata* aggravation, while aggravated *Vata* further impairs tissue function and contributes to the progression and persistence of local structural and functional changes.

AIM

To critically explore the role of *Vata Dosha* and *Dhatu Kshaya* in the pathogenesis of *Janusandhigata Vata* and to develop a contemporary conceptual understanding of their interaction in relation to the pathophysiology of knee osteoarthritis.

OBJECTIVES

1. To review the classical concept of *Janusandhigata Vata* with reference to its *Nidana*, *Purvarupa*, *Rupa*, *Samprapti*, *Upashaya* and *Anupashaya* described in major Ayurvedic texts.
2. To analyze the role of *Vata Dosha* in the initiation, progression and localization of pathology at *Janu Sandhi*, with particular emphasis on its *Ruksha*, *Laghu*, *Khara*, *Sukshma* and *Chala Guna*.
3. To examine the contribution of *Dhatu Kshaya* to the development and progression of *Janusandhigata Vata*, particularly with respect to *Asthi*, *Majja*, *Mamsa* and *Snayu*.
4. To explore the *Asthi-Vata* relationship and the concept of *Ashraya-Ashrayi Bhava* in the pathogenesis of degenerative changes involving *Janu Sandhi*.
5. To evaluate the role of *Shleshaka Kapha* in maintaining joint lubrication, stability and smooth movement and to discuss its possible impairment in *Janusandhigata Vata*.
6. To critically interpret the concepts of *Kha-Vaigunya* and *Sthana Samshraya* in relation to the localization of aggravated *Vata* at *Janu Sandhi*.
7. To establish a conceptual correlation between Ayurvedic manifestations such as *Sandhi Shula*, *Atopa*, *Sandhi Shotha* and *Prasarana-Akunchana Vedana* and contemporary features of knee osteoarthritis.
8. To develop an integrated *Vata-Dhatu Kshaya Samprapti* model explaining the interaction between *Vata Prakopa*, tissue vulnerability and progressive joint dysfunction.
9. To identify similarities and differences between Ayurvedic and contemporary biomedical models of knee osteoarthritis while avoiding direct one-to-one equivalence of Ayurvedic concepts with anatomical or biochemical entities.
10. To identify research gaps and generate testable hypotheses for future clinical and translational studies on *Janusandhigata Vata*.

2. Concept of Janusandhigata Vata

2.1 Etymological understanding

The term *Janusandhigata Vata* can be understood through its constituent terms: *Janu* refers to the knee, *Sandhi* to the joint, *Gata* to being situated or localized,

and *Vata* to the *Dosha* associated with movement and dynamic functions. Thus, *Janusandhigata Vata* may be interpreted as a condition in which aggravated *Vata* becomes localized in the Janu Sandhi and produces characteristic structural, sensory, and functional abnormalities. However, the major classical descriptions are presented under the broader concepts of *Sandhigata Vata* or *Sandhigata Anila*, rather than as a separately elaborated disease entity specifically designated *Janusandhigata Vata*. Accordingly, *Janusandhigata Vata* represents a site-specific clinical application of the broader classical concept of *Sandhigata Vata* to the knee joint.

2.2 Classical description

Charaka Samhita

Charaka describes *Sandhigata Anila* under *Vatavyadhi*. The major manifestations include *Sandhi Shotha*, the characteristic *Vatapurna Driti Sparsha*, and pain associated with *Akunchana* and *Prasarana*, as described in the verse:

वातपूर्णदृतिस्पर्शः शोथः सन्धिगतेशिले ।

प्रसारणाकुञ्चनयोः प्रवृत्तिश्च सवेदना ॥ ३७॥

Thus, the classical description combines a local structural manifestation with movement-associated pain, highlighting the relationship between *Vata* disturbance and impaired joint function.

Vata in Asthi and Majja

An important reference for the present discussion is *Charaka Chikitsa Sthana* 28/33.

भेदोऽस्थिपर्वणां सन्धिशूलं मांसबलक्षयः ।

अस्वप्नः सन्तता रुक् च मज्जास्थिकुपितेशिले ॥ ३३॥

This verse describes the manifestations of aggravated *Vata* involving *Asthi* and *Majja*, including pain in the bones and joints and loss of muscular strength. It provides a valuable classical basis for understanding the relationship between *Vata*, *Asthi-Majja*, *Sandhi Shula*, and *Mamsa Bala Kshaya*, thereby supporting a broader interpretation of *Sandhigata Vata* beyond the manifestations described in the isolated *Sandhigata Anila* verse.

Sushruta Samhita

Sushruta describes *Sandhigata Vata* in *Nidana Sthana* 1/28–29, with the classical expression.

हन्ति सन्धिगतः सन्धीन् शूलादोषौ करोति च ।

The description highlights *Shula* (pain), *Atopa* (abnormal joint sounds), and impairment of normal joint function. Thus, the *Sushruta* description further emphasizes the functional component of *Sandhigata Vata* and its effect on the affected *Sandhi*.

Vagbhata

Vagbhata provides a similar description of *Sandhigata Vata*, including swelling and pain associated with *Akunchana* and *Prasarana*. This reinforces the classical association of aggravated *Vata* with movement-related pain, local swelling, and functional disturbance of the affected joint.

Madhavakara and Later Descriptions

Madhavakara discusses *Vata Vyadhi* in *Madhava Nidana* 22, with *Sandhigata Vata* commonly cited around 22/21–23. The description gives importance to *Atopa*, which is clinically relevant to the interpretation of abnormal joint sounds or crepitus. Later Ayurvedic descriptions similarly retain *Atopa* as an important clinical feature, providing a useful point of comparison with the crepitus commonly observed in knee osteoarthritis.

Classical symptom complex

The classical manifestations of *Sandhigata Vata* can therefore be organized as *Sandhi Shotha* → *Sandhi Shula* → *Akunchana–Prasarana Vedana* → *Atopa* → *Hanti Sandhigatah*.⁷ This pattern demonstrates that *Sandhigata Vata* is not merely a disorder characterized by pain; rather, it encompasses local structural alteration, movement-associated symptoms, and progressive functional impairment. Taken together, the classical descriptions provide a broader clinical framework in which *Charaka* presents the primary manifestation of *Sandhigata Anila*, *Sushruta* emphasizes its functional and potentially destructive aspect, *Vagbhata* further elaborates the characteristic clinical features, and *Madhavakara* gives particular importance to *Atopa*, providing a useful point of comparison with abnormal joint sounds or crepitus.

2.3 Nidana

The *Nidana* of *Janusandhigata Vata* can be considered under three major categories.^[8]

A. Vata Prakopaka Nidana

Vata-aggravating dietary and behavioural factors may include the regular consumption of *Ruksha*, *Laghu*, and *Sheeta Ahara*, irregular food habits, excessive fasting, *Ati Vyayama*, excessive walking or travelling, prolonged physical exertion, inadequate rest, *Prajagarana*, and an irregular lifestyle. These factors may contribute to the aggravation of *Vata* and thereby influence the development and progression of *Sandhigata Vata*.

B. Factors Contributing to Dhātu Kshaya

Factors contributing to *Dhātu Kshaya* may include advancing age, inadequate nourishment, prolonged illness, excessive physical exertion, chronic *Vata* aggravation, and inadequate tissue support. Progressive depletion or inadequate maintenance of *Dhātu* may increase the vulnerability of the musculoskeletal tissues to functional and structural changes.

C. Local Predisposing Factors

Local *Kha-Vaigunya* of the *Janu Sandhi* may be produced or aggravated by previous trauma, repetitive mechanical loading, obesity-associated joint stress, altered biomechanics, muscle weakness, ligamentous instability, and occupational overuse. These factors may increase local mechanical stress and compromise the functional integrity of the knee joint.

Taken together, these observations suggest that the pathogenesis of *Janusandhigata Vata* should be understood through the combined influence of systemic *Vata-prakopaka* factors, progressive *Dhatu Kshaya*, and local structural or mechanical vulnerability of the *Janu Sandhi*.

2.4 Purvarupa^[9]

A separate and comprehensive list of *Purvarupa* specifically describing *Janusandhigata Vata* is not clearly established in the classical Ayurvedic descriptions. Therefore, probable early clinical manifestations should not be presented as classical *Purvarupa*. From a contemporary clinical perspective, early manifestations may include intermittent knee discomfort, mild exertional pain, early stiffness, discomfort after prolonged standing, difficulty during squatting, occasional crepitus, mild restriction of movement, and discomfort during stair climbing. These manifestations may therefore be appropriately designated as probable early clinical manifestations rather than classical *Purvarupa* of *Janusandhigata Vata*.

2.5 Rupa^[10]

2.5.1 Sandhi Shula

Sandhi Shula is the principal clinical manifestation of *Janusandhigata Vata*. The pain may become more

apparent during walking, weight-bearing, stair climbing, squatting, rising from a sitting position, flexion and extension of the knee, and prolonged physical activity. This activity-related pattern of pain is also consistent with the clinical presentation of modern knee osteoarthritis (KOA), in which pain is predominantly associated with movement and weight-bearing and is accompanied by varying degrees of functional limitation.

2.5.2 Sandhi Shotha

Swelling is another important classical feature.

In contemporary OA, swelling may be related to synovial inflammation, effusion and periarticular changes. Synovial abnormalities are recognized components of the whole-joint disease process.

2.5.3 Akunchana–Prasarana Vedana

Pain during flexion and extension is specifically described in the classical texts and is highly relevant to knee function.

2.5.4 Atopa

Atopa denotes abnormal sounds associated with joint movement and can be clinically correlated with crepitus.

2.5.5 Hanti Sandhigatah

Hanti Sandhigatah indicates impairment or restriction of normal joint function. From a clinical perspective, the manifestations may be understood as a progressive sequence in which pain leads to stiffness, followed by reduction in range of motion (ROM), increasing functional limitation, and, in advanced stages, disability. Thus, the progression may be represented as: Pain → Stiffness → Reduced ROM → Functional Limitation → Disability.

Classical Symptom Comparison

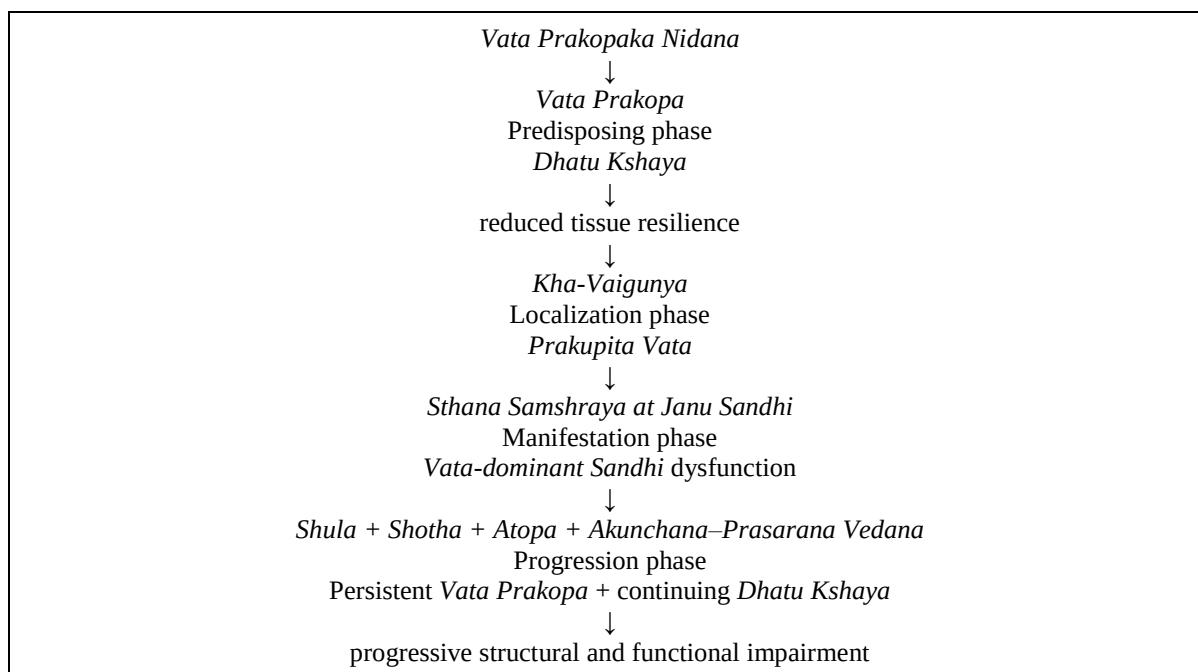
Table no.1 Classical Symptom Comparison.

Feature	Charaka	Sushruta	Ashtanga Hridaya	Madhava
<i>Sandhi Shula</i>	✓	✓	✓	✓
<i>Sandhi Shotha</i>	✓	✓	✓	—/variable
Painful flexion-extension	✓	—	✓	✓
<i>Vatapurna Driti Sparsha</i>	✓	—	✓	—
<i>Hanti Sandhi</i>	—	✓	—/related	✓
<i>Atopa</i>	—	✓/related	✓	✓

2.6 Samprapti

The Samprapti of *Janusandhigata Vata* should be understood as a dynamic process rather than a single linear pathway.^[11]

Initial phase



Flow diagram - 1

This model places *Dhātu Kshaya* and *Vata Prakopa* in an interacting relationship.

2.7 Upashaya and Anupashaya

Upashaya^[12]

As *Janusandhigata Vata* is predominantly *Vata*-dominant, measures that counteract the qualities and effects of aggravated *Vata* may provide symptomatic relief. These include appropriate *Snehana*, *Abhyanga*, *Swedana*, *Basti*, *Upanaha*, adequate rest, avoidance of excessive joint loading, suitable and appropriately dosed exercise, and adequate nutritional support. Ayurvedic literature also describes modalities such as *Snehana*, *Basti*, *Upanaha*, *Agnikarma*, *Bandhana*, and *Unmardana* in the management of *Janusandhigata Vata*.

Anupashaya^[13]

Factors that may aggravate the condition include excessive walking, prolonged standing, excessive or

inappropriate exercise, repeated mechanical loading of the knee, inadequate rest, inappropriate posture, and continued exposure to *Vata*-aggravating dietary and lifestyle practices. Such factors may further increase *Vata* aggravation and mechanical stress on the *Janu Sandhi*, thereby contributing to persistence or worsening of symptoms.

3. Role of Vata Dosha in Janusandhigata Vata

3.1 Vata as regulator of movement

Vata is the principal *Dosha* associated with movement and dynamic activity. At the level of the knee joint, this functional role of *Vata* may be conceptually related to flexion, extension, locomotion, neuromuscular coordination, sensory-motor integration, and maintenance of functional mobility. Disturbance of *Vata* may therefore provide an Ayurvedic framework for understanding the development of pain, restricted movement, and altered functional capacity of the knee joint.^[14]

3.2 Role of Vata Guna

Table no. 2 Role of Vata Guna.

Vata Guna	Possible relevance in Janusandhigata Vata
Ruksha	Reduced unctuousness and tissue dryness
Laghu	Reduced stability/support
Khara	Roughness/irregularity
Chala	Abnormal/excessive mobility
Sukshma	Pervasive functional influence

These are functional Ayurvedic properties, not direct biochemical descriptions.

3.3 Vata Prakopa and lifestyle

Excessive physical activity, repetitive joint loading, an irregular lifestyle, and *Vata*-aggravating dietary practices may contribute to *Vata Prakopa*. From a contemporary

perspective, excessive or abnormal mechanical loading may disturb joint homeostasis and contribute to alterations in cartilage, subchondral bone, and synovial tissues. Knee osteoarthritis is now understood as a complex disorder involving interacting mechanical, inflammatory, metabolic, and cellular processes. Thus, the two models may be placed in conceptual dialogue:

Ati Chesta / Ati Vyayama → *Vata Prakopa*, and excessive mechanical loading → altered joint homeostasis. However, this represents a conceptual parallel rather than evidence that the two models describe identical biological mechanisms.^[15]

4. *Dhatu Kshaya* as a Pathogenic Mechanism

4.1 Concept of *Dhatu Kshaya*

4.1 *Dhatu Kshaya*

Dhatu Kshaya may be understood as diminution or deterioration of the structural and functional properties of a *Dhatu*. For the present review, it is useful to interpret *Dhatu Kshaya* as progressive reduction in tissue integrity, resilience, and functional capacity rather than merely reduction in tissue volume. This interpretation is particularly relevant to chronic degenerative conditions, in which progressive changes in tissue quality and function may occur over time.^[16]

4.2 *Dhatu Kshaya* and *Vata Vriddhi*

A central Ayurvedic concept is the relationship of *Dhatu Kshaya* → *Vata Vriddhi*. However, the reverse interaction may also be considered, wherein *Vata Prakopa* → progressive impairment of *Dhatu*. Thus, a bidirectional pathological cycle may be proposed: *Dhatu Kshaya* → *Vata aggravation* → functional disturbance → further tissue impairment → further *Dhatu Kshaya*. This may be understood as a vicious cycle in which tissue vulnerability and *Vata* aggravation reinforce each other and contribute to the persistence and progression of the disorder.^[17]

5. *Asthi Dhatu Kshaya*

Asthi Dhatu has particular relevance in the present context because the knee is a weight-bearing articulation involving major bony structures. From the Ayurvedic perspective, *Asthi* provides structural support and stability; therefore, *Asthi Kshaya* may be considered a state of reduced structural resilience. Contemporary knee osteoarthritis involves substantial changes in the subchondral bone, including altered bone remodeling, sclerosis, bone marrow lesions, cystic changes, and osteophyte formation. However, it would be scientifically inappropriate to equate *Asthi Dhatu Kshaya* directly with subchondral bone degeneration. A more defensible interpretation is that *Asthi Dhatu Kshaya* may provide an Ayurvedic conceptual framework for discussing structural vulnerability of the bony component of the joint, whereas contemporary subchondral bone pathology represents a distinct biomedical model requiring independent evidence.^[18]

6. *Majja Dhatu* Involvement

Majja Dhatu provides another important conceptual dimension. Contemporary osteoarthritis research increasingly recognizes the role of subchondral bone and bone-marrow abnormalities, with bone marrow lesions being associated with pain and structural progression.^[19] Therefore, *Majja* involvement may be explored as a potential conceptual area for further research. However,

Majja Dhatu should not be equated directly with bone marrow in a strict anatomical sense. The relationship between the Ayurvedic concept of *Majja* and contemporary bone-marrow pathology should therefore be investigated rather than assumed.

7. *Mamsa* and *Snayu* Involvement

The knee functions as an integrated musculoskeletal unit involving bone, cartilage, synovium, ligaments, menisci, muscles, capsule, and neural structures. Contemporary osteoarthritis literature recognizes changes in periarticular muscles and stabilizing tissues as important components of the disease process. Therefore, the Ayurvedic consideration of *Mamsa* and *Snayu* may be useful in interpreting reduced muscular support, functional instability, altered joint mechanics, and impairment of mobility in *Janusandhigata Vata*.^[20]

8. *Asthi–Vata* Relationship

The *Ashraya–Ashrayi Bhava* between *Vata* and *Asthi* is central to the proposed model. A conceptual bidirectional relationship may be represented as *Asthi vulnerability* → *Vata aggravation*, while *Vata Prakopa* → further *Asthi*-related dysfunction. This relationship provides an Ayurvedic framework for understanding why *Vata*-dominant disorders frequently manifest in the musculoskeletal system. Contemporary research similarly demonstrates significant interaction between cartilage and subchondral bone, with mechanical and biochemical communication between these tissues contributing to the progression of osteoarthritis. Thus, the *Asthi–Vata* relationship may serve as a useful Ayurvedic conceptual framework for exploring the interaction between tissue vulnerability and *Vata*-related dysfunction, without assuming direct equivalence with contemporary anatomical or pathological models.^[21]

9. Role of *Shleshaka Kapha*

Shleshaka Kapha is traditionally associated with the *Sandhi* and is considered important for maintaining smooth and stable joint function. Its conceptual functions include lubrication, facilitating smooth movement, providing protection and stability, and reducing friction within the joint. In contrast, aggravated *Vata* is characterized by qualities such as *Ruksha* and *Khara*, which may conceptually oppose the lubricating and stabilizing functions of *Shleshaka Kapha* and thereby contribute to impaired joint function and increased susceptibility to degenerative changes.²² Thus, *Vata Prakopa* with reduced *Shleshaka Kapha* function may lead to loss of smooth joint function, followed by movement-associated discomfort and stiffness. From a contemporary perspective, synovial physiology provides a possible area for comparison, as the synovium and synovial fluid contribute to joint lubrication and cartilage nutrition. However, *Shleshaka Kapha* should not be directly equated with synovial fluid; rather, it is better understood as a broader functional Ayurvedic principle encompassing the lubricating, protective, and stabilizing aspects of joint function.

10. Contemporary Pathophysiological Perspective

Modern OA is increasingly understood as a **whole-joint disorder**.

10.1 Articular cartilage

Cartilage undergoes extracellular matrix disruption and alters chondrocyte activity. Excessive mechanical stress can disturb anabolic-catabolic balance and promote matrix degradation.^[22]

10.2 Subchondral bone

Subchondral bone undergoes altered remodeling and interacts closely with cartilage.

10.3 Synovium

Synovial inflammation can contribute to pain and disease progression.

10.4 Periarticular tissues

Muscles, ligaments, menisci and other supporting structures may undergo functional and structural changes.

10.5 Pain mechanisms

Pain may arise from several innervated joint tissues rather than from cartilage itself. Subchondral bone, synovium, capsule and periarticular structures can contribute to nociception.^[24]

This whole-joint model is increasingly supported by contemporary literature.

11. Ayurvedic–Contemporary Conceptual Correlation

Table no. 3: Ayurvedic–Contemporary Conceptual Correlation

Ayurvedic concept	Contemporary area for comparison
<i>Vata Prakopa</i>	Altered movement, neuromusculoskeletal dysfunction and pain processing
<i>Dhatu Kshaya</i>	Reduced tissue resilience/homeostasis
<i>Asthi involvement</i>	Subchondral bone remodeling
<i>Majja involvement</i>	Bone-marrow/subchondral abnormalities
<i>Mamsa involvement</i>	Periarticular muscle dysfunction
<i>Snayu involvement</i>	Ligamentous/supporting tissue changes
<i>Shleshaka Kapha</i>	Joint lubrication and functional stability
<i>Kha-Vaigunya</i>	Local joint susceptibility
<i>Sthana Samshraya</i>	Localization of pathological process
<i>Sandhi Shula</i>	Knee pain
<i>Sandhi Shotha</i>	Swelling/effusion and synovial/periarticular changes
<i>Atopa</i>	Crepitus
<i>Akunchana–Prasarana Vedana</i>	Pain during movement
<i>Hanti Sandhigatah</i>	Functional restriction

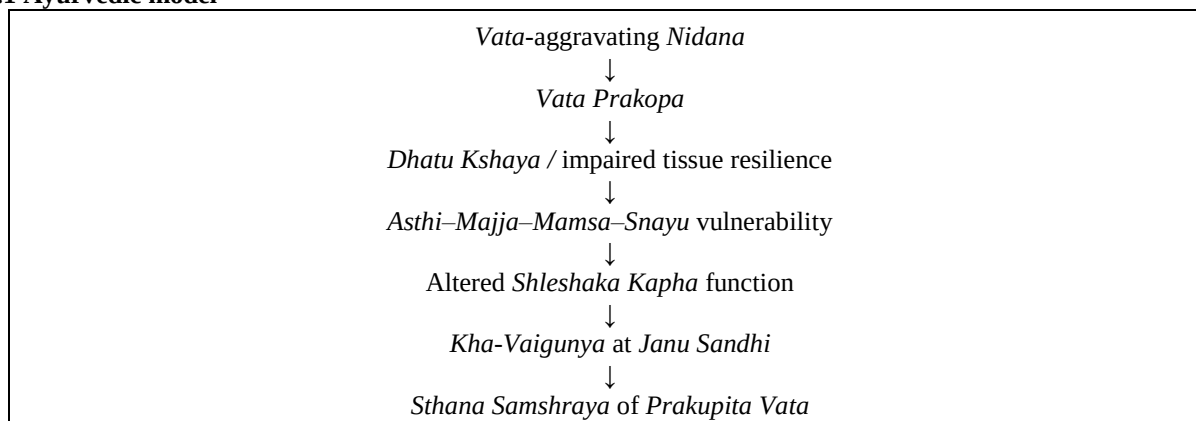
Scientific interpretation

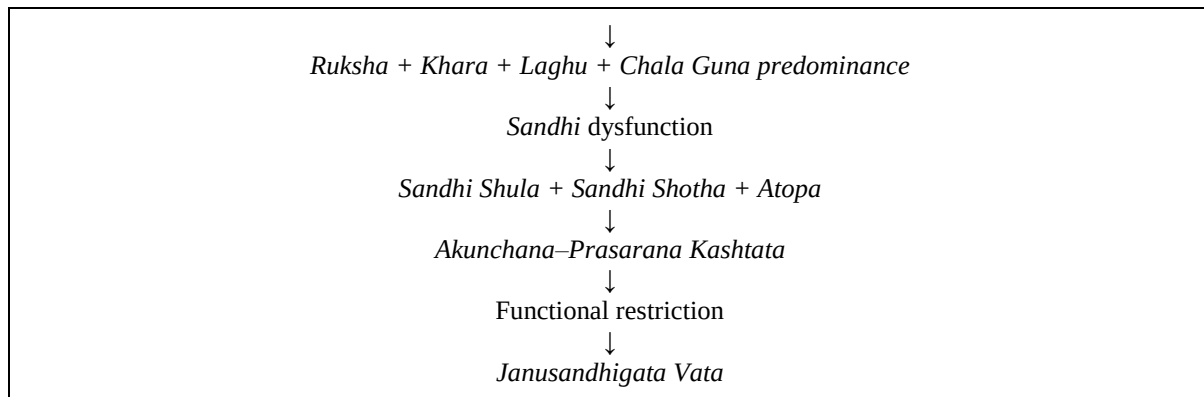
The proposed comparison should be presented as a conceptual bridge rather than a claim of direct anatomical, physiological, or molecular equivalence between Ayurvedic and contemporary biomedical concepts. Accordingly, *Vata* should not be simplistically labelled as “neurological dysfunction,” *Dhatu Kshaya* should not be equated with “cartilage loss,” *Shleshaka Kapha* should not be reduced to “synovial fluid,” and

Asthi Dhatu should not be equated exclusively with subchondral bone. Such one-to-one mapping may oversimplify the multidimensional nature of Ayurvedic concepts and could weaken the scientific credibility of the review. Instead, these concepts should be discussed in terms of functional parallels, possible areas of correspondence, and testable hypotheses, while maintaining the distinct theoretical frameworks of Ayurveda and contemporary biomedical science.

12. Integrated Samprapti Model

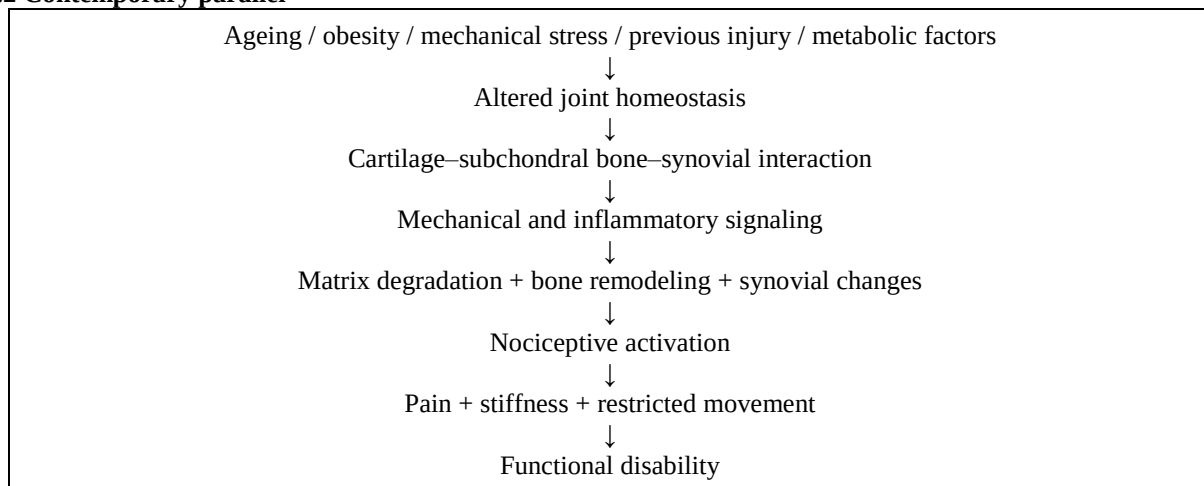
12.1 Ayurvedic model





Flow diagram - 2

12.2 Contemporary parallel

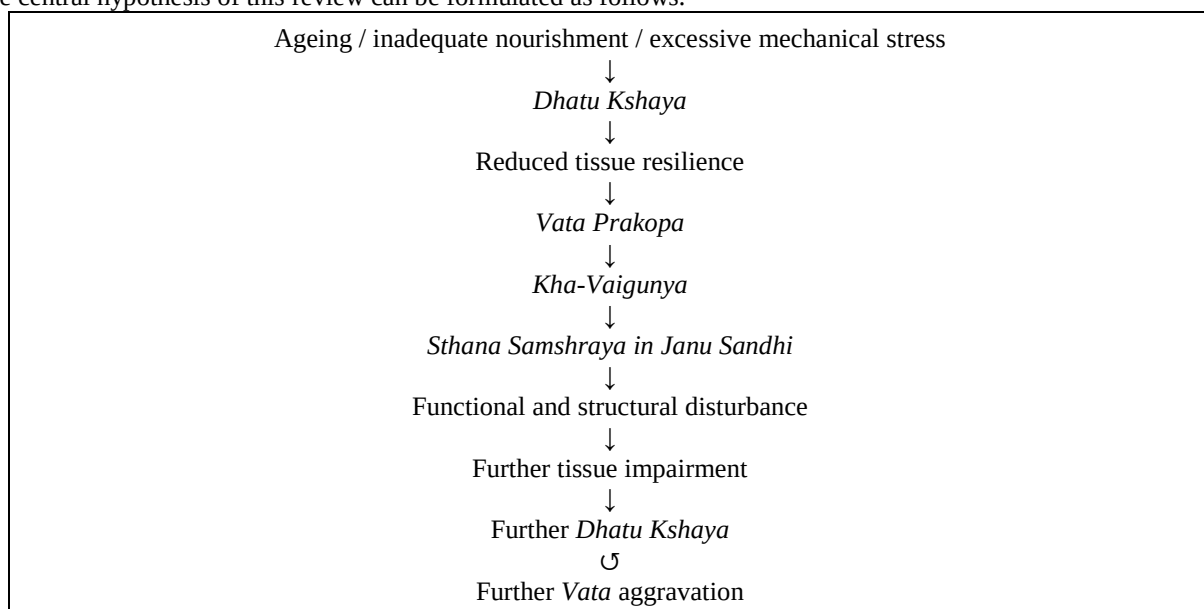


Flow diagram - 3

Modern evidence supports this interconnected whole-joint model rather than a simple cartilage-only degeneration model.^[25]

13. Proposed *Vata–Dhatu Kshaya Vicious Cycle*

The central hypothesis of this review can be formulated as follows.



Flow diagram - 4

This represents the major conceptual novelty of the proposed review. Rather than viewing *Dhatu Kshaya* as a unidirectional cause of *Vata Prakopa*, the review proposes that *Dhatu Kshaya* and *Vata Prakopa* may participate in a mutually reinforcing pathological cycle, in which progressive tissue vulnerability facilitates *Vata* localization at the affected joint, while persistent *Vata* disturbance may further contribute to functional impairment and deterioration of tissue integrity. This bidirectional model provides a more dynamic interpretation of the pathogenesis of *Janusandhigata Vata* and offers a framework for understanding how tissue vulnerability and *Vata*-related dysfunction may interact and perpetuate the clinical manifestations of the disorder.^[26]

14. *Dhatukshaya-janya* and *Avarana-janya* Perspectives

Recent Ayurvedic literature recognizes more than one possible *Samprapti* of *Janusandhigata Vata*.

Dhatukshaya-janya Pathway

The *Dhatukshaya-janya* pathway may be understood as a sequence in which *Dhatu Kshaya* contributes to *Vata Prakopa*, followed by the development of *Kha-Vaigunya* and *Sthana Samshraya*, ultimately resulting in the manifestation of *Janusandhigata Vata*. This pathway is particularly relevant to ageing and degenerative presentations, where progressive tissue vulnerability may predispose the *Janu Sandhi* to *Vata*-related dysfunction.

Avarana-janya Pathway

Avarana represents obstruction or alteration of the normal movement of *Vata* by another *Dosha* or pathological factor. Conceptually, an *Avaraka* factor may interfere with normal *Vata Gati*, resulting in *Vata* dysfunction and subsequent localization of clinical manifestations. This pathway may be relevant in patients presenting with prominent metabolic, inflammatory, or *Kapha*-associated features.^[27] The two mechanisms should not necessarily be considered mutually exclusive, as different pathogenic pathways may coexist or predominate at different stages of the disease.

15. DISCUSSION

The central strength of the *Janusandhigata Vata* concept lies in its multidimensional understanding of joint disease. Classical descriptions do not limit the condition to pain but encompass a sequence involving structure, sensation, movement, and function. This perspective is relevant to contemporary knee osteoarthritis (KOA), in which structural changes and clinical symptoms interact, although their relationship is not always directly proportional.

The modern whole-joint model demonstrates that osteoarthritis involves cartilage, subchondral bone, synovium, and periarticular tissues through interconnected mechanical and biological interactions.

The Ayurvedic framework similarly allows multiple components to participate through the relationship of *Dosha*, *Dhatu*, *Srotas*, *Sandhi*, and function. This does not imply that the two models are identical; rather, they may be viewed as different explanatory frameworks for a shared clinical phenotype.

The *Vata–Dhatu Kshaya* relationship is particularly relevant in this context. In a degenerative condition, progressive tissue vulnerability may increase susceptibility to functional disturbance, while persistent functional and mechanical stress may further compromise tissue homeostasis.^[28] This creates a conceptual similarity with contemporary osteoarthritis, in which mechanical stress, inflammatory signaling, tissue remodeling, and cellular dysfunction may interact through self-reinforcing pathological processes. Recent literature similarly emphasizes the interconnected and progressive nature of these mechanisms.

16. Clinical Implications

The proposed model has several implications for Ayurvedic clinical research. First, assessment should not be limited to pain intensity alone but should include a comprehensive evaluation of stiffness, range of motion (ROM), crepitus, functional ability, muscle strength, gait, weight-bearing capacity, and quality of life. Second, future research protocols may incorporate systematic assessment of *Vata*-related clinical features and indicators of *Dhatu*-related vulnerability to better characterize the underlying pathological process. Third, therapeutic studies may investigate whether an integrated approach involving *Vata Shamana*, *Dhatu Poshan*, and *local Sandhi management* produces different clinical outcomes compared with interventions primarily directed toward symptomatic relief.

17. Research Gaps

Although published reviews have described *Janusandhigata Vata* and its management, the specific mechanistic relationship between *Vata Prakopa* and *Dhatu Kshaya* remains an area requiring greater conceptual and empirical development. Existing Ayurvedic literature already discusses classical symptoms and treatment modalities, making a simple descriptive review less novel.

Future research should therefore focus on.

1. Clinical characterization of *Vata*-dominant phenotypes.
2. Standardization of Ayurvedic assessment of *Dhatu Kshaya*.
3. Correlation of Ayurvedic findings with WOMAC, VAS and ROM.
4. Correlation with radiological severity.
5. Investigation of muscle strength and functional capacity.
6. Longitudinal evaluation of disease progression.
7. Exploration of inflammatory and metabolic markers.

8. Development of integrative models linking Ayurvedic phenotypes with contemporary OA subtypes.

18. Limitations

The following limitations should be explicitly acknowledged.

- *Janusandhigata Vata* and KOA are not identical diagnostic constructs.
- Ayurvedic concepts do not have universally accepted one-to-one biomedical equivalents.
- The proposed correlations are conceptual rather than experimentally established.
- *Dhatu Kshaya* cannot currently be reduced to a single biochemical marker.
- *Shleshaka Kapha* cannot be equated exclusively with synovial fluid.
- *Asthi Dhatu Kshaya* should not be equated with osteoporosis or isolated bone loss.
- Further clinical and experimental validation is necessary.

19. CONCLUSION

Janusandhigata Vata is a clinically important *Vata*-dominant disorder characterized by pain, swelling, movement-associated discomfort, crepitus and functional restriction. Its classical description demonstrates substantial clinical overlap with knee osteoarthritis, while its Ayurvedic pathogenesis provides a broader framework involving *Dosha*, *Dhatu*, *Guna*, *Kha-Vaigunya* and *Sthana Samshraya*.^[29]

Vata Prakopa and *Dhatu Kshaya* may be regarded as mutually interacting processes rather than isolated pathogenic events. Ageing, inadequate nourishment and excessive mechanical activity may contribute to tissue vulnerability and *Vata* aggravation. In the presence of *Kha-Vaigunya* at the *Janu Sandhi*, aggravated *Vata* may undergo *Sthana Samshraya* and produce the characteristic manifestations of *Janusandhigata Vata*.

The *Asthi-Vata* relationship provides an important conceptual basis for understanding structural vulnerability, while *Shleshaka Kapha* provides a framework for smooth and stable joint function. Contemporary whole-joint research demonstrates that cartilage, subchondral bone, synovium, menisci, ligaments and periarticular tissues interact dynamically in osteoarthritis.^[30,31]

The central model proposed in this review is.

Dhatu Kshaya → tissue vulnerability → *Vata Prakopa* → *Kha-Vaigunya* → *Sthana Samshraya* → *Janu Sandhi* dysfunction → progressive tissue impairment → further *Dhatu Kshaya*.

This *Vata-Dhatu Kshaya* interaction model provides a potentially valuable framework for future Ayurvedic research on degenerative joint disorders. Nevertheless, it should be regarded as a conceptual hypothesis rather

than a proven biomedical mechanism. Carefully designed clinical, observational and translational studies are required to determine whether these Ayurvedic constructs can be associated with reproducible contemporary clinical, imaging or biological parameters.

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