WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 22, 705-722. Research Article ISSN 2277–7105

# A COMPARATIVE CLINICAL STUDY TO EVALUATE THE ROLE OF VIDDHA AGNIKARMA AND JALAUKAAVACHARAN IN JANUSANDHIGATA VATA

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Article Received on 17 Oct. 2026,
Article Revised on 07 Nov. 2026,
Article Published on 16 Nov. 2026

https://doi.org/10.5281/zenodo.24277114

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**How to cite this Article:** Batra Khushbu[1]*, Dwivedi Amarprakash[2]. (2026). A Comparative Clinical Study To Evaluate The Role of Viddha Agnikarma and Jalaukaavacharan In Janusandhigata Vata. World Journal of Pharmaceutical Research, 15(22), 705–722.

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## ABSTRACT

**Introduction:** Janusandhigata Vata is a degenerative joint disorder described in Ayurveda, clinically comparable to knee osteoarthritis. Viddha Agnikarmaand Jalaukaavacharanare established Ayurvedic para-surgical procedures used in the management of painful musculoskeletal conditions. However, comparative clinical evidence regarding their efficacy in Janusandhigata Vata is limited. The present study was undertaken to evaluate and compare the clinical effects of Viddha Agnikarma and Jalaukaavacharan ~Leech Therapy in patients with Janusandhigata Vata. **Methodology:** An open comparative clinical study was conducted in the Department of Shalyatantra, D.Y. Patil Ayurvedic Hospital, Navi Mumbai. Sixty patients aged 40–60 years diagnosed with Janusandhigata Vata were randomly allocated into two groups of 30 each. Group A received Viddha Agnikarmaand Group B received Jalaukaavacharan on Days 0, 15 and 30, with follow-up until Day 45. Clinical outcomes were assessed using pain, tenderness, knee flexion, extension, swelling and crepitations at baseline, immediately after treatment and scheduled follow-up visits. Within-group changes were analysed using Friedman and Wilcoxon signed-rank tests, and intergroup differences using the Mann–Whitney U test. **Results:** Both groups showed highly significant improvement in

pain, tenderness, flexion and extension over time ($p<0.001$). Viddha Agnikarma produced significantly greater immediate median reductions in pain (2.0 vs. 0.0, $p<0.001$) and tenderness (1.0 vs. 0.0, $p<0.001$). Jalaukaavacharandemonstrated progressive improvement during follow-up, particularly in swelling and crepitations. At Day 45, no significant intergroup differences were observed for pain, tenderness, flexion, extension or swelling ($p>0.05$). A significant difference was observed for crepitations ($U=650.00$, $Z=3.38$, $p<0.001$), although the median score was 1.0 in both groups. **Conclusion:** Both interventions produced significant clinical improvement. Viddha Agnikarmademonstrated a comparatively rapid response in pain and tenderness, whereas Jalaukaavacharanshowed progressive improvement during follow-up. Their principal difference was the pattern of response rather than the final outcome for most parameters.

**KEYWORDS:** Janusandhigata Vata; Knee Osteoarthritis; Viddha-Agnikarma; Jalauka-Avacharan; Raktamokshana; Agnikarma; Ayurvedic Pain Management.

## INTRODUCTION

Vata is considered the most important among the three Doshas and is responsible for various movements and functions of the body.[1] In later life, Vata Dosha naturally becomes predominant, while progressive depletion of the Dhatus, particularly Asthi Dhatu, contributes to degenerative musculoskeletal disorders.[2,3] One such disorder is Sandhigata Vata ~osteoarthritis ,described under Vatavyadhi, where in aggravated Vata localizes in the joints and produces pain, swelling and painful restriction of flexion and extension.[4] When these manifestations involve the knee joint, the condition is clinically considered as Janusandhigata Vata. The clinical features of Janusandhigata Vata show considerable similarity with knee osteoarthritis, a chronic degenerative disorder of the knee joint characterized by pain, stiffness, swelling, crepitus and restriction of movements.[5]

Knee osteoarthritis is a common degenerative joint disorder and an important cause of chronic pain, physical disability and reduced quality of life. Its prevalence increases with age and is influenced by factors such as ageing, obesity, sedentary lifestyle, occupational stress and increased life expectancy.[10] Patients commonly experience knee pain, tenderness, swelling, stiffness, crepitus and restricted movements, which may interfere with walking, climbing stairs, squatting and sitting cross-legged. Although various conservative and surgical treatment options are available, the chronic nature of the condition and limitations associated with prolonged medication use and invasive procedures create a need for safe,

effective, economical and minimally invasive treatment approaches.

Ayurveda describes various treatment modalities for the management of Janusandhigata Vata, including Snehana (~Oleation), Swedana (~Fomentation), Basti (~Medicated Enema), Upanaha (~Poultice), Agnikarma (~Thermal Cauterization) and Raktamokshana (~Blood Letting)[6] Among the para-surgical procedures, Agnikarma is described by Acharya Sushruta for painful conditions involving Sandhi and Asthi.[7,8] Viddha Agnikarma is a precise novel cautery technique using a heated needle tip to deliver targeted thermal stimulation to modulate pain, improve microcirculation and restore musculoskeletal function**.** Raktamokshana is another important para-surgical procedure, among which Jalaukaavacharanis considered a gentle method of bloodletting using medicinal leeches.[9] Both procedures are minimally invasive and have been used in the management of painful musculoskeletal conditions. Viddha Agnikarmaand Jalaukaavacharanare established Ayurvedic para-surgical procedures; however, comparative clinical evidence regarding their efficacy in Janusandhigata Vata is limited. Therefore, the present study was undertaken to evaluate and compare the clinical efficacy of Viddha Agnikarmaand Jalaukaavacharanin Janusandhigata Vata.

**Study Design**

An open comparative clinical study was conducted in the Department of Shalyatantra, D.Y. Patil Ayurvedic Hospital, Navi Mumbai. A total of 60 patients diagnosed with Janusandhigata Vata and fulfilling the selection criteria were enrolled and randomly divided into two groups of 30 patients each. Group A received Viddha-Agnikarma, whereas Group B received Raktamokshana by Jalauka-Avacharan. Both interventions were administered in three sittings on Days 0, 15 and 30, with clinical follow-up continued until Day 45. Ethical clearance was obtained from the Institutional Ethical Committee of D.Y. Patil Deemed to be University School of Ayurveda (IEC No. DYPUSA/24/454), and the study was registered with the Clinical Trials Registry–India (CTRI/2025/01/079367). Written informed consent was obtained from all participants.

**Inclusion Criteria**

Patients of either sex, aged 40–60 years, who were clinically diagnosed with Janusandhigata Vata and showed degenerative changes in the knee joint on X-ray examination were included in the study. Patients who were not receiving any other treatment for osteoarthritis were also eligible for inclusion.

**Exclusion Criteria**

Patients with a history of significant knee trauma, systemic or debilitating illness, osteomyelitis, pyogenic, tuberculous, hemophilic, neuropathic or inflammatory arthritis, osteochondritis dissecans, intra-articular loose bodies, meniscal tears or cysts, knee deformities such as genu varum or genu valgum, prepatellar bursitis or popliteal swelling, bone tumours, syphilitic arthritis, gout or other crystal-induced arthropathies were excluded. Pregnant women and patients with severe anaemia, coagulation disorders or paralysis were also excluded.

**Investigations**

Essential investigations included complete blood count with erythrocyte sedimentation rate, bleeding time, clotting time, random blood sugar, HIV, HBsAg and HCV. X-ray of the knee joint in anteroposterior and lateral views was performed to assess degenerative changes. Serum uric acid, C-reactive protein, rheumatoid factor and renal function tests were included as desirable investigations.

**Procedure**

**Group A – Viddha Agnikarma**[12,13]



**Fig. 1: Viddha Agnikarma.**

**Purva Karma:** The procedure was explained to the patient and written informed consent was obtained. The patient was positioned with the knee in flexion, and the most tender points over the affected knee were identified by palpation and marked. The treatment area was then cleansed with normal saline.

**Pradhana Karma:** Six sterile hypodermic needles of 26-gauge and ½-inch size were heated until red hot using a spirit lamp. The needles were inserted sequentially at the marked tender points, approximately 1 cm apart and to a depth of about 5 mm. The needles were retained for approximately five minutes and then removed.

**Pashchat Karma:** Yashtimadhu Ghrita was applied over the treated sites using sterile gauze.

**Group B – Jalauka-Avacharan**[14]



**Fig 2-Jalaukaavacharana.**

**Purva Karma:** The procedure was explained to the patient and written informed consent was obtained. The patient was positioned with the knee in flexion, and the most tender points were identified and marked. The selected area was cleansed with normal saline. Healthy and active leeches were selected and purified by keeping them in water containing a small quantity of turmeric powder, followed by transfer to fresh water.

**Pradhana Karma:** Two to three purified, active leeches were applied over the marked tender points and allowed to suck blood naturally under observation. The leeches were allowed to detach spontaneously, generally after approximately 30–40 minutes.

**Pashchat Karma:** The treated area was cleaned with normal saline, turmeric powder was applied over the bleeding sites, and sterile pressure bandaging was performed.

**Follow-up**

Patients in both groups were followed prospectively to evaluate the immediate and sustained effects of the interventions. Clinical assessments were performed at baseline (before treatment), immediately after the intervention (Day 0), and subsequently on Days 1, 2, 3, 8, 15, 23, 30, and 45. The predefined clinical parameters were assessed at each scheduled follow-up visit, wherever applicable.

**Assessment Parameters**

The clinical efficacy of both interventions was assessed using predefined subjective and objective parameters. Pain was assessed using the Visual Analogue Scale (VAS), while tenderness, swelling, knee joint flexion, extension, and crepitations were assessed using

standardized grading criteria adopted for the study.

**Table 01: Assessment criteria used for evaluation of clinical parameters.**

| Parameter | Score | Assessment criteria |
|---|---|---|
| **Pain (VAS)** | 0 | No pain |
| | 1–3 | Mild pain |
| | 4–7 | Moderate pain |
| | 8–10 | Severe pain |
| **Tenderness** | 0 | No tenderness |
| | 1 | Mildly painful on pressure, but bearable |
| | 2 | Moderately painful on pressure, bearable |
| | 3 | Severe pain on touch, unbearable |
| **Flexion** | 0 | Complete movement without pain |
| | 1 | Mild pain with complete movement; can walk without support |
| | 2 | Painful incomplete movement; can walk without support |
| | 3 | Painful restricted movement; unable to walk |
| **Extension** | 0 | Complete movement without pain |
| | 1 | Mild pain with complete movement; can walk without support |
| | 2 | Painful incomplete movement; can walk without support |
| | 3 | Painful restricted movement; unable to walk |
| **Crepitations** | 0 | No crepitus palpable or audible |
| | 1 | Crepitus palpable but not audible |
| | 2 | Soft audible and palpable crepitus |
| | 3 | Louder grating or snapping sound |
| **Swelling** | 0 | No swelling- The knee joint appears normal with no visible swelling or signs of fluid accumulation |
| | 1 | Mild swelling- Slight swelling that may be noticeable but does not cause significant changes in joint contour; the swelling may not be palpable |
| | 2 | Moderate swelling- Noticeable swelling that is palpable; the joint may feel tense, and the contour of the knee is visibly altered. The swelling may be present on one side of the knee or throughout |
| | 3 | Severe swelling- Marked swelling with significant joint distension; the knee is very tense and may have a boggy feel upon palpation |

**Assessment of Results**

The assessment of treatment outcomes was performed by comparing the clinical status of patients before and after treatment based on the predefined grading criteria for the subjective and objective parameters. Symptomatic improvement was considered the principal indicator of therapeutic response. The immediate response to treatment was assessed by comparing the clinical status before treatment (BT) with that observed immediately after treatment (AT/Day 0). The overall therapeutic outcome was evaluated through the changes observed in the assessed clinical parameters during the predefined treatment and follow-up period.

## OBSERVATION AND RESULTS

The study included 60 patients diagnosed with Janusandhigata Vata, with 30 patients each allocated to Group A (Viddha-Agnikarma) and Group B (Jalaukaavacharan). The majority of patients (46.66%) belonged to the 51–60 years age group, followed by 31.67% in the 41–50 years group. Females constituted the majority of the study population (66.67%), while males accounted for 33.33%. With regard to occupation, housewives formed the largest group (40%), followed by patients engaged in private/skilled occupations (28.30%). Most patients belonged to the lower socioeconomic group (55%), followed by the middle socioeconomic group (41.66%). Regarding Ayurvedic characteristics, Manda Agni was observed in 45% of patients, while 65% had Madhyama Koshtha. A mixed diet was predominant, being reported in 66.67% of the participants. These demographic and baseline characteristics provided the background for evaluating the clinical response to the two interventions.

### Clinical observation

Clinical efficacy was assessed using six parameters: pain, tenderness, flexion, extension, swelling and crepitations. Assessments were performed before treatment (BT), immediately after treatment (AT/Day 0), and during follow-up on Days 1, 2, 3, 8, 15, 23, 30 and 45. The Friedman test was used to assess overall changes across repeated observations, while the Wilcoxon signed-rank test was used for comparison with baseline. Between-group comparisons were performed using the Mann–Whitney U test.

### Effect on Pain

Both groups showed a highly significant change in pain scores across the assessment period. Group A demonstrated a highly significant overall change ($\chi^2$=197.66, df=9, $p<0.001$), with a marked reduction immediately after Viddha Agnikarmaand continued improvement during follow-up. Group B also showed a highly significant overall change ($\chi^2$=258.93, df=9, $p<0.001$), with improvement becoming more evident progressively during follow-up. In Group A, the median pain score decreased from 6.0 at baseline to 2.5 at Day 45, while in Group B it decreased from 8.0 to 2.0. The final intergroup difference was not statistically significant (p=0.2335).

### Effect on Tenderness

Tenderness showed a highly significant overall improvement in both groups. Group A demonstrated a significant change across the assessment period ($\chi^2$=165.96, df=9, $p<0.001$), with significant reduction from baseline at the reported follow-up assessments. Group B also

showed a highly significant overall change ($\chi^2$=233.73, df=9, p<0.001), with significant improvement becoming evident from Day 3 onwards. The median tenderness score decreased from 2.0 at baseline to 0.0 at Day 45 in both groups. The final intergroup difference was not statistically significant (p=0.8037).

**Effect on Flexion**

A highly significant improvement in flexion was observed in both groups. Group A showed a significant overall change ($\chi^2$=131.97, df=9, p<0.001), with improvement evident from the immediate post-treatment assessment. Group B also demonstrated a highly significant overall change ($\chi^2$=218.10, df=9, p<0.001), with improvement developing progressively during follow-up. The median flexion score decreased from 1.0 at baseline to 0.0 at Day 45 in both groups. The final intergroup difference was not statistically significant (p=0.2013).

**Effect on Extension**

Both groups demonstrated highly significant improvement in extension. Group A showed a significant overall change ($\chi^2$=124.66, df=9, p<0.001), with improvement observed from the immediate post-treatment assessment. Group B also showed a highly significant overall change ($\chi^2$=208.09, df=9, p<0.001), with improvement becoming progressively evident during follow-up. The median extension score decreased from 1.0 at baseline to 0.0 at Day 45 in both groups. The final intergroup difference was not statistically significant (p=0.6304).

**Effect on Crepitations**

Crepitations showed a different pattern of response between the two groups. Group A did not demonstrate a statistically significant change over the assessment period ($\chi^2$=9.00, df=9, p=0.4373). In contrast, Group B showed a highly significant overall change ($\chi^2$=83.92, df=9, p<0.001), with significant improvement observed during the later follow-up assessments. The final intergroup comparison showed a statistically significant difference between the groups (U=650.00, Z=3.38, p<0.001). However, the median score at Day 45 remained 1.0 in both groups, indicating that the significant intergroup finding reflected differences in the distribution of scores rather than a difference in the final median.

**Effect on Swelling**

Swelling was absent throughout the observation period in Group A; therefore, statistical testing for within-group change was not applicable because there was no variation in the scores. Group B demonstrated a highly significant overall change in swelling scores

($\chi^2$=70.10, df=9, p<0.001), with significant improvement observed during follow-up. At Day 45, the median swelling score was 0.0 in both groups, and the final intergroup difference was not statistically significant (p=0.3070).

**Table 02: Intergroup Comparison of Clinical Parameters at Day 45.**

| Clinical Parameter | Group A: Median at Day 45 | Group B: Median at Day 45 | Mann–Whitney U | Z | p-value | Significance |
|---|---|---|---|---|---|---|
| Pain | 2.5 | 2.0 | 527.50 | 1.19 | 0.2335 | NS |
| Tenderness | 0.0 | 0.0 | 464.50 | 0.25 | 0.8037 | NS |
| Flexion | 0.0 | 0.0 | 522.50 | 1.28 | 0.2013 | NS |
| Extension | 0.0 | 0.0 | 475.50 | 0.48 | 0.6304 | NS |
| Crepitations | 1.0 | 1.0 | 650.00 | 3.38 | <0.001 | Significant |
| Swelling | 0.0 | 0.0 | 500.00 | 1.02 | 0.3070 | NS |

*NS: Not significant.*

**Immediate Treatment Response**

To specifically evaluate the rapid effect of the interventions, the change from **Before Treatment (BT) to immediately After Treatment (AT/Day 0)** was compared between groups.

**Table 03: Intergroup comparison of immediate treatment response.**

| Parameter | Group A: Median Reduction | Group B: Median Reduction | Statistical significance |
|---|---|---|---|
| Pain | **2.0** | 0.0 | **p < 0.001** |
| Tenderness | **1.0** | 0.0 | **p < 0.001** |
| Flexion | 1.0 | 0.0 | p > 0.05 |
| Extension | 1.0 | 0.0 | p > 0.05 |
| Crepitations | 0.0 | 0.0 | No change |
| Swelling | 0.0 | 0.0 | No change |

The immediate response was significantly greater with Viddha Agnikarmafor pain and tenderness, with median reductions of 2.0 and 1.0 respectively, compared with no immediate median reduction in Group B. No significant immediate intergroup difference was observed for flexion or extension, while neither treatment produced an immediate change in swelling or crepitations.

**Overall Therapeutic Outcome**

The overall therapeutic outcome was determined from the pattern of changes observed across the treatment and follow-up period. Within each group, the Friedman test demonstrated

statistically significant changes over time for pain, tenderness, flexion and extension ($p<0.001$ in both groups), while significant improvement was also observed for crepitations and swelling in Group B ($p<0.001$). The Wilcoxon signed-rank analysis further confirmed significant reductions from baseline at the reported follow-up assessments, with Group A generally demonstrating an earlier response, particularly for pain and tenderness, whereas Group B showed progressive improvement during subsequent follow-up. At Day 45, the Mann–Whitney U test showed no statistically significant intergroup difference for pain ($p=0.2335$), tenderness ($p=0.8037$), flexion ($p=0.2013$), extension ($p=0.6304$) or swelling ($p=0.3070$). A statistically significant intergroup difference was observed for crepitations ($U=650.00$, $Z=3.38$, $p<0.001$), although the median crepitation score at Day 45 was 1.0 in both groups. Overall, the findings indicate that both Viddha Agnikarmaand Jalaukaavacharanwere associated with improvement in the assessed clinical parameters, with the principal difference being the timing and pattern of response rather than a statistically significant difference in the final outcome for most parameters.

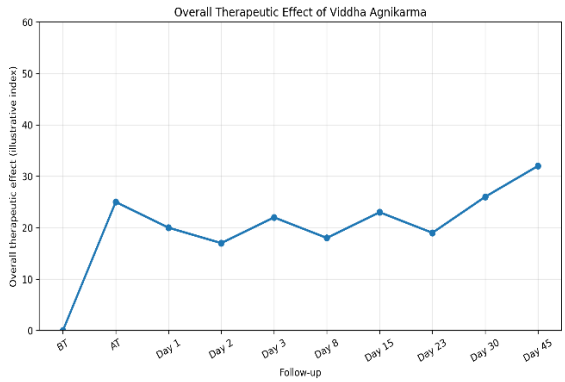



**Fig. 3: Effect of Viddha Agnikarma.**

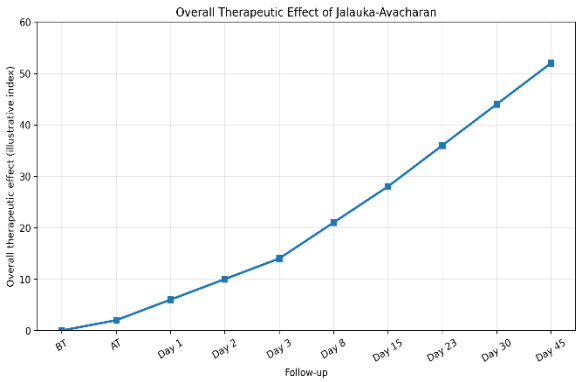



**Fig. 4: Effect of Jalaukaavacharana.**

## RESULTS

The study included 60 patients with Janusandhigata Vata, with 30 patients each in Group A (Viddha-Agnikarma) and Group B (Jalauka-Avacharan). Both groups demonstrated significant improvement in the major clinical parameters during the treatment and follow-up period. Pain, tenderness, flexion and extension showed highly significant improvement over time in both groups ($p<0.001$). The clinical response demonstrated two distinct patterns. Viddha Agnikarmaproduced a rapid symptomatic response, particularly for pain and tenderness, with a marked reduction immediately after treatment, although some fluctuation in symptoms was observed during subsequent assessments. In contrast, Jalaukaavacharanshowed a gradual and progressive response, with continued improvement

during follow-up and a comparatively favourable response in swelling and crepitations. At Day 45, no statistically significant intergroup difference was observed for pain, tenderness, flexion, extension or swelling. A statistically significant intergroup difference was observed for crepitations ($U=650.00$, $Z=3.38$, $p<0.001$); however, the median crepitation score at Day 45 was 1.0 in both groups. Overall, both interventions demonstrated improvement in the assessed clinical parameters, with the principal difference being the timing and pattern of clinical response rather than a statistically significant difference in the final outcome for most parameters.

## DISCUSSION

In this clinical study, the role of Viddha Agnikarmaand Jalaukaavacharanin the management of Janusandhigata Vata was evaluated in 60 patients who were randomly allocated into two groups. Group A received Viddha-Agnikarma, while Group B received Jalauka-Avacharan. The present study demonstrated that both interventions produced significant improvement in the majority of clinical parameters assessed in patients with Janusandhigata Vata. However, the two interventions showed a different pattern of response. Viddha Agnikarmaproduced a more rapid symptomatic response, particularly in pain and tenderness, with significant immediate relief following treatment. This finding may be attributed to the combined mechanical and thermal stimulation produced by the procedure, which may influence local circulation and pain modulation.[15-18]

The mechanical component of Viddha Agnikarmainvolves controlled puncturing at the affected site, which may produce localized sensory stimulation and improve local microcirculation. The thermal component may further enhance local vascularity and produce neuromodulatory effects. These mechanisms may explain the rapid reduction in pain and tenderness observed immediately after treatment.[15-19] The present findings are also consistent with previous clinical observations reporting beneficial effects of Viddha Agnikarmain painful musculoskeletal conditions.[20-22]

Jalaukaavacharandemonstrated a comparatively gradual pattern of improvement, with benefits continuing during the follow-up period. Controlled Raktamokshana may reduce local vascular congestion, while the bioactive constituents of leech saliva have anticoagulant, thrombolytic, vasodilatory, anti-inflammatory and analgesic properties. These effects may collectively contribute to improvement in pain, swelling and local tissue congestion.[23-25] Previous clinical studies and reviews have also reported improvement in pain and functional

parameters following leech therapy in knee osteoarthritis.[24,25]

Both groups showed highly significant improvement in knee flexion and extension, while no significant final intergroup difference was observed for these parameters. Improvement in joint movement may be related to reduction in pain, tenderness and local tissue restriction, thereby allowing greater ease of movement. Thus, both procedures appeared to provide comparable functional benefit despite differences in the timing of symptomatic relief.

Swelling showed minimal change in the Viddha Agnikarmagroup, whereas Jalaukaavacharandemonstrated a gradual reduction during follow-up. Although this represented a favourable clinical trend for Jalauka-Avacharan, the final intergroup difference was not statistically significant. Similarly, crepitations showed limited change with Viddha Agnikarmaand a more favourable response with Jalauka-Avacharan. Since crepitations may be associated with structural changes within the joint, their response to short-term intervention should be interpreted cautiously.

The overall findings suggest that the two procedures may act through different therapeutic pathways while producing comparable clinical outcomes. Viddha Agnikarmaappears to provide relatively rapid symptomatic relief, particularly in pain and tenderness, whereas Jalaukaavacharandemonstrates a more progressive response, particularly in inflammatory manifestations such as swelling. Therefore, neither procedure can be considered universally superior on the basis of the present findings. The choice of intervention may instead be individualized according to the predominant clinical presentation and therapeutic requirement.

**Probable Mode of Action of Viddha-Agnikarma**

**Controlled mechanical puncture + localized thermal stimulation**

**Mechanical Effect:** Controlled mechanical puncturing during Viddha Agnikarmaproduces localized micro-trauma, which may provide sensory stimulation and improve local microcirculation. This may help reduce tissue tension and Srotorodha, thereby contributing to reduction in stiffness and improvement in joint mobility.[26]

**Thermal Effect and Vasodilation**: The localized heat produced during Agnikarma may induce vasodilation and increase local blood flow, thereby improving the supply of oxygen and nutrients to the treated area. Increased circulation may facilitate the removal of

inflammatory and metabolic products and enhance lymphatic drainage, which may contribute to reduction in pain, tenderness and swelling.[27]

**Neurophysiological Effect:** The combined mechanical and thermal stimulation may activate and modulate sensory afferent pathways, resulting in inhibition of nociceptive transmission through gate-control mechanisms and activation of descending inhibitory pathways. A possible contribution from endogenous opioid release may further enhance analgesia, which may explain the rapid reduction in pain observed following treatment.[28]

**Anti-inflammatory Effect**: Increased local circulation following Viddha Agnikarmamay facilitate the removal or reduction of pain-producing inflammatory mediators and decrease nociceptor sensitization and local oedema. These effects may contribute to reduction in pain, tenderness and swelling.[29,30]

**Muscle Relaxation and Joint Biomechanics:** The thermal effect of Agnikarma may reduce periarticular muscle spasm and increase the elasticity of connective tissues. This may decrease joint stiffness and facilitate improvement in the range of motion, particularly knee flexion and extension.[29,30]

**Tissue Metabolism and Repair:** Localized thermal stimulation may increase cellular metabolism and support tissue repair and collagen remodelling. These effects may provide a supportive role in the recovery and maintenance of periarticular tissues.[27,32]

**Possible Piezoelectric Effect:** Mechanical stimulation may produce bioelectric changes within the bone and collagen matrix, suggesting a possible piezoelectric effect. Such bioelectric changes may influence osteoblastic activity and bone remodelling, thereby potentially contributing to tissue adaptation and maintenance of joint integrity.[27]

**Ayurvedic Perspective:** From an Ayurvedic perspective, the Ushna, Tikshna and Sukshma properties associated with Agnikarma may facilitate Srotoshodhana and exert Vata-Kapha Shamaka action. This may help reduce Shoola and Stambha and improve the functional status of the Sandhi.[27,31,33]

Collectively, these mechanisms may contribute to reduction in pain, tenderness, stiffness and swelling, along with improvement in knee flexion, extension and overall joint function in Janusandhigata Vata.

**Probable Mode of Action of Jalauka-Avacharan Controlled Raktamokshana + Bioactive constituents of leech saliva**

**Raktamokshana Effect:** Removal of a small quantity of blood during Raktamokshana may reduce local vascular congestion and tissue pressure while improving local circulation. These effects may contribute to reduction in pain, tenderness and swelling.[34,14]

**Anticoagulant and Thrombolytic Action:** The saliva of leeches contains several bioactive substances that may influence coagulation and microcirculation. Hirudin inhibits thrombin and produces an anticoagulant effect, while Calin inhibits platelet aggregation and may prolong local bleeding. Destabilase possesses fibrinolytic activity and may help reduce microvascular stagnation. Collectively, these effects may improve local microcirculation and tissue perfusion, thereby reducing congestion and improving tissue oxygenation.[35]

**Vasodilatory Action:** Bioactive salivary constituents, including acetylcholine, histamine-like substances and carboxypeptidase A inhibitors, may promote vasodilation and increase local blood supply. Improved tissue perfusion may contribute to reduction in pain and swelling and support the local tissue environment.[34]

**Anti-inflammatory Action**: Salivary constituents such as bdellins, eglins and hirustasin may inhibit inflammatory proteases and thereby reduce inflammatory activity. This anti-inflammatory effect may contribute to reduction in pain, tenderness and swelling at the affected site.[35]

**Enhanced Tissue Penetration:** Hyaluronidase present in leech saliva may increase tissue permeability and facilitate the penetration of other bioactive salivary substances into the local tissues. This may enhance their local therapeutic effects.[35]

**Neurophysiological Analgesia:** Attachment of the leech to the skin produces sensory stimulation, which may contribute to modulation of pain perception through possible gate-control mechanisms. In addition, reduction in inflammatory mediator activity and peripheral nociceptor stimulation may further contribute to analgesia and reduction in pain perception.[36]

**Anti-oedematous Effect:** Continued oozing of blood from the bite site after detachment of the leech may facilitate local venous and lymphatic drainage, thereby reducing periarticular oedema and tissue pressure. This may contribute to reduction in swelling and improvement in

joint mobility.[37]

**Improvement of Local Joint Environment:** The combined anticoagulant, anti-inflammatory, vasodilatory, thrombolytic and anti-oedematous effects of Jalaukaavacharanmay improve local tissue perfusion and create a supportive environment for tissue recovery. These effects may consequently contribute to improvement in joint function.[14,38]

**Ayurvedic Perspective:** From an Ayurvedic perspective, Raktamokshana may facilitate Rakta-Shodhana through the removal of Dushta Rakta. This may help reduce Shoola, Shotha, Sparsha-Asahyata and Stambha, thereby reducing Vata-related pain and restriction of movement.[14]

Collectively, these effects may contribute to reduction in pain, tenderness, swelling and stiffness, along with improvement in knee flexion, extension and overall joint function, resulting in clinical improvement in Janusandhigata Vata.

## CONCLUSION

The present clinical study demonstrates that both Viddha Agnikarma and Jalaukaavacharanproduced significant clinical improvement in patients with Janusandhigata Vata. Viddha Agnikarma provided a rapid reduction in pain and tenderness, particularly evident immediately after treatment, whereas Jalaukaavacharan showed a gradual and sustained improvement during follow-up, with a comparatively favourable response in swelling and crepitations. Although no statistically significant overall difference was observed between the two interventions for most clinical parameters at the final assessment, their different patterns of response suggest that Viddha Agnikarma may be considered particularly useful when pain and tenderness are the predominant clinical features, whereas Jalaukaavacharan may be considered when inflammatory manifestations such as swelling and local tissue congestion are more prominent. Thus, the selection of the procedure may be guided by the predominant clinical presentation and the desired therapeutic response. The proposed mechanisms, including neurophysiological modulation, local vascular effects and possible mechanotransduction, remain probable and warrant further experimental investigation.

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