



A Comparative Clinical Study of Agnikarma (Therapeutic Heat Burn) with Suvarna Shalaka (Rod of Gold) and Panchadhatu Shalaka (Rod Made Up of Five Metals) in Janusandhigata Vata W.S.R to Osteoarthritis of Knee Joint

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Abstract

Janu Sandhigata Vata is the commonest form of *Vata Vyadhi* confronted by the Ayurvedic physicians. The classical description of *Sandhigata Vata* looks identical to the Osteoarthritis (OA) of the knee joint. Providing relief from the joints pain and stiffness, limiting functional impairment and increasing mobility are the main principles of its management. In Ayurveda, *Agnikarma* (therapeutic heat burn) is prescribed as one of the therapeutic measures for the effective management of *Janu Sandhigata Vata*. The objective is to evaluate and compare the efficacy of *Agnikarma* with *Suvarna Shalaka* and *Panchadhatu Shalaka* in management of *Janu Sandhigata Vata* w.s.r to Osteoarthritis of knee joint. The trial was carried out by randomly including the patients into two groups, of thirty each. Group A patients were treated by *Agnikarma* with *Suvarna Shalaka* and Group B with *Panchadhatu Shalaka*. *Agnikarma* was done in four sittings with a weekly interval. The patients were assessed in each sitting immediately after the treatment and a follow up was done after 15 and 30 days. The test significantly showed that *Agnikarma* using *Suvarna Shalaka* was statistically significant in reducing pain, tenderness, crepitus, swelling, angle of extension and angle of flexion. On comparison the *Suvarna Shalaka* is statistically more significant in pain, tenderness, crepitus, swelling, angle of extension and angle of flexion than that of *Agnikarma* done using *Panchadhatu Shalaka*. The *Agnikarma* using *Suvarna Shalaka* is found to be more beneficial than the *Agnikarma* using *Panchadhatu Shalaka* in the prime symptoms of the *Janu Sandhigata Vata* (Osteoarthritis).

Keywords: Alternative System of Medicines, Ayurveda, *Sandhigata Vata*, *Vata Vyadhi*

1. Introduction

Sandhigata Vata is the commonest form of articular disorder prone to be manifested in the knee joint¹. As the name suggests, the dominance of *Vatadosha* is

seen in its pathogenesis. The symptoms of *Sandhigata Vata* described in *Sushrut Samhita* are *Sandhi Shula* (joint pain) and *Shopha* (swelling) which gradually curb the functionality of the joint², due to these symptoms stiffness and crepitus develop, which may

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be correlated with disease osteoarthritis (O.A) in modern parlance^{3,4}. Osteoarthritis (OA) is the most common degenerative joint disease, affecting more than 25% of the population over 18 years-old⁵. The incidence of OA is going on increasing worldwide and the main factors contributing to it are raising prevalence of ageing population and obesity⁶. The World Health Organization (WHO) estimates that 10% of the population over 60 years has serious medical problems resulting from OA⁷. The knee is commonly affected by OA and is thought to account for the majority of disability from OA⁸. For its management, both surgical and non-surgical approaches are used which aimed to reduce the joint pain, increase mobility and minimize functional impairment⁹. Initially always non-surgical approach is preferred and for this number of non-pharmaceutical and pharmaceutical measures are used. In pharmacological treatment of OA Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) in combination with other medications (e.g. proton pump inhibitors), opioid analgesics, potentially cartilage active agents and phytopharmaceuticals are used¹⁰. But there are limitations of prescribing these medicines and they have failed in providing adequate relief to some of the patients^{11,12}. There are studies which claims effect of these medicines as placebo and challenge their therapeutic role in the management of OA^{11,12}. Due to several limitations of conventional management of OA, there is increasing curiosity to find an effective and safe management in the complementary and alternative system of medicines¹³. Ayurveda, the world's oldest system of health care has abundant possibilities to provide safer and sustainable therapeutic spectrum in the management of OA. There are at least eight clinical trials available in the PubMed on the *Agnikarma*¹⁴ among which two are specifically done on OA¹⁵. But, none of these trials done by using *Suvarna Shalaka* (rod/probe of gold) and the analysis of thermal behavior of the *Shalaka* were also not carried out in any of the study. Thus, considering the recommendation of *Sushrut Samhita*, the *Agnikarma* (therapeutic heat burn) has been selected as one of the therapeutic treatments for Osteoarthritis¹⁶. This study was planned with an objective to evaluate and compare the efficacy of *Agnikarma* with *Suvarna Shalaka* and *Panchadhatu Shalaka* (rod or probe made

up of five metals viz. *Tamra* – Copper (42.56%), *Loha* – Iron (33.8%), *Yashada* – Zinc (9.2%), *Rajata* – Silver (8.35%), *Vanga*– Lead (6.37%) in management of *Janu Sandhigata Vata* w.s.r to Osteoarthritis of Knee joint.

2. Materials and Methods

Patients (n = 60) suffering from sign and symptoms of *Janu Sandhigata Vata* were registered from OPD and IPD of Shalya Tantra Department, irrespective of their gender, caste, creed and religion. Ethical clearance was obtained for this study from the institutional ethical committee (ref. No. 2863/GAM, Puri, dated 18/11/2014). For *Agnikarma*, the standardization of *Suvarna Shalaka* was done. The *Shalaka*, measuring 3 inches in length, 2 inches diameter having gold made tip of 1 cm was taken. This *Shalaka* was heated to red hot in open place, inside the room and in a confined space of the room. The procedure was repeated for three times and temperature was recorded each time. Finally, in the room temperature, it was standardized in to 470°C.

2.1 Inclusion Criteria

- Patient suffering from *Janu Sandhigata Vata* (O.A of knee joint)
- Patients between the age group 40-70 years of both sex

2.2 Exclusion Criteria

- Age below 40 years and above 70 years
- *Sandhi Vata* associated with Diabetes Mellitus
- Associated with other chronic diseases like Paralysis, Parkinson's disease, Anemia
- Pregnancy
- *Sandhigata Vata* other than *Janu Sandhigata Vata*
- R.A (Rheumatoid Arthritis)
- Patients of Cancer, Tuberculosis and AIDS

2.3 Investigations

Routine hematological and biochemical investigations such as blood sugar (fasting and postprandial), TLC, DLC, Hb and ESR, Uric acid, RA factor, ASO Titer and Routine Urine analysis were carried out before

starting the treatment to rule out any other pathology. Radiological examination was carried out before and after completion of treatment.

2.4 Grouping

The trial was carried out by randomly including the patients into two groups, of thirty each;

- Group - A: Patients were treated by *Agnikarma* with *Suvarna Shalaka*
- Group - B: Patients were treated by *Agnikarma* with *Panchadhatu Shalaka*

2.5 Requirements

1. *Agnikarma Shalaka*: *Suvarna shalaka* and *Panchadhatu Shalaka*.
2. *Triphala Kwatha* (decoction): It was used for the cleaning of local part before *Agnikarma*.
3. *Haridra Churna* (powder of *Curcuma longa* L. rhizome): It was used for dusting after *Agnikarma* (dressing purpose).
4. *Ghritakumari* (*Aloe barbadensis* Miller. leaf): It was used as soothing effect after *Agnikarma* (dressing purpose).
5. *Yashtimadhu Churna*: it was used as healing of wound after *Agnikarma*.
6. *Madhu-Sarpi* (honey and ghee): It was used after *Agnikarma* for healing of wound.

2.5.1 Agnikarma Procedure

Agnikarma was done following the guidelines of the text¹⁷. It is shown in Figures 1 to 8. The procedure consisted of;

1. *Poorva Karma* (preparatory procedures) – Figures 1 to 4
2. *Pradhana Karma* (main procedure) – Figures 5 and 6
3. *Pashchat Karma* (post treatment procedures) – Figures 7 and 8

2.5.2 Poorva Karma

In preparatory measures, informed consent of the patient was taken after explaining the whole procedure.



Figure 1. Arrangement of accessories.



Figure 2. Goniometer extension.

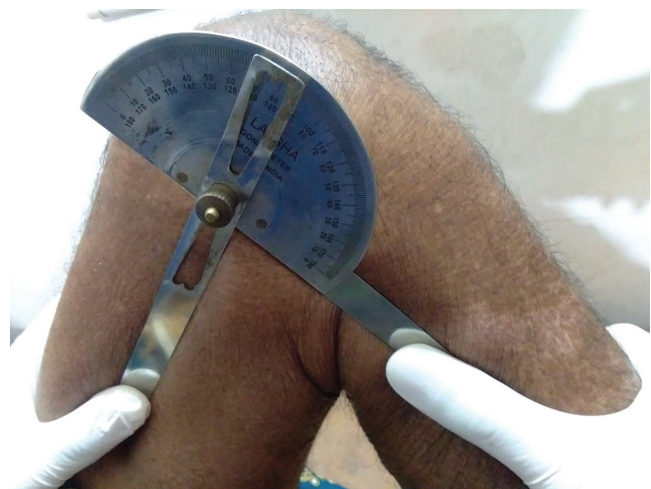


Figure 3. Goniometer flexion.



Figure 4. Heating of Agnikarma Shalaka.



Figure 5. Bindu Agnikarma



Figure 6. Application of Ghridakumari Pulp



Figure 7. Dusting of Haridra Choorna.

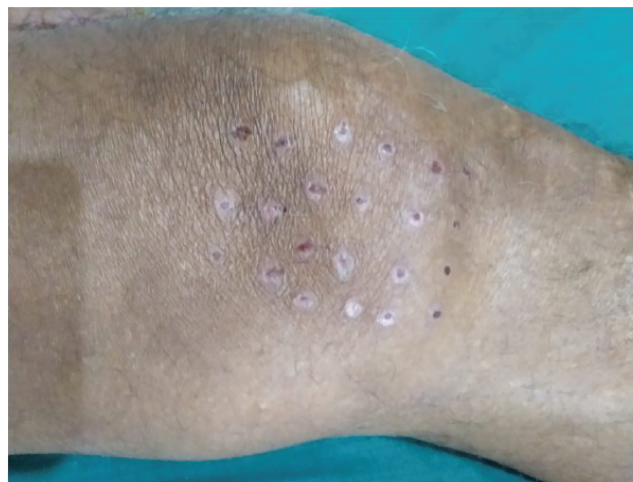


Figure 8. Scar marks of Agnikarma

The Minor O.T. was well arranged and *Agropaharaniya* (prior arrangement of accessories) was done. Proper sterilization methods were obtained. For Group A Sterile Swab holding forceps, Cotton pieces, Drape, surgical spirit, *Suvrana Shalaka*, Steel dish, Borosil glass pipette and *Madhu, Ghrita* mixture were kept ready. For Group B instead of *Suvarna, Panchadhatu Shalaka* was used. The *Shalaka* was heated directly over the stove until red hot. The patient was laid down comfortably in supine position and told the patient to supinate the forearm, so that the site for the *Agnikarma* was visible. Other than Knee, surrounding part was covered with sterile towel. The knee and surrounding area were cleaned with surgical spirit and allowed to dry.

2.5.3 Pradhana Karma

As the main procedure, *Agnikarma* was done at maximum tender site affected at the knee joint after marking it. The minimum space was kept between two *Agnikarma* points to avoid overlapping of *Dagdha Vrana*. About 5mm gap was maintained between each burning spot (*Bindu*). *Bindu* type of *Agnikarma* was performed (*Bindu Dahana Vishesha*). *Shalaka* was withdrawn abruptly after inflicting each burn. *Ghritkumari* pulp was applied to the spotted area for soothing.

2.5.4 Paschat Karma

In post-operative procedure, after wiping of *Ghritakumari* pulp, honey and ghee was applied on *Dagdha Vrana* (burned spots). After that, dusting of *Haridra Churna* was done. Patient was observed for 30 min after procedure and advised *Pathyapathya* as mentioned in *Sushrut Samhita*¹⁸ until the healing of *Samyak Dagdha Vrana*. The diet of a patient should consist of *Laghuahaara* (light diet) in small quantities. Food should always be consumed fresh and should be cooked with fatty articles (especially cow ghee). Patients were strictly advised not to allow water contact at *Dagdha Vrana* site up to 24 h.

2.6 Study Period

Agnikarma was done in four sittings with a weekly interval (28 days).

2.7 Follow Up Period

After completion of treatment the patients were examined after 15 days and 30 days to observe the status.

2.8 Criteria of Assessment

The assessment of the patients was done before the treatment and after the treatment (on the 1st week, 2nd week, 3rd week and 4th week). Following scoring pattern was adopted for the study to observe the changes in signs and symptoms.

1. Pain (VAS score)

Mild	0-2
Moderate	3-6
Severe	7-10
3. Tenderness

Absent	0
Present	1
4. Crepitus

Present	1
Absent	0
5. Swelling

Absent	0
Present	1
6. Angle of Extension (using Goniometer)

180 ⁰	0
170 ⁰ -100 ⁰	1
<100 ⁰	2
7. Angle of flexion

140 ⁰	0
120 ⁰ -90 ⁰	1
<90 ⁰	2

2.9 Assessment of Results and Response to Therapy

Patients were graded into 4 groups to assess the overall effect of therapy

1. Cured: 91% to 100% improvement in subjective and objective parameters
2. Marked Improvement: 70% to 90% improvement in subjective and objective parameters
3. Moderate Improvement: 50% to 69% improvement in subjective and Objective parameters

4. Mild Improvement: 25% to 49% improvement in subjective and objective parameters
5. Unchanged: < 25% improvement in subjective and objective parameters.

2.10 Statistical Analysis

Paired *t*-test was applied for assessment of individual group whereas unpaired *t*-test was used to assess the comparative efficacy of *Agnikarma* in Group - A with Group- B.

3. Observations

Out of 60 registered patients, all the patients had completed treatment and there was no drop out (30 in each group). Demographic data of the study that is age, sex, religion, socioeconomic status, etc., are depicted in Table 1.

4. Results

The study was carried out in 60 patients of which 30 patients received *Agnikarma* with *Suvarna Shalaka*,

and 30 patients received *Agnikarma* with *Panchadhatu Shalaka* schedule, in 2 groups, Group A and Group B respectively. The data was collected from patients before the treatment, after procedure of 1st week, 2nd week, 3rd week and 4th week and followed up on 15 days and 30 days.

Assessment of the condition was done based on detailed Performance adopting standard scoring method of subjective and objective parameters. The assessment parameters include a mixture of qualitative and quantitative data. Two groups are compared in support of pre and post values of the criteria using following statistical analysis.

Student 't' Test was done for comparing the effectiveness of treatment between Group A and B. Paired *t*-test was performed for proving the effectiveness of Group A and B.

The below depicted results were derived statistically taking the values before and after treatment under various clinical parameters using *Suvarna shalaka* and *Panchadhatu Shalaka* which are depicted in Table 2 – 9.

Table 1. Demographic observations of Group A (*Suvarna Shalaka*) and Group B (*Panchadhatu Shalaka*)

Group A		Group B	
Hindu	100	Hindu	96.6
Urban	66.66	Urban & Rural	50
Middle class	43.33	Middle class	60
Dietic habit (<i>Viruddhashana</i>)	33.33	Dietic habit (<i>Adhyashana</i>)	36.6
Koshta (<i>Madhyama</i>)	50	Koshta (<i>Madhyama</i>)	50
Addiction (Tea)	70	Addiction (Tea)	50
<i>Prakruti</i> (<i>Vataja</i>)	26	<i>Prakruti</i> (<i>Kapha, Ptta-Kapha</i>)	20
Onset (Gradual)	80	Onset (Gradual)	90
Gender (Female)	63.33	Gender (Male)	66.6
Educational status (Literate)	83.3	Educational status (Literate)	60
Occupation (House wife)	33.33	Occupation (House wife, Laborer, Business)	20
Built (<i>Madhyama</i>)	83.33	Built (<i>Madhyama</i>)	70
Nature of work (Light)	43.33	Nature of work (Light)	90
Marital status (Married)	83.33	Marital status (Married)	71

Table 2. Comparative effect of both treatments in signs and symptoms on 1st week

<i>Signs and symptoms</i>	<i>Percentage of Relief</i>		<i>Mean difference</i>		<i>T Value</i>	<i>P value</i>
	<i>Group A</i>	<i>Group B</i>	<i>Group A</i>	<i>Group B</i>		
Pain	41.50	24.52	3.1	4.40	2.056	=0.044
Tenderness	100	85.74	0.00	0.133	2.047	=0.045
Crepitus	81	18.5	0.133	0.567	3.883	<0.001
Swelling- middle point of patella	17.63	31.59	0.467	0.433	1.077	=0.028
Swelling- 2 inches above patella	33.33	15.87	0.40	0.533	1.077	=0.286
Swelling-2 inches below patella	50	47.61	0.30	0.300	0.00	=1.00
Angle of extension	23.06	18.18	0.667	0.900	0.484	=0.630
Angle of flexion	25.88	19.36	0.667	0.833	0.308	=0.759

Table 3. Comparative effect of both treatments in signs and symptoms on 2nd week

<i>Signs and symptoms</i>	<i>Percentage of Relief</i>		<i>Mean difference</i>		<i>T Value</i>	<i>P value</i>
	<i>Group A</i>	<i>Group B</i>	<i>Group A</i>	<i>Group B</i>		
Pain	42.07	24.52	3.067	4.267	1.323	=0.191
Tenderness	100	85.74	0.00	0.133	2.047	=0.045
Crepitus	81	18.5	0.133	0.567	3.883	<0.001
Swelling- middle point of patella	70.54	31.59	0.167	0.233	0.261	=0.795
Swelling- 2 inches above patella	66.66	15.87	0.200	0.267	0.261	=0.795
Swelling-2 inches below patella	77.83	47.61	0.133	0.467	0.000	=1.00
Angle of extension	30.795	18.18	0.600	0.900	0.516	=0.608
Angle of flexion	30.66	19.36	0.621	0.793	0.000	=1.00

Table 4. Comparative effect of both treatments in signs and symptoms on 3rd week

<i>Signs and symptoms</i>	<i>Percentage of Relief</i>		<i>Mean difference</i>		<i>T Value</i>	<i>P value</i>
	<i>Group A</i>	<i>Group B</i>	<i>Group A</i>	<i>Group B</i>		
Pain	40.16	38.5	2.033	3.467	2.321	=0.024
Tenderness	100	85.74	0.00	0.133	2.047	=0.045
Crepitus	90.42	23.85	0.0667	0.533	4.125	<0.001
Swelling- middle point of patella	100	95.23	0.00	0.033	0.258	=0.789
Swelling- 2 inches above patella	100	78.98	0.000	1.33	0.510	=0.612
Swelling-2 inches below patella	100	89.57	0.000	0.0667	0.258	=0.798
Angle of extension	69.20	27.27	0.267	0.800	1.533	=0.131
Angle of flexion	77.77	41.74	0.200	0.600	1.871	=0.066

Table 5. Comparative effect of both treatments in signs and symptoms on 4th week

Signs and symptoms	Percentage of Relief		Mean difference		T Value	P value
	Group A	Group B	Group A	Group B		
Pain	62.83	43.44	1.921	3.300	7.895	<0.001
Tenderness	100	89.24	0.00	0.100	2.294	0.025
Crepitus	90.42	23.85	0.0667	0.533	3.791	<0.001
Swelling- middle point of patella	100	95.23	0.00	0.033	0.519	=0.605
Swelling- 2 inches above patella	100	89.57	0.000	0.0667	0.255	=0.799
Swelling-2 inches below patella	100	100	0.000	0.000	0.261	=0.795
Angle of extension	84.54	33.36	0.133	0.733	2.537	=0.014
Angle of flexion	88.88	54.36	0.100	0.567	2.300	=0.025

Table 6. Effect of treatment in signs and symptoms on 15 days of Follow up in Group A and B

Signs and Symptoms	Group A			Group B		
	Percentage of relief	"t" Value	"p" Value	Percentage of relief	"t" Value	"p" Value
Pain	87.41	10.514	<0.001	58.33	10.263	<0.001
Tenderness	100	29.00	<0.001	92.17	13.730	<0.001
Crepitus	90.42	7.077	<0.001	23.85	2.408	=0.023

Table 7. Effect of treatment in signs and symptoms on 30 days of Follow up in Group A and B

Signs and Symptoms	Group A			Group B		
	Percentage of relief	"t" Value	"p" Value	Percentage of relief	"t" Value	"p" Value
Pain	71.07	3.930	<0.001	58.31	10.069	<0.001
Tenderness	100	29.00	<0.001	92.17	13.730	<0.001
Crepitus	85.71	6.595	<0.001	19.21	2.112	=0.043

Table 8. Overall effect of the treatment

Effect of Therapy	Group A	Group B	Total	%
Cured (91-100) % Relief	02	0	02	3.33
Markedly Improved (70-90% Relief)	21	02	23	38.33
Moderately Improved (50-69 % Relief)	07	07	14	23.33
Mildly Improved (25-49 % Relief)	0	21	21	35
Unchange<25 % Relief	0	0	0	0

Table 9. Comparative effect of the treatment

Effect of Therapy	Group A	%	Group B	%
Cured (91-100% Relief)	02	6.66	0	0
Markedly Improved (70-90% Relief)	21	70	02	6.66
Moderately Improved (50-69 % Relief)	07	23.33	07	23.33
Mildly Improved (25-49 % Relief)	0	0	21	70
Unchange<25 % Relief	0	0	0	0

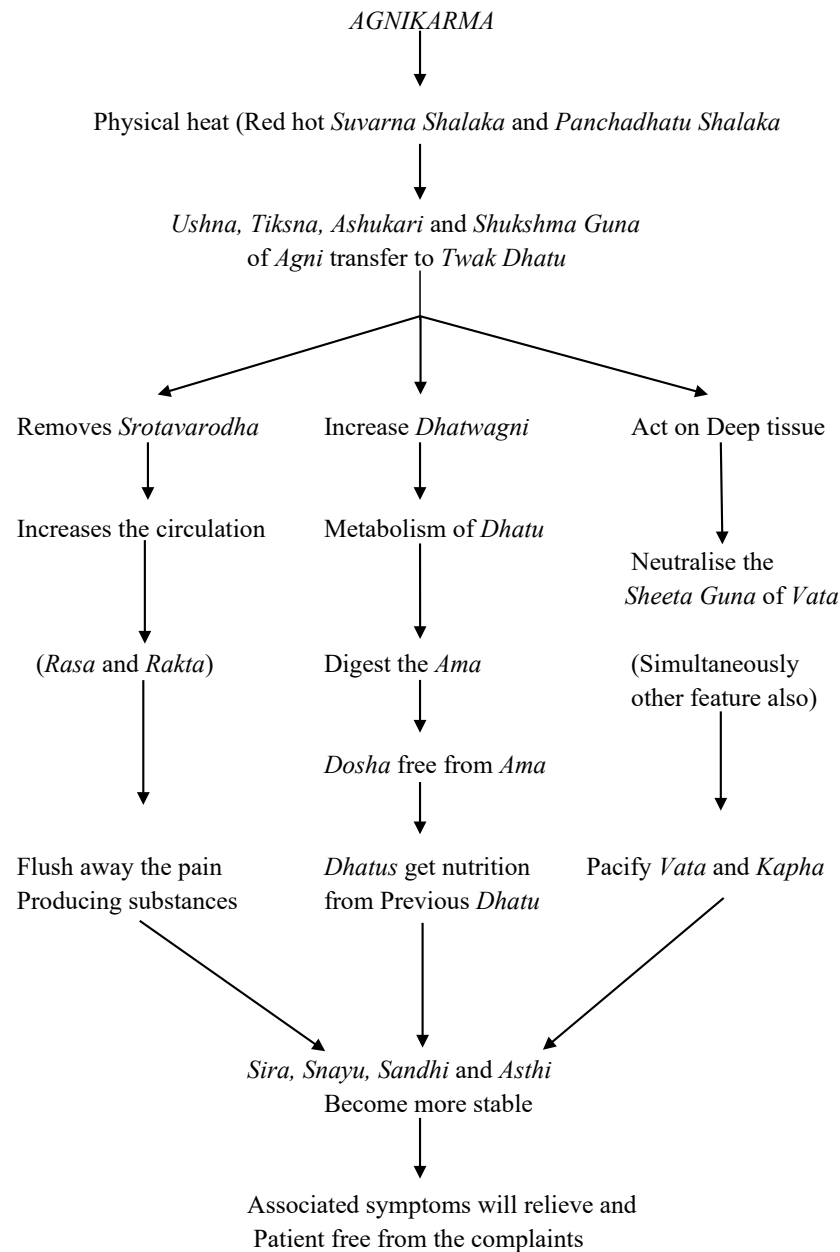


Figure 9. Ayurvedic pharmacological mode of action of Agnikarma.

5. Discussion

In *Sushrut Samhita*, the *Agnikarma* has been selected as one of the therapeutic treatments for Osteoarthritis¹⁹. *Charak* has also recommended *Agnikarma* for deep seated pathology, associated with pain and stiffness, caused by the aggravated *Vata* predominantly²⁰. The existing treatment of O.A are the analgesic and anti-inflammatory drugs being prescribed for its remedy which gives temporary relief and the

continuance of chemist drugs give rise to APD and other complications. Hence the patient is compelled to search complete remedy from O.A. In chronic O.A, the knee replacement by surgical approach may not be possible and affordable for common man and also it does not make fit a healthy knee joint as before. Under the above circumstances the medical research unit finds solution in Ayurveda para surgery. *Sushrut*, the father of the surgery has advocated the *Agnikarma*²¹ “a direct cauterization procedure” para surgical work for

the complete relief of O.A. *Agnikarma* can be applied for *Vataja* and *Kaphajavyadh* (the disease of *Vata* and *Kaphadosha*), grossly in which O.A is one of them as per *Doshic* consideration. *Agnikarma* helps to remove the aggravation of both *Dosha* by its opposite action of heat production (Cauterization).

5.1 Analysis of Thermal Behavior of *Suvarna Shalaka* and *Panchadhatu Shalaka*

The thermal behavior of the *Suvarna Shalaka* and *Panchadhatu Shalaka* were studied by direct methods employed in temperature measurement. The red-hot temperature of *Suvarana*, was found to be 518°C. An immediate decrease to 470°C was observed on removing the *Shalaka* from the heat source while the red hot the temperature of *Panchadhatu Shalaka*, was found to be 260°C. An immediate decrease to 234°C was observed on removing the *Shalaka* from the heat source. This is followed by an approximate dissipation of 2°C to 3°C per minute from *Suvarna Shalaka* and from *Panchadhatu Shalaka* 8°C to 9°C per minute. All the experiments were carried out under normal atmospheric pressure and temperature.

Though *Suvarna Shalaka* has a considerably higher temperature than that of the *Panchadhatu Shalaka* when employed for *Agnikarma*, *Suvarana* due to its higher specific heat (heat retention capacity of metal is high) can affect a greater variation in the temperature of the tissue surface in contact with the *Suvarna Shalaka* and also that of the subsequent layers. Eventually the heat penetration will always be higher when such metals are used for *Agnikarma*.

5.2 Probable Mode of Action of *Agnikarma*

The Osteoarthritis of knee joint (*Janu Sandhigata Vata*) produced by vitiated *Vata Dosha* with or without association of *Kapha*. So, *Agnikarma* is considered as the most preferred therapy to pacify these *Dosha*. The heat application is indicated in cases of chronic inflammation²². The probable mode of action can be described in the form of pharmacological actions which ultimately relieve the disease. The application of the *Agnikarma* produce physical heat by its red

hot *Shalaka* which counts with its various properties *Ushna* (hot), *Tikshna* (acute/potent), *Asukhari* (immediately) and *Sukshma* (minute)²³. By doing cauterization therapy, these properties are transferred to deeper layers dermis followed by epidermis of the skin (*Twak*). Further it penetrates to the deeper *Dhatu* and act probably in following manner; 1. It removes *Srothavarodha* (blockage of channels) which increases the circulation of plasma and blood (*Rasa* and *Rakta*) and thereby flush out/pacifies the pain²⁴. 2. Heat may stimulate lateral spinothalamic tract which leads stimulation of descending pain inhibitory fibers which release endogenous opioid peptide which binds with opioid receptors at substantia gelatinosa rolandi which inhibit release of P-substance (Presynaptic inhibition) and blockage of transmission of pain sensation occur²⁵. 3. Heat leads to vasodilatation, exudation of fluid, increase in white blood cells and antibodies²⁶. It also increases the tissue metabolism which supports for removing the deranged *Doshas* and at the same time it helps in nourishments of body tissues (*Dhatus*) that makes the diseased area healthy. 4. Application of heat nullifies the cold property (*Sheetaguna*) and simultaneously pacifying the aggravated *Vata* and *Kapha Dosha* which subsides the symptoms of the diseases. Under the above mode of action, *Janu Sandhigata Vata* and associated symptoms of disease are treated by *Agnikarma* with *Suvarna Shalaka* and *Panchadhatu Shalka* and relieved. By which the *Sira* (Vein), *Snayu* (Tendon), *Sandhi* (joints) and *Asthi* (Bone) becomes stable. The schematic presentation of mode of action of *Agnikarma* is depicted in Figure 9.

5.3 Probable Mode of Action of *Suvarna*

The use of gold by humans is known for centuries. In this study the use of *Suvarna* in *Agnikarma* revealed that there is significant effect of the metal gold when it comes in direct contact with the skin. Gold ions have been shown to inhibit the lysosomal enzymes of phagocytotic cells, to decrease the number of macrophages in the synovial membrane and to reduce production of pro-inflammatory cytokines in cell culture²⁷.

Synovial macrophages are key players in Arthritis. They are involved in the initiation and perpetuation of inflammation, leukocyte adhesion and migration, matrix degradation and angiogenesis. Macrophages

express adhesion molecules, chemokine receptors and other surface antigens and secrete several chemokines, cytokines, growth factors, proteases and other mediators. Macrophages and their products are key players in the pathogenesis of arthritis and other inflammatory diseases and may be promising therapeutic targets²².

Charged gold atoms are released from pure metallic gold implants by macrophages via a dissolucytosis membrane, and that gold ions are taken up by local macrophages, mast cells and to some extent fibroblasts. These findings open the question of possible immunomodulatory effects of metallic gold and motivate efforts on a deeper understanding of the effect of metallic gold on key inflammatory cells as macrophages.

5.4 Discussion on Clinical Study

In the present study the age group was selected between 40–70 years. Of the 60 patients 51.66% of patients belonged to the age group between 40–50 years, 40% of the patients were in the age group between 51–60 years, 8.33% of the patients belonged to the age group between 61–70 years. This may be due to the reason that most of the patients belonged to the working class and progressive *Vata Prakopa* with advancing age. So, the *Nidana* is more and occurrence of the condition will be easy. In the present study 51.66% of the patients were males and 48.33% of the patients were females. The males are engaging more in physical activities which needed the repetitive flexion and extension of the knee joint according to the part of their job or daily activities. Of the 60 patients 51.66% of patients belonged to middle class, 23.33% and 25% of patients belonged to poor and upper middle class respectively. This might be because the range of physical activity is higher compared to upper middle class and the frequency of rest and work schedule irregular compared to lower middle class. Out of the 60 patients 26.66% were house wives, 15% were labors, 25% were business, 8.33% were farmers, 16.66% were servicemen and 8.33% were retired. As the knee joint is weight bearing joint and the house wives are more in to strenuous physical activity round the clock. Out of the 60 patients 36.66% of patient had hard work, 43.33% of patient had light work and remaining 20% had sedentary work. Continuous exercise keeps the

joints and associated muscles healthy. So, it might be the reason why hard workers are less prone to Osteoarthritis of Knee joint than light workers. Out of the 60 patients 30% resorted to *Viruddhashana*, 18.33% resorted to *Vishamashana*, 26.66% resorted to *Adhyashana*, while 25% of the patients were *Samashana*. *Viruddhashana* in their routine diet which leads to *Agni Vaishamy* and *Vataprakopa* resulting in *Dhatukshaya* which coupled with old age leads to *Sandhigata Vata*. This type of dietary habit affects the *Agni* resulting in formation of *Aama*, leading to *Agnimandya* and in turn *Dhatvagnimandya*, which ultimately obstructs the *Srotas*. Due to obstruction of *Srotas*, *Vata* gets vitiated and affects *Sandhi* of knee resulting into *Janu Sandhigata Vata*. Maximum patients were found to be having some addiction. In this study 60% of the patients were addicted to tea, 8.33% of the patients are addicted to smoking, 16.66% having the habit of tobacco chewing and 15% addicted to alcohol. Addiction plays an important role in the health of joints and muscles. Among them, tobaccos chewing addicted patients were 16.66%. Provocative findings of tobacco chewing on Osteoarthritis of knee joint have been reported from various studies. A joint most always be well bound and stable. But because of *Vyavayi*, *Vikashi* quality, alcohol penetrates in to the tissues and brings about *Slathana* (Loosening) its integrity. In this study, Maximum 76.6% patients had *Madhyama* built, whereas 13.33% patients had *Sthula* built and 10% of patients of *Krusha*. It is observed that *Sthaulya* (obesity) causes excess *Vridhhi* (increase) of *Dushita Medas* and deprive nutrition to later *Dhatu*s, especially *Asthi* and *Majja* which are the *Dushyas* of *Sandhigata Vata*. In *Madhyama* built patients, the cause of *Sandhigata Vata* is taking *Apathyakara Ahara* and *Vihara* as prevailing in the modern lifestyle. In the present study 21.66% of patients had *Vataprakruti*, 15% of patients had *Pitta Prakruti*, 11.66% of patient had *Kaphaprakruti*, *Vata-Kaphaprakruti* was found in 15% of patients, *Vata-Pitta prakruti* was found in 15% of patients, *Pitta-Kaphaprakruti* was found in 11% of patients and 3.33% had *Sannipathaja prakruti*. Here *Vata* predominant *prakruti* showed its natural inclination to cause the disease O.A which is known to have *Vata vikruta lakshana*.

5.5 Discussion

5.5.1 Group A (*Agnikarma* using *Suvarna Shalaka*)

The effect of *Agnikarma* on various cardinal signs and symptoms as assessed on 1st week, 2nd week, 3rd week and 4th week reveals a clinically gradual improvement. Statistically significant results on the 1st week, 2nd week, 3rd week and 4th week are seen in all the signs and symptoms.

5.5.2 Group B (*Agnikarma* using *Panchadhatu Shalaka*)

The effect of *Agnikarma* using *Panchadhatu Shalaka* in various cardinal signs and symptoms as assessed on the 1st week, 2nd week, 3rd week and 4th week reveals a clinically gradual improvement. Statistically significant results on the 1st week, 2nd week, 3rd week and 4th week are seen in all the signs and symptoms.

5.5.3 Discussion on comparative effect of *Agnikarma* using *Suvarna Shalaka* and *Panchadhatu Shalaka*

On comparison the *Suvarna Shalaka* is statistically more significant in Pain, Tenderness, Crepitus, Swelling – Midpoint of patella, Swelling – 2 inches above patella, Swelling – 2 inches below patella, Angle of extension and Angle of flexion than that of *Agnikarma* done using *Panchadhatu Shalaka* in *Janu Sandhigata Vata* (Osteoarthritis of Knee joint). In Group A and Group B in the case of Pain, Tenderness, Swelling – Midpoint of patella, Swelling – 2 inches above patella, Swelling – 2 inches below patella and Angle of flexion, the P values of the symptoms are $P < 0.001$, $P < 0.001$, $P < 0.001$, $P < 0.001$, $P < 0.001$ and $P < 0.001$ respectively. In group A, swelling – midpoint of patella and Angle of extension, the P value is $P < 0.001$ whereas in Group B, P value is $P = 0.023$ and $P = 0.003$ respectively. Thus, the treatment in Group A is more significant than that of Group B in the case of Pain, Tenderness, Crepitus, swelling – Midpoint of patella, swelling – 2 inches above patella, Swelling – 2 inches below patella, Angle of Extension and Angle of flexion.

Hence the *Agnikarma* using with *Suvarna Shalaka* can be considered to be more beneficial than *Agnikarma*

using with *Panchadhatu Shalaka* in the symptoms of *Janu Sandhigata Vata* (Osteoarthritis of Knee joint) such as Pain, Tenderness, swelling – Midpoint of patella, swelling – 2 inches above patella, Swelling – 2 inches below patella and Angle of flexion.

5.5.4 Comparative Percentage Relief of Group A and Group B

The comparative percentage relief in signs and symptoms of Group A and Group B are as follows:

1. Pain: 62.83% of relief in Group A and 43.44% in Group B
2. Tenderness: 100% of relief in Group A and 89.24% in Group B
3. Crepitus: 90.42% of relief in Group A and 23.85% in Group B
4. Swelling–Midpoint of patella: 100% of relief in Group A and 95.23% in Group B
5. Swelling–2 inches above patella: 100% improvement in Group A and 89.57% in Group B
6. Swelling–2 inches below patella: 100% improvement in Group A and 100% in Group B
7. Angle of Extension: 84.54% improvement in Group A and 33.36% in Group B
8. Angle of Flexion: 88.88% improvement in Group A and 54.36% in Group B

5.5.5 Evidence of *Agnikarma* from Previous Studies

The efficacy of *Agnikarma* is well documented in various *Vataja* and *Vata-Kaphaja* dominant musculoskeletal disorders such as in *Gridhrasi* (sciatica) by using *Lauha*, *Tamra* and *Panchadhatu Shalakas*²⁸, in *Sandhigata Vata* (osteoarthritis of knee joint) by using *Rajata* and *Loha Dhatu Shalaka*²⁹, in the management of tennis elbow by using *Panchadhatu Shalakas*³⁰ in *Kati Sandhigata Vata* (*lumbar spondylosis*) by using *Panchadhatu Shalaka*³¹. In all such conditions *Agnikarma* is found to be very helpful specially to control the *Shool* (pain), *Stambha* (stiffness), *Gaurava* (heaviness) and *Shotha* (swelling). The effect of *Agnikarma* depends upon various factors such as thickness of *Shalaka*, its shape, temperature, type of *Shalaka* used, number of sittings *Agnikarma* performed, severity of disease etc. *Bindu* type of *Agnikarma* is the most preferred, easiest to perform and even suitable for the cosmetic purpose. The study

done by Jethava NG, Dudhamal TS and Gupta SK on role of *Agnikarma* in *Sandhigata Vata* found that both *Rajat* and *Loha Shalaka* were having no statical difference in the results, however in pain relief, *Loha Shalaka* provided better results than *Rajata Shalaka*²⁹. Though, *Panchdhatu Shalaka* is the most commonly used for performing *Agnikarma* but in present study *Suvarna Shalaka* gave better results.

6. Conclusion

Patients of both Group A (*Suvarna Shalaka*) and Group B (*Panchadhatu Shalaka*) show statistically significant difference in majority of the signs and symptoms of *Janu Sandhigata Vata* (Osteoarthritis of Knee joint). On comparison the *Agnikarma* using *Suvarna Shalaka* is statistically more significant in Pain, Tenderness, swelling – Midpoint of patella, swelling – 2 inches above patella, swelling – 2 inches below patella, Angle of extension and Angle of flexion than that of *Agnikarma* done using *Panchadhatu Shalaka* in *Janu Sandhigata Vata* (Osteoarthritis of Knee joint). *Agnikarma* is a non-pharmaceutical, OPD procedure requires minimum equipment so that it can be used for management of *Janu Sandhigata Vata* (Osteoarthritis of Knee joint). In present study, highly significant improvement in pacifying the symptoms of O.A was observed by using *Suvarna Shalaka* than with *Panchadhathu Shalaka*. The temperature of *Suvarna Shalaka* was standardized in to 470°C.

7. Limitations of Study

The prevalence of degenerative joints disorders increases with the advancing age but the present study excluded the patient having age more than 70 years. Use of latest imaging techniques would have given better objectivity to the results of the *Agnikarma* in the management of osteoarthritis but present study lacking this aspect.

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