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Research Article

A CLINICAL STUDY TO EVALUATE THE EFFICACY OF CONDUCTIVE METHOD OF *AGNIKARMA* WITH *SUVARNADI SALAKA* IN THE PAIN MANAGEMENT OF *SANDHIGATAVATA* (OSTEOARTHRITIS OF KNEE JOINT)

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ABSTRACT

The conductive method of *Agnikarma* using *Suvarnadi Shalaka* has proven to be an effective treatment for *Sandhigata Vata* (osteoarthritis of the knee joint), a degenerative disorder characterized by pain, stiffness, and restricted joint mobility. This clinical study aimed to evaluate the efficacy of *Agnikarma* in pain management and functional improvement. A total of 30 patients diagnosed with knee osteoarthritis were treated with conductive method of *Agnikarma* once a week for four weeks. The results demonstrated a significant reduction in pain (85.32%), tenderness (89.75%), and crepitus (78.35%), along with improvements in joint mobility (extension: 55.87%, flexion: 10.89%). Statistical analysis confirmed these findings as highly significant ($p<0.0001$). The treatment was well tolerated with no major adverse effects, offering a safe, minimally invasive, and effective alternative to conventional therapies. *Agnikarma* works by improving local circulation, reducing inflammation, and enhancing tissue healing, making it particularly beneficial for *Vata-Kaphaja* disorders. This study concludes that the conductive method of *Agnikarma* with *Suvarnadi Shalaka* is a promising approach for managing knee osteoarthritis, with further large-scale studies needed to establish its long-term efficacy.

INTRODUCTION

Pain is an unpleasant sensation that leads individuals to seek medical attention, disrupting their daily activities. When mobile joints like the knee joint are affected by *Sandhigata Vata,* the discomfort is particularly acute. This condition tends to target the knee joint due to its frequent involvement in routine tasks, compounded by the fact that it bears significant weight. *Sandhigata Vata* is primarily characterized by the dominance of *Vata Dosha* in its pathogenesis. In the realm of *Shalya Tantra*, various treatment methods are outlined, including *Bheshajakarma, Ksharakarma, Agnikarma, Raktamokshana,* and *Shastrakarma. Agnikarma* is regarded as particularly effective, as per *Sushruta Samhita,* offering complete relief with minimal chances of recurrence.

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In Ayurveda, *Agnikarma* involves therapeutic heat application, also known as "*Dahan Karma,*" and is considered superior to oral medications, *Ksharakarma*, and even surgery.[1]

तद्दग्धानां रोगाणामपुर्नभावाद्वेषजशस्त्रक्षारैरसाध्यानां तत्साध्यत्वाच्च ॥ (Su.Su.12/3)

According to *Acharya Dalhana*, the commentator of *Sushruta Samhita, Agnikarma* is deemed the most effective treatment for *Vataja* and *Kaphaja Vyadhis.*[2] This is attributed to its ability to mitigate the risk of complications such as putrefaction, infection, and bleeding.

व्याधि वातकफात्मकं तंत्राग्निकर्माधिकारः (Su.Su.12/12)

The symptoms of *Sandhigata Vata* as described in *Samhita* include *Vedana* (joint pain during flexion and extension) and *Sotha* (swelling). These symptoms can lead to stiffness and crepitus, which could be correlated with osteoarthritis of the knee joint (O.A) in modern terms. *Sandhigata Vata* has become increasingly prevalent in society, primarily due to these symptomatic manifestations.[3,4]

Clinical Study

Sandhigatavata is the most effective treatment for joint disabling conditions. In terms of etiology, pathology, and clinical characteristics, osteoarthritis (OA) of the knee joint belongs to the same category as the *Sandhigatavata* described in Ayurveda. Allopathic medicine has limitations when it comes to treating this progressive illness. It has problematic side effects, is very symptomatic, and can offer conservative or surgical treatment. However, the methods and management described in the classics of Ayurveda can be more effective in treating such conditions. The diarthrodial (movable, synovial-lined) joint fails in osteoarthritis (OA), a degenerative joint disease. In India, OA is the most prevalent joint illness and the second most common rheumatologic issue, with a frequency of between 22–39%. Of these individuals, 29.8% of those aged 45 to 64 have been diagnosed with arthritis.

Till date no medicine is available which prevents or control the disease process. So, in such condition the treatment that slow down or halt disease progression is critically needed.

AIM AND OBJECTIVE

- A clinical study on conductive method of *Agnikarma* in the pain management *Sandhigata Vata*.
- Efficacy of *Agnikarma* with *Suvarndi salaka* in the pain management of *Sandhigata vata*.
- Contemporary and comprehensive study of the *Sandhigata vata* (osteoarthritis of knee joint) related problem.

Ethical clearance

Ethical clearance has been taken from IEC (Institutional Ethics Committee) of PGIA, Jodhpur vide letter No. DSRRAU/PGIA/IEC/21-22/478 dated 31.01. 2023 before starting the clinical trial.

CTRI Registration

The study has been registered in Clinical Trial Registry of India (CTRI) vide No CTRI/2023/07/ 055171 on dated 13.07.2023. Trial was registered retrospectively.

Plan of Study

Patients suffering from osteoarthritis were selected from O.P.D. and I.P.D. of University College of Ayurveda Sanjeevani Hospital, camp organized by university Dr. Sarvepalli Radhakrishnan Rajasthan Ayurved University, Jodhpur; irrespective of age, sex, religion, occupation etc., full filing the criteria of selection and eligible for the study. diagnosed on the basis of signs and symptoms as per specially prepared proforma based on Ayurvedic as well as modern texts. Written informed consent had been taken from each patient at the time of registration.

Intervention

Intervention	*Agnikarma*
Shalaka	*Suvarnadi Shalaka*
Type	*Bindu Dagdha* (conductive method)
Sittings	Four
Duration	One sitting per week
Follow up	One month

Inclusion Criteria

Patients between the age group 20 - 70 years of either gender suffering from *Janusandhigatavata* (knee OA.) with symptoms of pain, tenderness, stiffness with restricted joint movements.

Exclusion Criteria

Patients below 20 years and above 70 years. Systemic diseases like uncontrolled diabetes mellitus (DM), severe anemia, knee effusion, Rheumatoid Arthritis (R.A), paralysis, Parkinson's, malignancy, infectious diseases like syphilis, leprosy, AIDS, Tuberculosis (TB).

Laboratory Investigations

1. Blood Sugar (RBS)
2. Routine haemogram (Hb, TLC, DLC, ESR)
3. Serum uric acid
4. R.A factor quantitative
5. Serum calcium

The above investigations were done at baseline and after treatment except R.A. factor as R.A. factor quantitative was done only to exclude the patients of rheumatoid arthritis.

Radiological Investigations

X-ray knee joint anterio-posterior and lateral view.

MATERIALS AND METHODS

Materials

Agnikarma Shalaka: *Suvarnadi* (gold) *Shalaka*-14 carat. Dimensions - 7cm long, 2mm thick, 4mm end (Tip of *Salaka*).

- ***Triphala Kwatha* (decoction):** It was used for the cleaning of local part before *Agnikarma*.
- ***Ghritakumari* (*Aloe barbadensis* Miller. leaf):** It was used as soothing effect after *Agni karma* (dressing purpose).

The procedure was performed in three stages as *Purvey Karma* (pre-procedures), *Pradhana Karma* (Main-procedures), and *Paschat Karma* (Post-procedures) mentioned by Acharya Sushrut.

Methodology

Before starting the procedure, fitness and investigations were ensured. Procedure details were explained to every patient.

Agnikarma procedure was followed by the *Trividha Karma*.

Purvakarma

Proper instrumentation (*Agropaharaniyani*)

- The instruments for *Agnikarma* was well prepared with all required *Agropaharaniyani* described by *Acharya Sushruta.*
- *Haridra* powder, small pieces of *Kumari Patra*, swab holding forceps*, Plota* (gauze piece), *Pichu* (cotton), and gas stove, *Shalakas,* Betadine solution, etc. were kept ready for use.

Figure 1: *Suvarnadi salaka*

Pradhana Karma

- Painting of the local part (affected knee joint) was done with betadine solution.
- Draping was done with sterilized cut sheet.
- After carefully considering the symptoms of the disease, vitals and the strength of the patient as well as seasons, *Agnikarma* was done at affected knee joint.
- Conductive method of *Agnikarma* was done at maximum painful site of knee joint.
- *Agnikarma* was done in conductive method of *Suvarnadi Shalaka*.

Figure 2: Goniometric measurement before *Agnikarma*

Figure 3: Conductive method of *Agnikarma*

Figure 4. Conductive method of *Agnikarma*

Figure 5: Conductive method of *Agnikarma*

Figure 6: Goniometric measurement after *Agnikarma*

Figure 7: Goniometric measurement after *Agnikarma*

Paschatkarma

After making *Samyaka Dagdha Vrana* fresh pulp of *Ghrita kumari* (*Aloe vera*) was applied immediately to subside the burning pain.

- Patients were instructed to avoid contact of water for atleast 24 hours.
- Patients were instructed to follow *Pathya Apathyas* like avoid drinking cold water, avoid *Dal* curry made up of black gram, recipes made up of potato brinjal etc at least for one month.

Follow Up

After completion of the treatment, patient was advised to visit after every 7 days for follow up for at least one month.

Criteria for Assessment

The improvement of treatment was assessed mainly on the basis of relief in the cardinal signs and symptoms of the disease. To assess the effect of therapy, all the signs and symptoms were given scoring patterns depending upon their severity which are as below:

Subjective parameters

- *Vedana* (pain)
- *Sparsha asahyata* (tenderness)
- *Sandhi sphutana* (crepitus)
- *Sandhi graha* (stiffness)

Objective parameters

- Angle of the knee joint (ROM) with goniometer

Subjective parameters

Pain

0	No pain
1	Mild pain (pain exaggerated by movement but subsided by rest)
2	Moderate pain (not relieved by rest but not disturbing sleep or routine activities)
3	Severe pain (disturbing sleep and other routine activities but relieved by oral analgesics)

Tenderness

0	No tenderness
1	Mild tenderness (patient feels pain on pressure but does not withdraw joint)
2	Moderate tenderness (patient feels pain and on touch withdraws the joint)
3	Severe pain (patient does not allow to touch the joint)

Crepitus

0	No crepitus
1	Palpable crepitus
2	Audible crepitus

Stiffness

0	No stiffness
1	Mild stiffness (for few minutes, relived by mild movements)
2	Moderate stiffness (for more than 1 hour, once in a day)
3	Severe stiffness (more than 1 hour, many times a day affecting daily routine

Objective parameters

Goniometric measurement of angle of Knee Joint[2]

Angle of the knee joint was measured using a goniometer in supine position. It was done before treatment and after treatment to assess the improvement in flexion and extension of knee joint (ROM).

Normal flexion was considered as in degree; 135 to 150. Normal extension was considered as in degree; (0-10).

Procedure of goniometry

Motion	Recommended Position	Stabilization	Center	Proximal Arm	Distal arm
Flexion & Extension	Supine, knee in extension,	Stabilize femur to prevent rotation, abduction & adduction	Over Lateral epicondyle of femur	Lateral midline of femur, referencing greater trochanter	Lateral midline of fibula, reference lateral malleolus & fibular head

Overall Effect of Therapy

Overall effect	% of improvement
Complete Remission	100%
Marked Improvement	70 to 99%
Moderate improvement	50 to 69%
Mild improvement	30 to 49%
No improvement	< 30 %

Statistical Analysis

For nonparametric data like pain, tenderness etc.

Wilcoxon-signed rank test was applied within the groups

Mean score, percentage of relief, ± S.D (Standard deviation), S.E (Standard error) 't' value and p value were calculated to assess the effect of therapy.

OBSERVATION & RESULT

Local Examination of the Knee Joint

Local examination (knee joint)	No. of patients	Percentage
Swelling	10	33.33
Deformity	12	40.00
Muscular atrophy	11	36.67
Raised temperature	11	36.67
Tenderness	30	100.00
Crepitus	30	100.00
Movement	12	40.00

The table highlights clinical findings in the knee joint. All patients (100%) report tenderness and crepitus, while swelling is present in 33.33%, and deformity is observed in 40%. These are key clinical symptoms of *Janusandhigata Vata.*

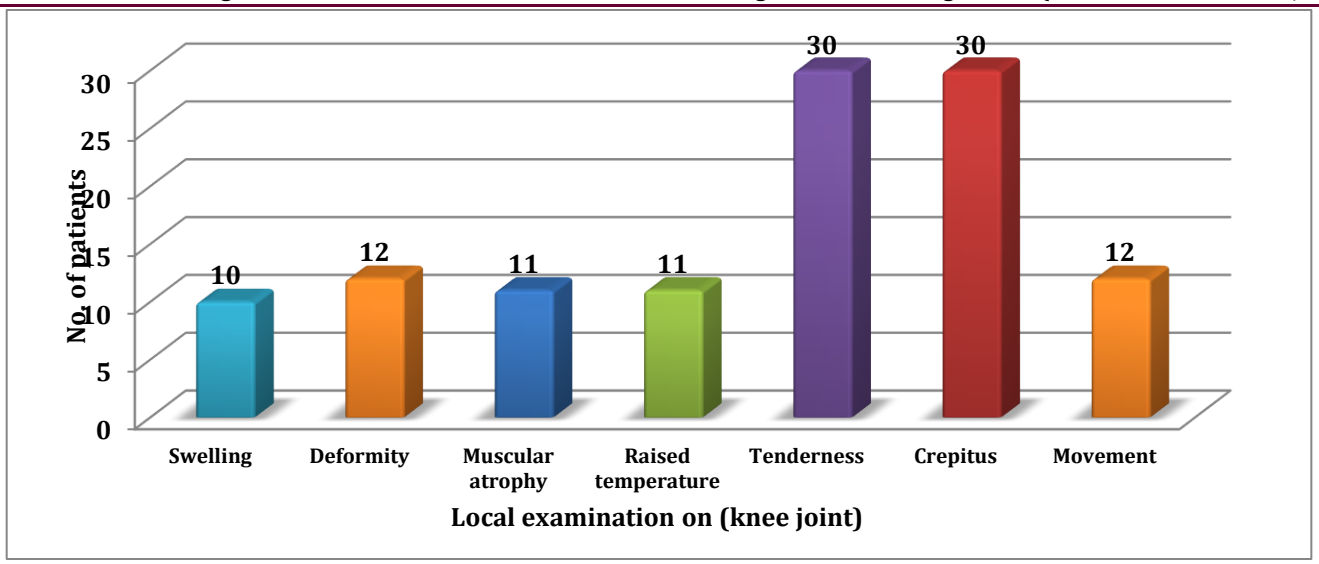


Table 2: Associated Symptoms

Associated Symptoms	No. of patients	Percentage
Loss of function	12	40.00
Joint instability/Buckling	15	50.00
Muscle weakness & atrophy	17	56.67
Deformity	12	40.00

Muscle weakness and atrophy are observed in 56.67% of patients, while joint instability is noted in 50%, and 40% report loss of function and deformity. These associated symptoms further underline the degenerative nature of the condition.

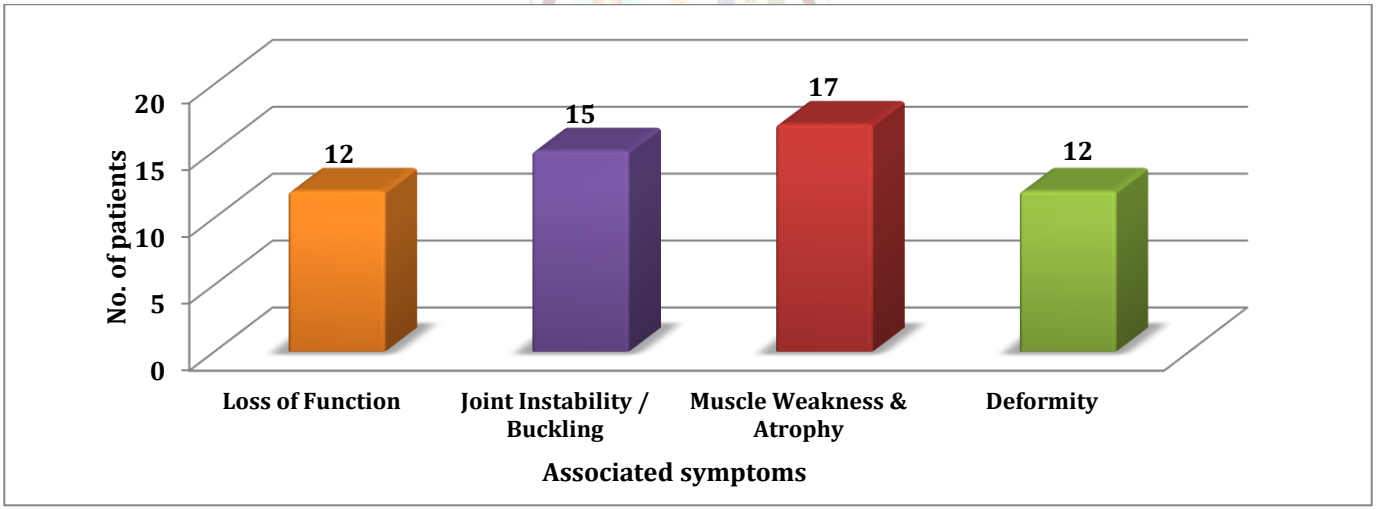


Table 3: Pain Follow-up (Wilcoxon matched pair test)

Follow up	Pain			p value
	Mean ± SD	Mean difference from baseline	% of improvement	
Baseline	2.93±0.25	-	-	-
1st week	2.6±0.56	0.333	11.36	0.002
2nd week	1.83±0.46	1.1	37.54	<0.0001
3rd week	1.36±0.55	1.567	53.48	<0.0001
4th week	0.46±0.57	2.467	84.19	<0.0001
AT (after 7 days)	0.43±0.50	2.5	85.32	<0.0001

The table shows a marked reduction in pain following treatment. The mean pain score decreases from 2.93 at baseline to 0.43 after seven days post-treatment, resulting in an 85.32% improvement. This indicates the effectiveness of the *Agnikarma* therapy.

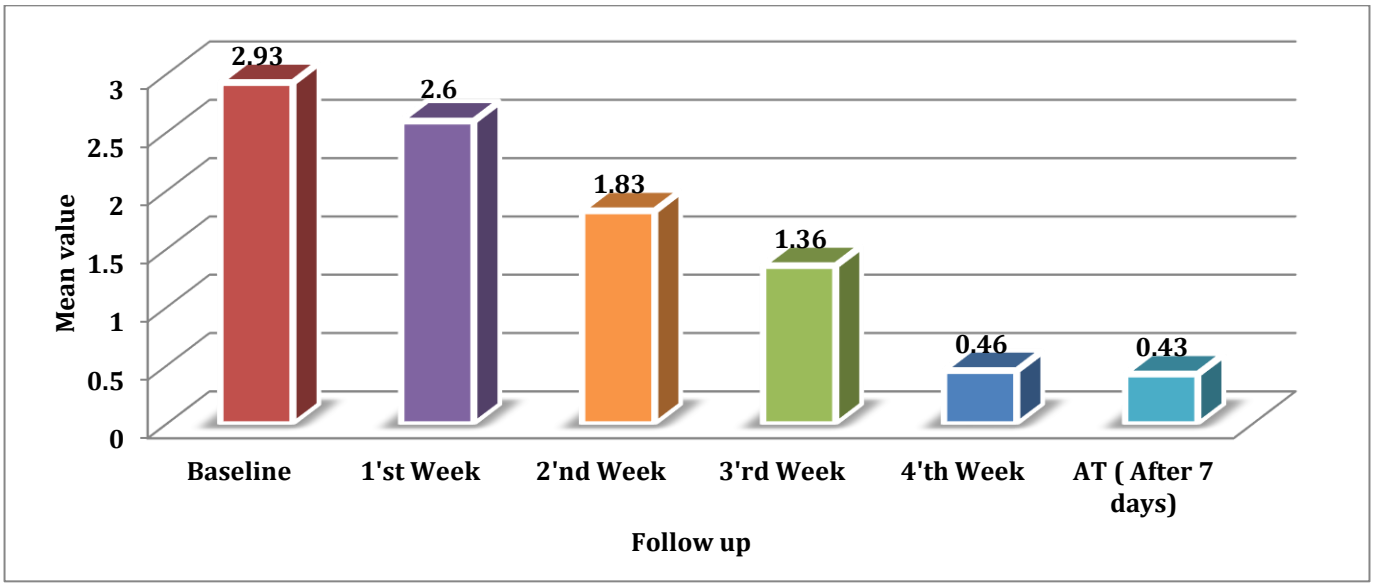


Table 4: Tenderness Follow-up (Wilcoxon matched pair test)

Follow up	Tenderness			P value
	Mean±SD	Mean difference from baseline	% of improvement	
Baseline	2.86±0.34	-	-	-
1st week	2.3±0.46	0.566	19.79	<0.0001
2nd week	1.4±0.49	1.467	51.29	<0.0001
3rd week	1.3±0.46	1.567	54.79	<0.0001
4th week	0.3±0.46	2.567	89.75	<0.0001
AT (after 7 days)	0.3±0.46	2.567	89.75	<0.0001

Tenderness also shows significant improvement, with the mean tenderness score dropping from 2.86 at baseline to 0.3 after treatment. This corresponds to an 89.75% reduction in tenderness, highlighting the treatment's success in reducing inflammation and discomfort.

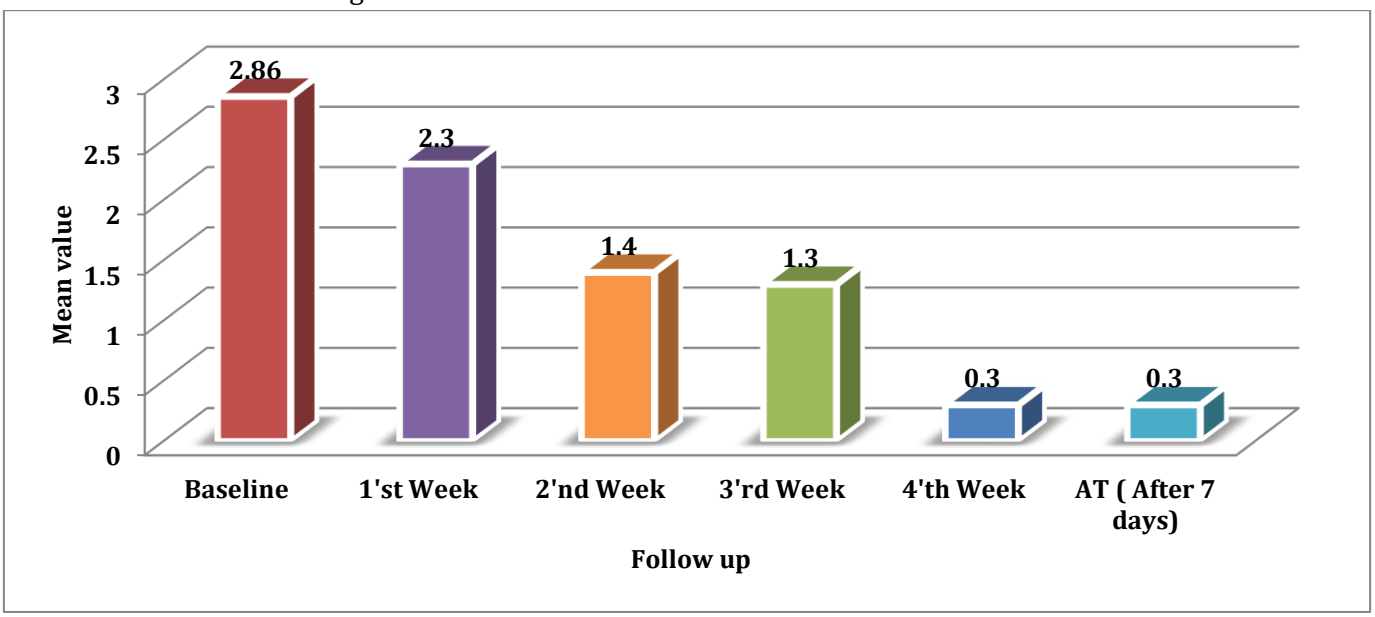


Table 5: Crepitus Follow-up

Follow up	Crepitus			P value
	Mean ± SD	Mean difference from baseline	% of improvement	
Baseline	2.00±0.00	-	-	-
1st week	2.1±0.30	-0.100	-5.00	-
2nd week	1.43±0.50	0.566	28.30	-
3rd week	1.4±0.49	0.600	30.00	-
4th week	0.43±0.56	1.567	78.35	-
AT (after 7 days)	0.43±0.56	1.567	78.35	-

Crepitus improves by 78.35% after treatment, with the mean crepitus score reducing from 2.0 to 0.43. Though there is a slight increase in crepitus during the first week, it steadily improves thereafter.

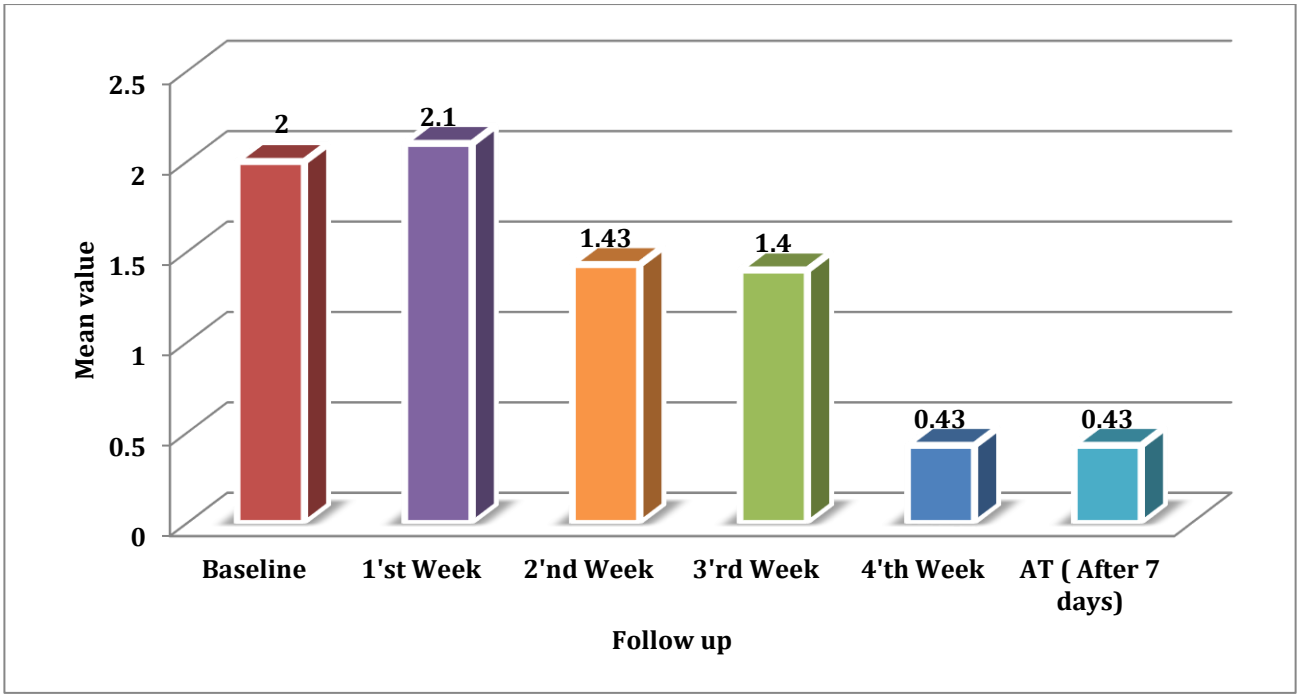
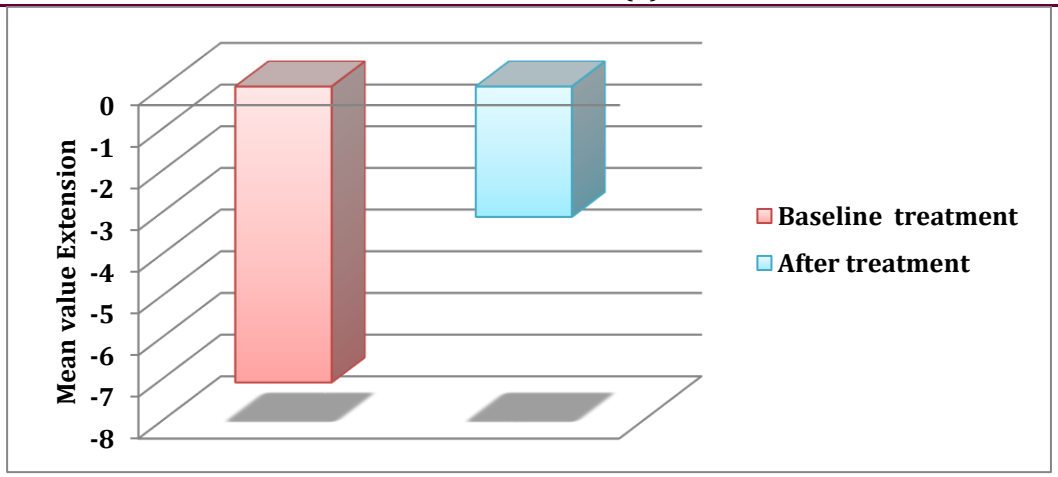


Table 6: Goniometric Reading (Joint Mobility)

Goniometric reading	Pain				P value
	Baseline treatment (Mean±SD)	After treatment (Mean±SD)	Mean difference	% of improvement	
Extension	-7.1±1.60	-3.13±1.35	-3.967	55.87	<0.0001
Flexion	119.26±4.70	132.16±1.44	-12.99	-10.89	<0.0001

Wilcoxon matched pair test

This table measures improvements in joint mobility. The extension of the knee joint improves by 55.87%, while flexion improves by 10.89%. These results indicate that the treatment significantly enhances the range of motion in the affected joint.



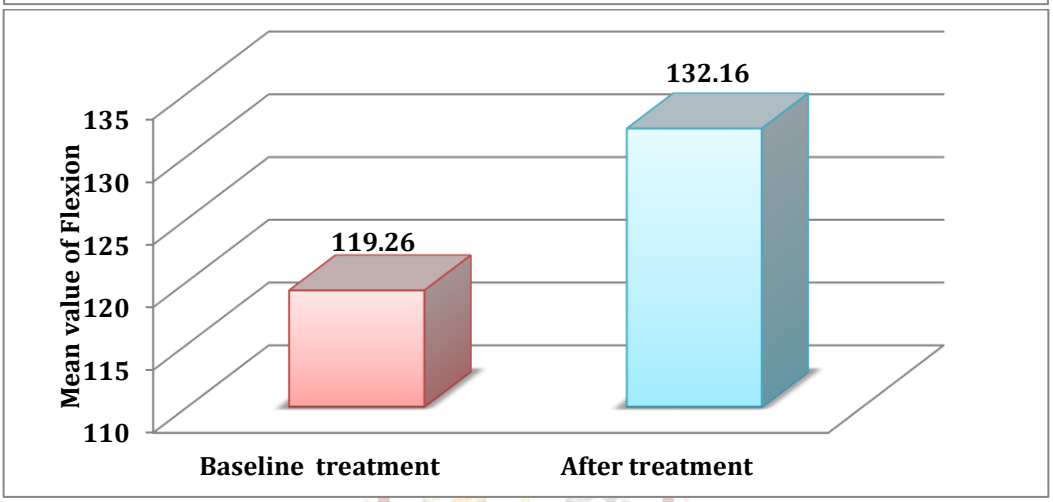


Table 7: Laboratory Investigations

Lab investigation	Baseline		
	Mean	SD	Median
Haemoglobin	12.8	1.39	13.10
TLC	12.86	1.33	12.50
ESR	23.11	2.35	23.50
Blood sugar RBS	118.8	21.65	120.00
Serum uric acid	5.13	1.05	5.20

Baseline blood investigations reveal that the average hemoglobin level is 12.8g/dL, the TLC is 12.86, ESR is 23.11, and serum uric acid is 5.13mg/dL. These values provide insight into the patients' general health and inflammatory status before treatment.

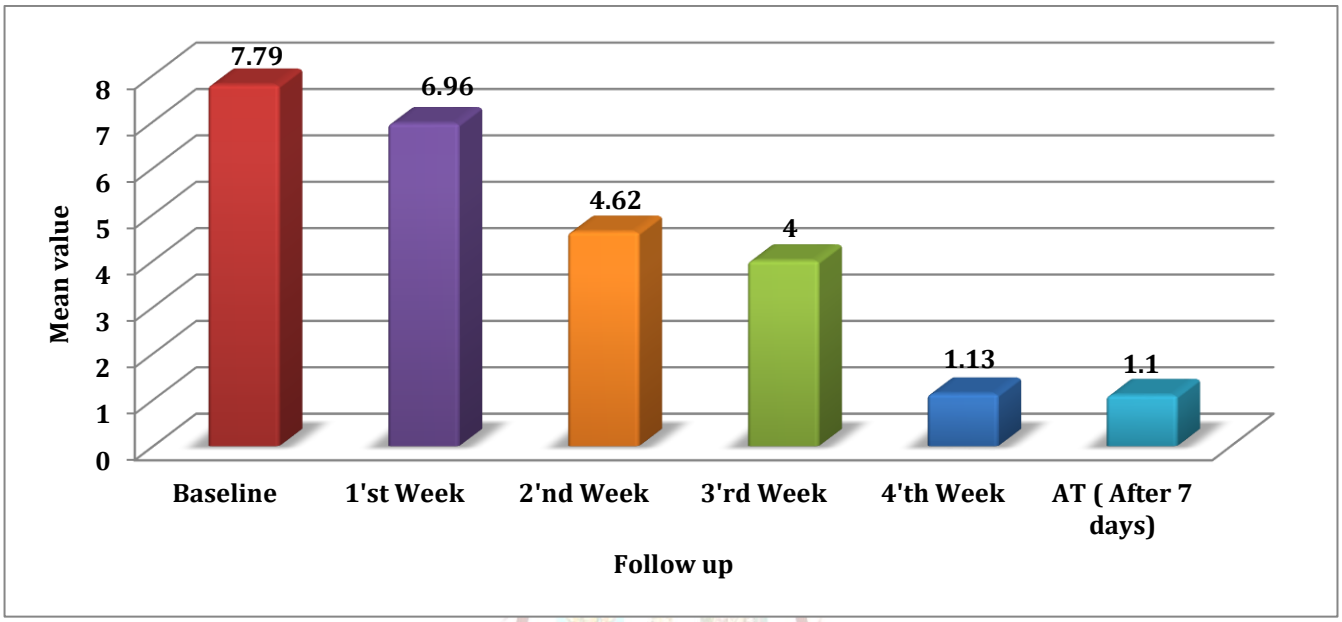
Table 8: Overall Follow-up for Pain Management

Follow up	Overall symptoms results			P value
	Mean±SD	Mean difference from baseline	% of improvement	
Baseline	7.79±0.49	-	-	-
1st week	6.96±0.90	0.827	10.62	<0.0001
2nd week	4.62±1.01	3.172	40.72	<0.0001
3rd week	4.00±1.00	3.793	48.69	<0.0001
4th week	1.13±1.06	6.655	85.43	<0.0001
AT (after 7 days)	1.10±1.01	6.690	85.88	<0.0001

Table 8 presents the overall results of symptoms over a follow-up period. The baseline mean score for symptoms was 7.79±0.49, which showed a significant improvement over the weeks of observation:

- In the 1st week, the mean score dropped to 6.96±0.90, representing a 10.62% improvement.
- By the 2nd week, the mean score further decreased to 4.62±1.01, indicating a 40.72% improvement.
- In the 3rd week, the score was 4.00 ±1.00, with a 48.69% improvement.
- By the 4th week, the mean score reached 1.13 ±1.06, showing a substantial 85.43% improvement.
- After 7 days, the score was 1.10±1.01, marking an overall 85.88% improvement from the baseline.

All changes were statistically significant with a p-value of <0.0001, indicating that the treatment led to a highly significant reduction in symptoms over time.



DISCUSSION

This clinical study aimed to assess the efficacy of the conductive method of *Agnikarma* using *Suvarnadi Salaka* in managing pain associated with *Sandhigatavata* (osteoarthritis of the knee joint). Osteoarthritis is a common degenerative condition affecting millions of individuals worldwide, leading to chronic pain, stiffness, and functional impairment. Conventional treatments such as nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, and physiotherapy provide relief but are often associated with side effects or limited efficacy in long-term management. *Agnikarma*, an Ayurvedic therapy involving the controlled application of heat, has emerged as a potential alternative therapy with promising results in pain management. This study focused on evaluating its impact on pain, tenderness, joint function, and overall quality of life.

Effectiveness of *Agnikarma* in Pain Management

Pain reduction was a primary outcome in this study, and the results were remarkable. At baseline, the mean pain score was 2.93, which decreased to 0.43 after the treatment, indicating an 85.32% reduction in pain over the course of the study. This improvement was statistically significant (p<0.0001) and demonstrates the efficacy of *Agnikarma* in providing substantial pain relief to patients with knee osteoarthritis.

The reduction in pain can be attributed to the mechanism of action of *Agnikarma*. By applying controlled heat to specific areas using the *Suvarnadi Salaka*, local circulation is improved, and there is a subsequent increase in the supply of oxygen and nutrients to the affected tissues. This helps in reducing inflammation and promoting tissue repair. Additionally, the heat application stimulates the body's endogenous pain-relieving mechanisms, such as the release of endorphins, which help in reducing the perception of pain. The heat may also have a soothing effect on the muscles and tendons surrounding the joint, reducing stiffness and facilitating movement.

The pain relief observed in this study is consistent with the outcomes of other studies on the use of heat therapy in osteoarthritis. However, *Agnikarma* has the added benefit of being a precise and controlled application of heat, which allows for targeted treatment of the affected joint without causing damage to surrounding tissues. This is in contrast to some conventional treatments, such as corticosteroid injections, which carry a risk of joint degeneration when used repeatedly.

Reduction in Tenderness and Crepitus

In addition to pain relief, tenderness was another key symptom evaluated in this study. At baseline, the mean tenderness score was 2.86, which decreased to 0.3 by the end of the treatment period, reflecting an 89.75% reduction ($p<0.0001$). Tenderness is a common symptom of osteoarthritis, indicating inflammation and irritation of the tissues surrounding the joint. The significant reduction in tenderness suggests that *Agnikarma* is effective in alleviating inflammation and promoting healing in the affected joint.

The reduction in crepitus, a characteristic cracking or popping sound in the joint, was also noteworthy. Although crepitus initially worsened in the first week (increasing from 2.0 to 2.1), it improved steadily over the course of the treatment, with an overall reduction of 78.35% by the end of the follow-up period. The initial worsening of crepitus could be explained by the increased mobility and activity in the joint following pain relief, as patients may have started using the joint more freely, leading to temporary exacerbation of the symptom. However, the long-term improvement in crepitus suggests that *Agnikarma* helps in reducing joint stiffness and improving the lubrication of the joint, which may reduce friction and the associated noise during movement.

Improvement in Joint Mobility

Joint mobility was another important parameter evaluated in this study, and the results were encouraging. The goniometric readings showed significant improvement in both extension and flexion of the knee joint. Extension improved by 55.87%, while flexion improved by 10.89%, indicating a substantial increase in the range of motion in the affected joint.

Improved joint mobility is critical for patients with osteoarthritis, as the condition often leads to stiffness and limited movement, severely affecting the ability to perform daily activities. The improvement in mobility observed in this study suggests that *Agnikarma* not only relieves pain but also helps in restoring joint function. This is likely due to the reduction in inflammation, the soothing effect of the heat on the muscles and tendons, and the overall improvement in blood flow to the joint.

In comparison to conventional treatments, *Agnikarma* offers a non-invasive approach to improving joint mobility without the need for surgical intervention or long-term reliance on medications. Physical therapy and exercises are often recommended for improving joint mobility, but the addition of *Agnikarma* may enhance the effectiveness of these interventions by providing immediate pain relief and reducing stiffness, allowing patients to engage more fully in rehabilitation exercises.

Impact on Overall Symptoms and Quality of Life

The overall symptom score showed significant improvement, with an 85.88% reduction from baseline to the final follow-up. This comprehensive improvement suggests that *Agnikarma* not only addresses individual symptoms such as pain and tenderness but also has a positive impact on the patient's overall quality of life. Many patients reported better mobility, reduced dependence on others for daily activities, and improved sleep patterns. Sleep disturbances, which were present in 53.33% of patients at baseline, are often a consequence of chronic pain, and the improvement in sleep quality observed in this study can be directly linked to the reduction in pain levels.

CONCLUSION

The results of this clinical study provide compelling evidence for the efficacy of the conductive method of *Agnikarma* using *Suvarnadi Salaka* in the pain management of *Sandhigatavata* (osteoarthritis of the knee joint). The treatment led to significant improvements in pain, tenderness, crepitus, joint mobility, and overall symptoms, with a marked enhancement in the quality of life for the patients.

The findings suggest that *Agnikarma* can be a valuable alternative or adjunctive treatment for patients with knee osteoarthritis, particularly those who may not tolerate or respond well to conventional pharmacological treatments. Its non-invasive nature, absence of significant side effects, and ability to provide long-lasting pain relief make it an attractive option for patients seeking holistic and effective management of osteoarthritis.

Future studies with larger sample sizes and longer follow-up periods are needed to further validate these findings and explore the long-term benefits of *Agnikarma*. Additionally, comparing the efficacy of *Agnikarma* with other non-pharmacological interventions such as physical therapy, acupuncture, or other forms of heat therapy would provide valuable insights into its relative effectiveness and role in the broader management of osteoarthritis. Nonetheless, the current study highlights the potential of *Agnikarma* as a promising treatment modality for osteoarthritis, offering hope to millions of patients suffering from this debilitating condition.

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