From Gut Dysfunction to Joint Degeneration Exploring the Vistabdhajirna–Sandhivata Axis Through Ayurvedic Principles and Contemporary Biomedical Science

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***Abstract*—Osteoarthritis (OA) is a multifactorial degenerative joint disorder traditionally characterized by progressive cartilage deterioration, pain, stiffness, and functional impairment. Emerging evidence has challenged the conventional wear-and-tear paradigm by highlighting the role of gastrointestinal dysfunction, gut microbial dysbiosis, metabolic inflammation, and immune dysregulation in OA pathogenesis, collectively described as the gut–joint axis. Interestingly, Ayurveda has long recognized the central role of impaired digestion (Agnimandya) in the development of systemic diseases. Vistabdhajirna, a Vata-dominant subtype of Ajirna, is characterized by abdominal distension, constipation, pain, and impaired gastrointestinal motility. Classical Ayurvedic literature suggests that chronic Vistabdhajirna may predispose individuals to Vatavyadhi, among which Sandhivata closely resembles Osteoarthritis in its clinical presentation and pathological manifestations.**

The present review explores the potential pathogenic continuum between Vistabdhajirna and Sandhivata through an integrative analysis of Ayurvedic concepts and contemporary biomedical evidence. It examines how persistent digestive dysfunction may contribute to intestinal dysbiosis, increased gut permeability, systemic low-grade inflammation, oxidative stress, and impaired nutrient assimilation, ultimately promoting cartilage degeneration and joint pathology. Furthermore, the review proposes a conceptual model linking Agnimandya, gut microbial alterations, inflammatory mediators, Asthi Dhatu Kshaya, and Vata aggravation in the development of Sandhivata.

By reinterpreting classical Ayurvedic principles through the lens of modern gut–joint axis research, this article provides a novel framework for understanding Osteoarthritis as a systemic disorder with gastrointestinal origins. The proposed Vistabdhajirna–Sandhivata axis may offer new opportunities for early diagnosis, preventive interventions, and integrative therapeutic strategies targeting both digestive and musculoskeletal health.

***Index Terms*—Agnimandya; Ayurveda; Gut Dysbiosis; Gut–Joint Axis; Inflammation; Integrative Medicine; Osteoarthritis; Sandhivata; Vistabdhajirna.**

I. INTRODUCTION

Osteoarthritis (OA) is the most prevalent chronic degenerative joint disease and a leading cause of pain, disability, and reduced quality of life worldwide. Traditionally regarded as a consequence of aging and mechanical wear of articular cartilage, OA is now increasingly recognized as a multifactorial disease involving chronic low-grade inflammation, metabolic dysfunction, oxidative stress, immune dysregulation, and alterations in gut microbial ecology.[1–4] Recent advances in microbiome research have shifted the paradigm of Osteoarthritis pathogenesis from a purely

localized degenerative process to a systemic disorder influenced by distant organ systems, particularly the gastrointestinal tract.[5]

The concept of a gut–joint axis has emerged as a novel area of investigation in musculoskeletal medicine. This model proposes that intestinal microbiota, intestinal barrier integrity, microbial metabolites, and immune responses collectively influence joint homeostasis and disease progression. [2,4,6] Dysbiosis of gut microbiota has been associated with increased intestinal permeability, systemic endotoxemia, chronic inflammation, cartilage degradation, and osteoarthritic progression.[3,7]

Interestingly, Ayurveda described a similar systemic relationship centuries ago through the concepts of Agni, Ajirna, Dosha imbalance, and Dhatu degeneration. Ayurvedic physiology identifies Agni as the fundamental regulator of digestion, metabolism, tissue nourishment, and health maintenance. Disturbance of Agni leads to Ajirna, which serves as the initiating factor for numerous pathological conditions. [8,9]

Among the various forms of Ajirna, Vistabdhajirna represents a Vata-dominant digestive disorder characterized by abdominal distension, constipation, abdominal pain, impaired flatus, generalized discomfort, and altered gastrointestinal motility.[10] Classical Ayurvedic literature indicates that prolonged persistence of Vistabdhajirna may eventually contribute to the development of Vatavyadhi.[11]

Sandhivata, one of the most clinically significant forms of Vatavyadhi, manifests through pain during joint movement, stiffness, crepitus, swelling, and restricted mobility.[12] These features closely resemble Osteoarthritis described in modern medicine. Although classical texts suggest a pathogenic relationship between chronic digestive dysfunction and joint disease, this relationship has not been adequately investigated through contemporary biomedical frameworks.

Recent discoveries regarding gut microbiota, inflammatory signalling pathways, metabolic endotoxemia, and systemic immune activation provide an unprecedented opportunity to reinterpret Ayurvedic concepts in light of modern scientific evidence. The proposed Vistabdhajirna–Sandhivata axis may therefore represent an ancient conceptual equivalent of the modern gut–joint axis.

The present review critically explores the possible mechanistic continuum linking Vistabdhajirna and Sandhivata by integrating classical Ayurvedic principles with emerging evidence from microbiome science, Osteoarthritis research, immunology, and metabolic medicine.

Conceptual Understanding of Vistabdhajirna in Ayurveda

Ayurveda places considerable emphasis on digestion and metabolism as the foundation of health. The concept of Agni extends beyond digestive activity and encompasses all transformative processes occurring within the body. Proper functioning of Agni ensures adequate digestion, nutrient assimilation, tissue formation, immune competence, and physiological balance.[8]

When Agni becomes impaired, food undergoes incomplete digestion, resulting in Ajirna. Classical texts describe several types of Ajirna depending upon the predominance of Doshas and characteristic clinical manifestations.[9]

Vistabdhajirna is a type of Ajirna predominantly caused by the aggravation of Vata Dosha. It is characterized by the retention and stagnation of improperly digested food within the gastrointestinal tract, leading to obstruction of the normal movement of Vata. Clinically, patients experience Shoola (abdominal pain) and Adhmana (abdominal distension) due to excessive gaseous accumulation. Mala Vata Apravritti, manifested as constipation and difficulty in the passage of flatus, is a hallmark feature of this condition. The disturbed Vata also produces Vividha Vata Vedana, resulting in various types of generalized bodily pain. Additionally, individuals may suffer from Angamarda (body ache) and Stambha (stiffness of the body), reflecting the systemic effects of aggravated Vata. Thus, Vistabdhajirna presents as a Vata-dominant digestive disorder marked by abdominal discomfort, impaired bowel function, and generalized musculoskeletal symptoms. These manifestations indicate disturbance of gastrointestinal motility, accumulation of gaseous products, intestinal obstruction-like symptoms, and systemic Vata aggravation.[10]

From a biomedical perspective, these symptoms resemble several functional gastrointestinal disorders characterized by altered gut motility, intestinal fermentation, dysbiosis, constipation-predominant

bowel dysfunction, and chronic low-grade inflammation. Such disorders are increasingly recognized as systemic conditions rather than isolated gastrointestinal abnormalities.

Importantly, Ayurveda does not consider Vistabdhajirna merely a digestive complaint. Rather, it is viewed as a pathological state capable of initiating systemic disease through persistent Dosha imbalance and impaired tissue nourishment.

Sandhivata and Osteoarthritis: Ayurvedic and Biomedical Perspectives

Sandhivata is described in Ayurveda as a disorder caused by the aggravation of Vata Dosha, which localizes within the joints and leads to both structural and functional derangements.[12] The condition is characterized by classical features such as Sandhishoola (joint pain), Sandhisphutana (crepitus), Vatapurna Druti Sparsha (swelling resembling an air-filled bag), pain during flexion and extension of joints, restricted movement, and stiffness. Sandhivata predominantly affects weight-bearing joints and is more frequently observed in the elderly population due to the natural predominance of Vata during old age and the progressive depletion of bodily tissues (Dhatu Kshaya).[13] These pathological changes ultimately impair joint mobility and significantly reduce quality of life.

The clinical manifestations of Sandhivata closely resemble those of Osteoarthritis, the most common degenerative joint disorder worldwide. Osteoarthritis is characterized by progressive degeneration of articular cartilage, remodelling of subchondral bone, osteophyte formation, synovial inflammation, chronic joint pain, stiffness, and functional disability. Affecting nearly 500 million individuals globally, Osteoarthritis represents one of the leading causes of disability among aging populations.[1] The striking similarity between the symptomatology of Sandhivata and Osteoarthritis has led many researchers to consider Sandhivata as the Ayurvedic correlate of Osteoarthritis.

Traditionally, Osteoarthritis was viewed primarily as a consequence of biomechanical wear and tear associated with aging and repetitive joint stress. However, contemporary scientific evidence indicates that mechanical factors alone cannot adequately explain disease initiation and progression.[4] Increasing research has highlighted the significant roles of metabolic syndrome, obesity, systemic inflammation, oxidative stress, gut microbiota dysbiosis, and immune dysregulation in the pathogenesis of Osteoarthritis. These findings have expanded the modern understanding of the disease from a purely localized joint disorder to a systemic metabolic-inflammatory condition. Interestingly, this perspective closely parallels the Ayurvedic concept that systemic metabolic disturbances and Doshic imbalance precede the manifestation of localized joint pathology, thereby providing a broader framework for understanding the development and progression of Sandhivata.

Agnimandya as a Systemic Metabolic Disorder

In Ayurveda, Agnimandya is regarded as the fundamental pathological event underlying the development of disease. The concept of Agni encompasses not only digestion but also the processes of absorption, metabolism, and transformation of nutrients into functional bodily tissues (Dhatus).[8] When Agni becomes impaired, digestion remains incomplete, resulting in inadequate nutrient assimilation and reduced tissue nourishment. Simultaneously, metabolic waste products accumulate within the body, leading to Dosha imbalance and increased susceptibility to disease. According to Ayurvedic principles, the consequences of Agnimandya extend far beyond the gastrointestinal system, as defective digestion disrupts the proper formation, transformation, and circulation of nutrients required for maintaining systemic physiological balance.

The systemic nature of Agnimandya is reflected in its impact on every Dhatu through impaired metabolic processing and tissue nutrition. Ayurveda proposes that when the digestive and metabolic fire loses its efficiency, the entire chain of nutrient transformation is affected, resulting in progressive deterioration of tissue health and function. This disturbance creates a favorable environment for the accumulation of pathological metabolites and the initiation of chronic disease processes. Consequently, Agnimandya is considered a central factor in the pathogenesis of numerous disorders, linking digestive dysfunction with widespread systemic manifestations.

Interestingly, contemporary biomedical research increasingly supports this broader interpretation of digestive impairment. Chronic digestive dysfunction

has been associated with alterations in gut microbial ecology, insulin resistance, metabolic syndrome, chronic low-grade inflammation, immune dysregulation, and oxidative stress. These interconnected mechanisms are now recognized as major contributors to the development of several chronic diseases, including Obesity, Diabetes Mellitus, Cardiovascular Disorders, Neurodegenerative Diseases, and Osteoarthritis.[1,3] From this perspective, Agnimandya may be understood as an ancient conceptual framework that remarkably parallels the modern understanding of systemic metabolic dysfunction, emphasizing the central role of impaired digestion and metabolism in the initiation and progression of chronic disease.

The Emerging Science of the Gut–Joint Axis

The gut–joint axis represents the complex bidirectional relationship between gastrointestinal physiology and musculoskeletal health, highlighting the influence of gut function on joint homeostasis and disease progression.[2,4] The human gastrointestinal tract harbours trillions of microorganisms collectively known as the gut microbiota, which play essential roles in nutrient metabolism, vitamin synthesis, immune regulation, maintenance of intestinal barrier integrity, and the production of anti-inflammatory metabolites. Under normal physiological conditions, these microbial communities contribute significantly to systemic homeostasis by regulating metabolic and immunological processes. However, disruption of the gut microbial ecosystem, commonly referred to as dysbiosis, can disturb these protective functions and initiate widespread pathological effects that extend beyond the gastrointestinal tract.[5]

Recent systematic reviews and clinical studies have demonstrated significant alterations in the gut microbiota of patients with Osteoarthritis, providing strong evidence for the involvement of the gut–joint axis in disease pathogenesis.[2,3,6] Common observations include reduced microbial diversity, altered Firmicutes-to-Bacteroidetes ratios, increased abundance of pro-inflammatory microbial species, and decreased production of beneficial microbial metabolites. These microbiome alterations have been associated with enhanced systemic inflammation, worsening osteoarthritic symptoms, greater radiological disease severity, accelerated pain progression, and elevated inflammatory biomarkers.[2,7] As a result, the gut–joint axis has emerged as one of the most promising areas of contemporary Osteoarthritis research, offering new insights into disease mechanisms and potential therapeutic strategies targeting the intestinal microbiome.

Literature Evidence Supporting the Gut–Joint Axis

Recent systematic reviews have demonstrated a strong association between gut dysbiosis and the progression of Osteoarthritis, further strengthening the concept of the gut–joint axis as a significant contributor to musculoskeletal disease.[2,6] Experimental studies have revealed that alterations in the gut microbial ecosystem can increase intestinal permeability, allowing microbial products such as Lipopolysaccharides (LPS) to enter systemic circulation. Elevated circulating LPS levels subsequently promote chronic low-grade inflammation, synovial inflammation, cartilage degradation, and osteophyte formation, all of which are characteristic features of Osteoarthritis. Animal studies have consistently shown that high-fat diets induce unfavourable microbial alterations that correlate with increased disease severity, suggesting a direct mechanistic link between metabolic disturbances, gut dysbiosis, and joint degeneration.[3] Importantly, growing evidence indicates that modulation of the gut microbiota through probiotics, prebiotics, and dietary interventions can exert beneficial effects on inflammatory biomarkers, cartilage preservation, and pain reduction in both experimental models and human studies.[3,7] These findings suggest that gastrointestinal dysfunction may not merely coexist with Osteoarthritis but may actively participate in its initiation and progression. This emerging scientific perspective bears a remarkable resemblance to the Ayurvedic concept that chronic Vistabdhajirna, through persistent impairment of digestion and aggravation of Vata Dosha, contributes to progressive tissue degeneration and ultimately culminates in the development of Sandhivata. Thus, contemporary microbiome research appears to provide a biological basis for the classical Ayurvedic understanding that chronic digestive disturbances can precede and influence the manifestation of joint disorders.

Gut Dysbiosis as a Mechanistic Bridge Between Vistabdhajirna and Sandhivata

One of the most significant developments in contemporary biomedical science has been the recognition of gut microbiota as a major regulator of systemic health. The human gastrointestinal tract harbours approximately 10^{14} microorganisms whose collective genetic material exceeds the human genome by several hundred-fold. These microorganisms contribute to nutrient metabolism, immune maturation, maintenance of intestinal barrier integrity, and production of bioactive metabolites.[14]

Under physiological conditions, the gut microbiome exists in a balanced state termed Eubiosis. However, dietary indiscretion, aging, stress, sedentary lifestyle, medication exposure, and digestive dysfunction can disrupt microbial equilibrium, resulting in dysbiosis.[15]

The symptom complex of Vistabdhajirna, including abdominal distension, constipation, impaired bowel evacuation, and abdominal discomfort, suggests a gastrointestinal environment conducive to microbial imbalance. Delayed intestinal transit and altered fermentation patterns may facilitate excessive proliferation of pathogenic bacteria while reducing beneficial microbial populations.

Several studies have demonstrated that dysbiosis is associated with increased abundance of pro-inflammatory bacterial species and depletion of short-chain fatty acid (SCFA)-producing organisms.[16] SCFAs, particularly butyrate, acetate, and propionate, play essential roles in maintaining intestinal epithelial integrity and regulating systemic immune responses.

Reduction in SCFA production may lead to disruption of epithelial tight junctions, resulting in increased intestinal permeability. This phenomenon provides a plausible mechanistic bridge connecting chronic digestive dysfunction with distant inflammatory disorders including Osteoarthritis.

Intestinal Permeability and Metabolic Endotoxemia

The intestinal barrier functions as a selective interface between luminal contents and systemic circulation. Tight junction proteins regulate the passage of nutrients while preventing entry of pathogens and toxins.[17]

In dysbiotic conditions, impairment of barrier integrity leads to increased intestinal permeability, commonly referred to as "Leaky Gut Syndrome." This permits translocation of bacterial components, particularly LPS, into systemic circulation.[18]

Circulating LPS, which originate from the outer membrane of Gram-negative bacteria, play a crucial role in mediating systemic inflammation associated with gut dysbiosis. Once translocated into the bloodstream, LPS activates toll-like receptor-4 (TLR-4) signalling pathways on immune and inflammatory cells, triggering a cascade of pro-inflammatory responses. This activation leads to increased production of several key cytokines, including tumour necrosis factor-alpha (TNF-α), interleukin-1β (IL-1β), interleukin-6 (IL-6), and interleukin-17 (IL-17). These inflammatory mediators promote chronic low-grade inflammation and contribute to tissue damage in multiple organ systems.

Growing evidence suggests that these cytokines play a central role in the pathogenesis and progression of Osteoarthritis.[19] Elevated levels of TNF-α, IL-1β, IL-6, and IL-17 stimulate cartilage degradation, enhance synovial inflammation, promote matrix metalloproteinase activity, and accelerate structural joint damage. Consequently, the activation of TLR-4 signalling by circulating LPS provides an important mechanistic link between gut dysbiosis, systemic inflammation, and osteoarthritic degeneration, further supporting the concept of the gut–joint axis in Osteoarthritis development.

The chronic low-grade inflammatory state generated by metabolic endotoxemia resembles the Ayurvedic concept of persistent Dosha aggravation arising from impaired digestion. In this context, Vistabdhajirna may represent a clinical manifestation of gastrointestinal dysfunction that predisposes individuals to systemic inflammatory responses affecting joint tissues.

Systemic Inflammation and Osteoarthritic Progression

Inflammation is now recognized as a central driver of Osteoarthritis progression rather than merely a secondary consequence of cartilage degeneration.[20] Increasing evidence suggests that inflammatory mediators originating from dysbiotic intestinal environments exert profound effects on joint tissues and contribute directly to disease progression. Pro-inflammatory cytokines stimulate the production of matrix metalloproteinases (MMPs) and aggrecanases, enzymes responsible for the degradation of the extracellular cartilage matrix.[21] These catabolic

enzymes progressively destroy type II collagen and proteoglycans, leading to structural deterioration of articular cartilage. Simultaneously, inflammatory mediators activate synovial macrophages and fibroblasts, promoting synovitis and perpetuating local inflammatory responses within the joint.[22] Persistent inflammation also alters the balance between osteoblast and osteoclast activity, resulting in abnormal subchondral bone remodeling, sclerosis, and osteophyte formation.[23] In addition, inflammatory cytokines contribute to both peripheral and central sensitization mechanisms, enhancing pain perception and reducing functional capacity.[24] Collectively, these interconnected processes culminate in the progressive joint degeneration characteristic of Osteoarthritis and closely parallel the pathological features described in Sandhivata.

Oxidative stress represents another important biological mechanism linking gastrointestinal dysfunction to joint degeneration. Chronic inflammation promotes the generation of reactive oxygen species (ROS), which induce chondrocyte apoptosis, DNA damage, lipid peroxidation, mitochondrial dysfunction, and degradation of the extracellular matrix. Excessive oxidative stress accelerates age-related cartilage degeneration and further contributes to Osteoarthritis progression.[25] From an Ayurvedic perspective, chronic digestive impairment disrupts tissue nourishment and ultimately leads to Dhatukshaya (tissue depletion). Since Asthi Dhatu is considered the principal seat of Vata, depletion of this tissue creates favorable conditions for Vata aggravation and its localization within the joints, resulting in Sandhivata.[26] Thus, the modern concept of inflammation-induced cartilage and bone degeneration may represent a biological correlate of the Ayurvedic concept of Asthi Dhatu Kshaya. Furthermore, chronic digestive dysfunction can impair the absorption and metabolism of essential nutrients required for musculoskeletal health, including calcium, magnesium, vitamins D and K, zinc, essential amino acids, and omega-3 fatty acids.[27] Deficiencies of these nutrients adversely affect cartilage repair, collagen synthesis, bone mineralization, antioxidant defenses, and immune regulation, thereby accelerating osteoarthritic changes. Ayurveda explains this phenomenon through defective Rasa Dhatu formation, which compromises the nourishment of successive Dhatus and ultimately leads to degeneration of Asthi and Majja Dhatu, further contributing to joint pathology.

The Proposed Vistabdhajirna–Sandhivata Axis

Based on classical Ayurvedic principles and contemporary biomedical evidence, a comprehensive pathogenic model describing the Vistabdhajirna–Sandhivata axis can be proposed. The process begins with Agnimandya, a state of impaired digestive and metabolic function that disrupts the proper digestion, absorption, and transformation of nutrients. Persistent dysfunction of Agni subsequently gives rise to Vistabdhajirna, a Vata-dominant digestive disorder characterized by constipation, abdominal distension, impaired gastrointestinal motility, and retention of improperly digested food. These alterations in digestive physiology create a favourable environment for the development of gut dysbiosis, leading to significant changes in microbial composition, diversity, and metabolic activity within the intestinal ecosystem.

As dysbiosis progresses, the integrity of the intestinal epithelial barrier becomes compromised, resulting in increased intestinal permeability and allowing microbial products and endotoxins to translocate into systemic circulation. This phenomenon initiates chronic low-grade systemic inflammation through activation of multiple inflammatory signaling pathways. Persistent inflammatory activity is accompanied by oxidative stress, which impairs tissue nutrition, disrupts cellular homeostasis, and accelerates degeneration of Asthi and Majja Dhatu. From an Ayurvedic perspective, this progressive Dhatukshaya weakens the structural integrity of the musculoskeletal system and creates conditions conducive to further Vata aggravation. Simultaneously, age-related degeneration and metabolic disturbances increase the vulnerability of joint tissues to inflammatory and degenerative changes.

In the later stages of this pathogenic cascade, the aggravated Vata localizes within susceptible Sandhis (joints), particularly weight-bearing joints already affected by tissue depletion and age-associated degeneration. The localization of Vata produces the characteristic manifestations of Sandhivata, including joint pain (Sandhishoola), stiffness, crepitus (Sandhisphutana), swelling, restricted movement, and progressive functional disability. Thus, the proposed

Vistabdhajirna–Sandhivata axis provides an integrative framework that links digestive dysfunction, gut dysbiosis, systemic inflammation, oxidative stress, tissue degeneration, and joint pathology. This model not only aligns closely with classical Ayurvedic concepts of disease progression but also corresponds remarkably with contemporary understanding of microbiome-mediated Osteoarthritis pathogenesis, thereby offering a unified perspective on the relationship between gastrointestinal health and musculoskeletal degeneration.

Clinical and Translational Implications

Recognition of the proposed Vistabdhajirna–Sandhivata axis carries important clinical and translational implications for the prevention and management of Osteoarthritis. Contemporary Osteoarthritis treatment largely focuses on symptomatic relief through analgesics, anti-inflammatory medications, physiotherapy, and, in advanced cases, joint replacement surgery.[28] While these approaches may alleviate pain and improve function, they often do not address the underlying mechanisms contributing to disease initiation and progression. If chronic gastrointestinal dysfunction, gut dysbiosis, and systemic inflammation play a significant role in Osteoarthritis pathogenesis, therapeutic strategies should extend beyond local joint management and target the upstream metabolic and digestive disturbances that may drive disease development.

From an Ayurvedic perspective, restoration of Agni through Deepana and Pachana therapies may represent an important upstream intervention capable of modifying disease progression by improving digestion, metabolism, and nutrient assimilation. Similarly, personalized dietary modifications aimed at enhancing digestive efficiency and promoting a healthy gut microbiome may help reduce systemic inflammatory burden. Emerging microbiome-based approaches, including probiotics, prebiotics, synbiotics, and postbiotics, also warrant investigation as potential adjunctive therapies in the management of Sandhivata. Furthermore, lifestyle interventions such as regular physical activity, adequate sleep, stress management, and maintenance of circadian rhythm may positively influence both gastrointestinal and musculoskeletal health by modulating inflammatory and metabolic pathways.

An integrative therapeutic approach combining modern medical management with Ayurvedic principles may therefore offer a more comprehensive strategy for Osteoarthritis care. Ayurvedic interventions possessing Deepana, Pachana, Vatahara, and Rasayana properties may provide dual benefits through simultaneous modulation of digestive function, microbial balance, systemic inflammation, and musculoskeletal health. Such an approach aligns with the emerging understanding of the gut–joint axis and offers a promising framework for future translational research aimed at developing holistic and disease-modifying strategies for Sandhivata and Osteoarthritis.

II. LIMITATIONS OF THE PROPOSED MODEL

The present review proposes a conceptual framework linking Vistabdhajirna and Sandhivata through mechanisms analogous to the gut–joint axis. However, direct clinical evidence establishing this relationship remains limited. Most available evidence originates from microbiome research, inflammatory studies, and experimental models of Osteoarthritis rather than investigations specifically evaluating Vistabdhajirna. Furthermore, objective biomarkers for Agni and Ajirna are yet to be standardized. Therefore, the proposed model should be interpreted as a hypothesis-generating framework requiring validation through longitudinal clinical studies, microbiome analyses, and translational research integrating Ayurvedic and biomedical parameters.

III. FUTURE RESEARCH DIRECTIONS

Despite increasing evidence supporting the gut–joint axis, several important questions remain unanswered. Future investigations should focus on:

- Characterization of gut microbiota profiles in patients with Sandhivata.
- Development of objective biomarkers correlating Agni status with microbial alterations.
- Longitudinal studies evaluating progression from chronic digestive dysfunction to Osteoarthritis.
- Metabolomic assessment of microbial-derived inflammatory mediators.
- Randomized controlled trials evaluating Deepana-Pachana therapies in Osteoarthritis.

- Integration of microbiome, radiological, biochemical, and Ayurvedic assessment parameters.
- Systems biology approaches exploring the molecular basis of Ayurvedic pathogenesis models.

Such studies may provide robust evidence supporting the clinical relevance of the proposed Vistabdhajirna–Sandhivata axis.

IV. CONCLUSION

The emerging concept of the gut–joint axis provides a valuable scientific framework for re-examining classical Ayurvedic descriptions of disease pathogenesis. The proposed Vistabdhajirna–Sandhivata axis suggests that chronic digestive dysfunction, mediated through gut microbial alterations, intestinal barrier impairment, systemic inflammation, and progressive tissue degeneration, may contribute to the development and progression of Osteoarthritis. While direct evidence remains limited, substantial conceptual convergence exists between Ayurvedic theories of Agnimandya, Vata aggravation, and Dhatu Kshaya and contemporary understanding of microbiome-mediated Osteoarthritis. Future interdisciplinary investigations integrating Ayurvedic diagnostics with microbiome science, metabolomics, inflammatory biomarkers, and radiological assessments are warranted to validate this hypothesis and identify novel preventive and therapeutic strategies for Osteoarthritis.

V. AUTHOR CONTRIBUTIONS

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All authors have read and approved the final manuscript.

VI. FUNDING

No external funding was received for the preparation of this manuscript.

VII. INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable. This article is a narrative review and does not involve human participants, animals, or identifiable personal data.

VIII. INFORMED CONSENT STATEMENT

Not applicable.

IX. DATA AVAILABILITY STATEMENT

No new datasets were generated during the current study. All information discussed in this review was obtained from previously published literature.

X. CONFLICT OF INTERESTS

The authors declare no conflict of interest.

ACKNOWLEDGMENTS

The authors acknowledge the contributions of classical Ayurvedic scholars and contemporary researchers whose work has facilitated the integration of traditional medical knowledge with modern biomedical science.

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