

AN OPEN CLINICAL STUDY EVALUATING THE THERAPEUTIC EFFECT OF SVAYAMBHUVAGUGGULU VATI IN JANUSANDHIGATAVATA W.S.R TO OSTEOARTHRISIS

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ABSTRACT

Mobility is the basic character of life. It is dependent on the structural as well as functional character of the physical as well as psychological body. Body is developed and nourished by food from time to time. Though proper nourishment is available, the body loses its qualitative capacity of structure and function as the age advances. *Sandhigataavata* is a type of joint disorder characterized by pain and swelling. The pathogenesis of *sandhigata* reveals the involvement of *vata* and for that reason it has been included in the category of *vatavyadhi*. Osteoarthritis is characterized by joint pain, swelling and limitation of movement. As the knee joint is the weight bearing joint and it is more susceptible to wear and tear. Osteoarthritis of knee is major health problem as large percentage of population suffers from this. In literature many treatment modalities are explained like administration of *snehana*, *upanaha*, *bandhana*, *agnikarma* etc and innumerable *shamana* yoga are also mentioned. To explore a safe and cost effective *shamanachikitsa* which can give better cure this study on *Svayambhuvagugguluvati* is selected **Source of data:** A minimum of 20 patients suffering from *JanuSandhigataavata* irrespective of gender and caste were selected from OPD and IPD of SDM Ayurveda hospital, Udupi **Study design:** It was an open clinical study with pre and post-test design. **Intervention:** 20 patients were subjected to oral medication with *Svayambhuvagugguluvati* in a dose of 4 tablets of 500 mg OD for 14 days. **Result:** Statistically significant results were observed. **Conclusion:** The *Svayambhuvagugguluvati* is effective in reducing the symptoms of *Janusandhigataavata*.

Keywords: *Vatavyadhi*, *Sandhigataavata*, *Margavaranajanya*, *Dhatukshayajanya* etc

INTRODUCTION

To live with pain is the worst tragedy that can happen to any living being. There are many reasons for pain. The most com-

mon cause of joint pain often affecting the middle aged and older people is Osteoarthritis (OA). *Vatadosha* is considered to play

a major role in maintaining *samyavastha* of *tridosha*¹. *Vatadosha* is also responsible for the vitiation of other *dosha, dhatu* and *mala*. All *dhatu* undergo *kshaya* leading to *vata-prakopa* and making individual prone to many diseases. *Sandhigatavata* is described under *vatavyadhi* in all the *Samhita* and *Sangrahagrantha*. The affliction of *sandhi* by *prakupitavata* is chief phenomena in *samprapti* of *Sandhigatavata*. It is a *kashtasadhyavyadhi* and mainly occurs due to the etiological factors which are classified as *dhatukshayajanya* and *margavarajananya*.

Osteoarthritis (OA) is inflammation of joints marked by progressive cartilage deterioration. Its high prevalence especially in elderly and high rate of disability related to the disease makes it an important disease to be known. The main symptoms are pain, stiffness, swelling, crepitus, and restricted movements of the joints.

Aging and Obesity are the major risk factors of increased prevalence, as the occurrence of osteoarthritis is on rise. It is reported that these degenerative changes in joints arise from the age of 40 and by the age of 65 years 80% of the people may have radiographic evidence of osteoarthritis although only 25% may have symptoms.

Osteoarthritis of knee is one of the most prevalent forms of this degenerative joint disease and is associated with pain and functional impairment². The functional impairment is seen which mainly deals with the movements.

The etiology of pain is multifactorial, including inflammatory and non-inflammatory causes. The disease is managed by NSAIDs, Analgesic drugs, physiotherapy and corticosteroids etc. Above drugs are very costly and cause adverse effects.

Even the surgical treatment does not provide complete relief.

The treatment modalities which are mentioned in the contemporary science include non-pharmacological and pharmacological measures. Exercises, lifestyle changes and proper medication play an important role in reducing the symptoms. In few cases where other treatments have not been helpful, surgery to repair, strengthen or replace damaged joints may also be considered. If not treated properly it will lead to further complications. Although it helps for the symptomatic relief, there will be less response and more side-effects.

In Ayurvedic point of view the increased morbidity of the disease are regulated by many treatment principles. *Samshodhna* and *samshamana chikitsa* includes *antaparimarjana* and *bahiparimarjana chikitsa*. The common treatment has been explained by *Acharya Charaka*. Later other authors described about the specific treatment of the disease. *Snehana, svedana, mardana, upanaha, agnikarma* and *bandhana*³ are the specific line of treatments.

In spite of vigorous research works on this area with different modalities of the treatment mankind is still leading miserable life with this disease. It is the need of hour to explore an effective, economic and domiciliary management against this disorder. Hence it is planned to prove clinically the efficacy of *Swayambhuvaguggulu vati*⁴ in *JanusandhigataVata*.

OBJECTIVES

1. To evaluate the therapeutic effect of *Swayambhuvagugguluvati* in patients suffering from *JanusandhigataVata*

MATERIALS AND METHODS

STUDY DESIGN

Open clinical study with pre-test and post-test design.

SOURCE OF DATA

20 patients diagnosed as *Janusandhigatavata*/Osteoarthritis(knee) fulfilling the diagnostic/ inclusion criteria were taken for study from OPD and IPD of SDM Ayurveda Hospital, Udupi, Karnataka.

DRUG

The drug *Svayambhuvagugguluvati* each of 500 mg was obtained from SDM Ayurveda Pharmacy, Udupi.

METHOD OF COLLECTION OF DATA

A special proforma was prepared incorporating all the clinical manifestation and assessment criteria including laboratory investigation findings of the *Sandhigatavata*/Osteoarthritis. Complete data including detailed clinical history and complete physical examination were collected from all the selected patients as per this proforma.

DIAGNOSTIC CRITERIA

1. Patient fulfilling the diagnostic criteria according to ACR diagnostic guidelines of osteoarthritis of the knee⁵
2. Patient presenting with symptoms diagnostic of *JanusandhigataVata* – *janusandhigatasoola*, *sopha* and *stabdhatha*

INCLUSION CRITERIA

1. Patients diagnosed as *JanusandhigataVata* fulfilling the diagnostic criteria of Osteoarthritis of knee
2. Age group between 40 to 70 years is selected.

EXCLUSION CRITERIA

1. Age group above 70 and below 40 years.
2. Patients with Tuberculosis, Rheumatoid Arthritis, Systemic Lupus Erythematosus, Psoriatic Arthritis, Gouty Arthritis.

3. Complications of OA like psuedogout, Spontaneous Osteonecrosis of the knee, ruptured Baker's Cyst.

ASSESSMENT CRITERIA

Subjective Parameters

1. Knee joint pain
2. Stiffness
3. Visual Analogue Scale⁶

Objective Parameters

1. Swelling-girth of the joint
2. Movement of joints
3. Goniometer findings
4. WOMAC index for Osteoarthritis⁷

INTERVENTION

***SvayambhuvagugguluVati* - 4 tablets each of 500 mg will be administered once a day at morning in empty stomach with the anupana of Ushnajala for 14 days.**

Follow up Period: 14 days.

Duration of study: 28 days.

INVESTIGATIONS

➤ ***Haematological investigations*** –

- Hemoglobin in %
- Total leukocyte count
- Differential leukocyte count
- Erythrocyte sedimentation rate
- Random blood sugar

➤ ***Urological investigations***:

- Sugar, Albumin & Microscopic

➤ ***Radiological Investigations***:

- X-ray : AP & Lateral view of knee

OBSERVATIONS

Among the 20 patients selected, maximum number (45%) of patients belonged to 61 to 70 years age group. Majority of them are females (70%) and married (95%). Most of the patients (85%) are living in *anupa desha*. All patients had Gradual onset. Majority (60%) was house wives and working manually and maximum number (70%) of patients registered are from middle

class. Study reveals that maximum numbers of patients (70%) had no addictions. Most of them are taking *vishamashana*. Most of them are having negative family history. Majority (90%) were of *vatakapha prakriti*. All patients had *madhyama sara*, *madhyama samhanana*, and *madhyama satmya*. Majority (90%) had *madhyama satva*. Maximum have *pravara abhyavarana Shakti* (70%) and *avara vyayama Shakti* (90%). All patients were of *Madhyama vaya*. According to *nidana* majority of the patients had *ativyayama*, *katu aahara* and *laghu aahara* as *nidana*. According to symptomatology maximum have pain, swelling, crepitus and tenderness as symptoms. WOMAC score of most of the patients (85%) were between 52 and 76.

RESULTS

Administration of *Svayambhuvaguggulu vati* found to be effective in reducing the pain. Mean score for pain reduced from 2.700 to 1.050 after the treatment. The analysis by applying the paired “t” test proved the statistical significance of the improvement as $P < 0.001$. (Table 1)

The mean score for morning stiffness reduced from 0.900 to 0.150 after treatment. The analysis by applying the paired “t” test proved the statistical significance of the improvement as $P = < 0.001$. (Table 2)

The efficacy of *Svayambhuvaguggulu vati* on swelling in knee is statistically significant with the P value 0.002. The mean value reduced from 2.050 to 1.650. (Table 3)

When treated with *Svayambhuvaguggulu vati* the mean value of tenderness in knee joint got reduced from 2.450 to 1.100 which is statistically highly significant ($P = < 0.001$). (Table 4)

Effect on range of movement of knee is statistically significant. The increase of mean value from 125.800 to 130.600 was statistically significant with $p = < 0.001$. (Table 5)

Effect on the time taken to walk 30 m is statistically not significant. There was slight reduction of mean value from 1.250 to 1.150 and the p value is 0.163. (Table 6). Effect on time taken to do 10 sits ups was statistically significant with the reduction of mean value from 3.600 to 2.850 and the $p = < 0.001$. (Table 7). On effect of time taken to climb 10 steps, statistically significant value is observed ($p = < 0.001$). Due to the effect of *Svayambhuvaguggulu vati* the mean value got reduced from 1.95 to 1.35. (Table 8). The change of WOMAC score after treatment indicates statistically significant value ($p = < 0.001$). The mean value of WOMAC score reduced from 2.850 to 2.050. (Table 9)

The overall effect in this treatment, percentage improvement of the patients with respect to their score symptoms showed that 5% of the patients fell into mild, 85% into moderate improvement and 10% into marked improvement category.

DISCUSSION

Sandhigatavata is one among the *vata vyadhi*, affecting the *sandhi*. It compels the patients to lead unproductive life due to physical disability and the disease is known since vedic period.

Sandhigatavata is caused by morbid *vata dosha*, though sometimes *kapha dosha* may also be associated. Pain is the clinical hallmark of the disease. The morbid *vata dosha* does *shoshana* of *shleshaka kapha* situated in *sandhi* and it is more evident in *asthi dhatu* as *asthi* and *vata* are having aa-

shrayaashrayisambandha. It clinically presents as *shotha*, *shoola*, *stabdata* and *sandhisputana*.

In modern parlance it can be compared with degenerative disease of joints i.e., Osteoarthritis. Osteoarthritis is common among musculoskeletal disorders and is important cause of disability. It is the second commonest musculoskeletal problem in the world (30%) after low back ache (50%). It is a chronic degenerative disorder of multifactorial etiology characterized by loss of articular cartilage and periarticular bone remodeling. It involves the entire joint including the nearby muscles, underlying bone, ligament, synovium and capsule. The risk factors for osteoarthritis are old age, obesity, female sex, major joint trauma, repetitive stress, genetic factors, prior inflammatory joint diseases and metabolic or endocrine disorders.

While going through the historical review, we can observe that *sandhigatavata* has been mentioned in all *Bruhatrayi* and *Laghutrayi*. *AcharyaCharaka* was the first who described the disease separately under the name of *SandhigataAnila* and *Acharya Sushruta* was the first who has given a line of treatment for *Sandhigatavata* separately. *Janusandhigatavata* is found by three words where in the part, *Janu* is defined as the junction between *uru* and *jangha* is the *adhishtana*. *Vata* which is vitiated moves and localizes in the *Janusandhi* producing the disease. The disease Osteoarthritis in parlance refers to a degenerative inflammatory disorder especially of the weight bearing joints, with presence of progressive loss of articular cartilage.

These etiological factors vitiate *vata* leading to *khavaigunya* and thus

sthanasamsraya causing *kevalavataja sandhigatavata*. Another pathology leading to *sandhigatavata* is *dhatukshaya*. Here age factor and increased *vata* causes *dhatukshaya*. *Margavarana* of *poshakadhatu* due to *medovridhi* and *kaphakara nidana* also leads to *vataprakopa*. This pathology leads to *margavaranajanya sandhigatavata*. Thus *prakupitavata* gets accumulated in the *asthi-sandhi* where *rikta srotas* is already present. Hence *doshadushyasammurchana* takes place leading to the entity.

The first and foremost risk factor of osteoarthritis is age. Factors like genetics, trauma, obesity, joint stress, endocrine disorders, psychological, metabolic disorders, constitutional and miscellaneous causes also lead to this disease. Initially there is loss of cartilaginous matrix followed by formation of cartilaginous clusters which further breaks into pieces of cartilage exposing subchondral bone. The underlying pathological changes here are inflammatory condition and foreign body cell reaction. Evidences showing changes in the shape of joint surface with osteophytes and spur formation. Later this leads to ossification and chronic synovitis.

Symptoms of *Janusandhigatavata* are *Sandhishula*, *Sandhishotha*, *Akunchana*, *PrasaranjanyaVedana* and *Hantisandhigati* described by various *Acharya*. Here, *Sandhishula* and *Sandhishotha* occur due to *Vataprakopa*. A special type of *Shotha* i.e. *Vatapurnadritisparsha* or *Atopa* is mentioned which indicates *Vata* dominance of *Shotha*. *Akunchanaprasaranjanyaavedana* and *hantisandhigati* occurs due to *Kaphakshaya* and *Vataprakopa*. Symptoms of Osteoarthritis are similar as of *Sandhigatavata* i.e. joint

pain, swelling, stiffness, disability and crepitus in the joint.

Since the diagnosis is depending upon the *lakshana*, *sandhigatavata* can be differentiated from other similar disease entities. With the affliction of *gambhiradhathu*, *marma* and *madhyama rogamarga* gait is very difficult to cure completely. In chronicity only palliative treatment can be given for the time being. No treatment can be given for the degenerative processes. Since it is considered as *mahagada* it is *kashtasadhyavyadhi* or *asadhya*.

Acharya Charaka has mentioned repeated use of *Snehana*, *Svedana*, *Basti* and *Mruduvirechana* for the treatment of *Vatavyadhi*. He has not mentioned the treatment of *Sandhigatavata* separately. *Acharya Sushruta* has described specific treatment for the *Sandhigatavata* i.e. *Snehana*, *Upanaha*, *Agnikarma*, *Bandhana* and *Unmardana*. According to Ayurveda, treatment is 'Vighatana of Samprapti'.

In *vridhavastha*, *agnivaishamyia* is also one of the reasons for *vataprakopa*. Here *shamanachikitsa* helps to achieve the *agnisamata*. Increased morbidity is the cause for *kevalavatajanya sandhigatavata*. *Shamanoushadhi* can alleviate this morbidity. In *dhatukshayajanya sandhigatavata* which especially occur in *vardhakya* can overcome by *Rasayanadravya* which nourishes the *dhathu*.

The effect of treatment was analyzed by scoring and was assessed statistically to see the significance. It included the assessment of pain, swelling, morning stiffness, tenderness, restricted movements and functional abilities.

The pain was recorded and analyzed during every follow up. The initial mean

pain score on knee joint before treatment was 2.700 and it reduced to 1.050 on 14th day follow up. Here mild increase of pain was observed during the second follow up. The mean value slightly rose to 1.150 on 28th day. The little increase of pain after the 3rd week may be due to some daily activities. The remission of pain after treatment is statistically highly significant ($P < 0.001$). This observation is proving the efficacy of Svayambhuvaguggulu vati in controlling the stage of the disease by the *shoolahara* property of the drugs specially *Guggulu*.

Due to the effectiveness of *Svayambhuvagugguluvati* in the morning stiffness in knee joint, the mean score before treatment gradually reduced from 0.900 to 0.150 on 14th day. On 28th day the decrease of symptoms was less compared to other weeks. This may be due to sedentary life style and daily activities. The effectiveness of *Svayambhuvagugguluvati* is statistically significant ($P < 0.001$). This may be due to the *Vatahara* property of most of the drugs which helps to alleviate the *Sthambha* of the joints.

The efficacy of *Svayambhuvagugguluvati* on swelling in knee is statistically significant with the P value 0.002. The mean value reduced from 2.050 to 1.650 on 14th day of treatment. Analyzing the weekly assessment of the treatment it was observed that the improvement with *Svayambhuvagugguluvati* is more seen in the second week. The improvement with *Svayambhuvagugguluvati* on swelling indicates the *Shothahara* property of *Suddhaguggulu*.

When treated with *Svayambhuvagugguluvati* the mean value of tenderness in knee joint got reduced from 2.450 to 1.100. From the day one the changes in the symptom were observed. Till 14th day the

velocity of the line is steady, later on 21st and 28th day follow up the effect on the symptom has got static. But overall efficacy with *Swayambhuvagugguluvati* is statistically highly significant ($P < 0.001$). The *Shoolahara* and *Shothahara* property along with *Tridoshagna* property of the drugs helps to reduce the symptoms.

Effect on range of movement of knee is statistically significant with very good improvement observed in second week. The increase of mean value from 125.800 to 130.600 was statistically insignificant with $p < 0.001$. Difference in means was 4.800 and the maximum response was observed, during the second week.

Effect on the time taken to walk 30 m is statistically not significant. The line diagram shows improvement during the second week of treatment. There was slight reduction of mean value from 1.250 to 1.150 and the p value is 0.163

Effect on time taken to do 10 sits ups was statistically significant with the reduction of mean value from 3.600 to 2.850 and the $p < 0.001$. The line diagram shows drastic changes with effectiveness of *Swayambhuvagugguluvati* till the 14th day.

On effect of time taken to climb 10 steps, statistically significant value is observed ($p < 0.001$). Due to the effect of *Swayambhuvagugguluvati* the mean value got reduced from 1.95 to 1.35. This is due to the *sothahara* and *shoolahara* as well as *Kaphavata shamaka* property of drugs mainly *Guggulu*, *Pippali*, *saindhava* and *ksharadwaya*.

The change of WOMAC score after treatment indicates statistically significant value ($p < 0.001$). The mean value of WOMAC score reduced from 2.850 to 2.050.

This is due to the effect of anti-inflammatory, anti-arthritic and analgesic property of the drugs of the drugs of *Swayambhuvagugguluvati*.

The overall effect in this treatment, percentage improvement of the patients with respect to their score symptoms showed that 5% of the patients fell into mild, 85% into moderate improvement and 10% into marked improvement category.

PROBABLE MODE OF ACTION

Selectivity and affinity are the principle parameter which characterizes the interaction between drug and receptor. Multiple receptors are present in the body for single drug. *Samprativighatana* is said to be the treatment. Therefore, the action of drug means to dismantle the *Samprapti Ghataka* of the disease. Hence to explain the mode of action of a drug means to establish a relationship between the *Samprapti Ghataka* of the disease and pentagonal principles of *Rasa*, *Guna*, *Virya*, *Vipaka* and *Prabhava* of the drugs.

Swayambhuva Guggulu:

Swayambhuva Guggulu was selected as a form of oral administration of drug in *Janusandhigatavata*. This drug, which is useful in *Vata Vyadhi* has been mentioned in classical text. It is *Tridoshanashaka*, *Shulahara*, *Vedana Sthapana*, *Shothahara*, *Deepana* and *Pachana*.

The *shamanoushadhi Swayambhuva-gugguluvati* mainly consist of *Chitraka*, *lavanatraya*, *ksharadwaya*, *shunti*, *triphala*, *jeerakadwaya*, *shuddhaguggulu* and is mentioned in *Vatavyadhi adhikara*. The drugs like *chitraka*, *shunti*, *saindhava lavana* alleviate *kaphavata*. They have anti-inflammatory action. *Shunti* has anti-oedematic activity. *Shunti*, *pippali*, *chitraka*,

jeerakadwaya and sudhaguggulu help to reduce vata kapha. They are having action on inflammation. It also acts as analgesic. Guggulu has anti-arthritic and anti-rheumatic action.

The property of it can be considered as *Katu Tikta rasa*, *Ushnaveerya* and *Vata-kaphashamaka*. Drugs are having *Laghu* and *Ruksha Guna*. Majority of the drugs in *Svayambhuvagugguluvati* have *UshnaVirya* and *Vata-kaphahara* property. *Katu* and *Tikta Rasa* present in *Svayambhuva Guggulu* possess an antagonistic property to that of *Vata* and *Kapha* which are the chief causative factor in this disease. Because of their *Vatashamaka* property, they increase digestion power, which also digest *Ama Rasa* and reduce the excessive production of *Kapha*. It also removes the obstruction of *Srotas*. Because of *Ushna Virya*, it also alleviates vitiated *Vata*; hence pain, swelling, tenderness and stiffness in joint were reduced.

CONCLUSION

The current study can be concluded by stressing upon the literary aspects of *sandhigatavata*, clinical diagnosis along with observations done during and after the course of treatment; beneath the beam of both Ayurveda and Conventional medicine. After the completion of the study the following are the conclusions drawn.

- ❖ *Janusandhigatavata* (Osteoarthritis of the Knee) is the degenerative joint disorder; mainly occurring in the middle and old age people.
- ❖ It is a *kashtasadyavata vyadhi* which requires prolonged treatment and maintenance with restricted work.
- ❖ The morbidity of *vyanavayu* either by *dhathukshaya* or *margavarana* is the main cause.

- ❖ Females, house wives, age group between 51 to 60 and *Vata kapha prakriti* are more prone to the disease.
- ❖ Pain, stiffness, swelling, tenderness, crepitus and restricted movements of the knee are the cardinal features of *Janusandhigatavata* as per the study.
- ❖ *Svayambhuvagugguluvati* is very effective in reducing the symptoms such as pain, stiffness, swelling, tenderness, restricted movements, and all functional abilities.
- ❖ The overall effect showed that 85% of the patients fell into moderate improvement and 5% into mild improvement and 10% of patients into marked group with *Svayambhuvaguggulu vati*.
- ❖ Adverse reaction in relation to the medicine used was not observed during the follow up of the patients.

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Table No.1.Effect on pain at knee joint on 14th day

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (± SE)	AT (± SE)		SD	SEM	t	P
2.700 ±0.219	1.050 ±0.114	1.650	0.671	0.150	11.000	<0.001

Table No.2.Effect on morning stiffness on 14th day at knee joint

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	t	P
0.900 ±0.0688	0.150 ±0.0819	0.750	0.444	0.0933	7.550	P=<0.001

Table No.3.Effect on swelling on 14th day atknee joint

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	t	P
2.050 ±0.185	1.650 ±0.167	0.400	0.503	0.112	3.559	P=0.002

Table No.4.Effect on tenderness on 14th day at knee joint

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	T	P
2.450 ±0.211	1.100 ±0.124	1.350	0.671	0.150	9.000	P=<0.001

Table No.5.Effect on range of movement of knee joint on 14th day

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	T	P
125.800 ±1.897	130.600 ±1.590	-4.800	3.270	0.731	6.564	P=<0.001

Table No.6.Effect on time taken to walk 30 m on 14th day

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	t	P
1.250 ±0.123	1.150 ±0.0819	0.1000	0.308	0.0688	1.453	P=0.163

Table No.7.Effect on time taken to do 10 sits up on 14th day

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	t	P
3.600 ±0.134	2.850 ±0.131	0.750	0.444	0.0993	7.550	P=<0.001

Table no.8.Effect on time taken to climb 10 steps on 14th day

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	t	P
1.950 ±0.153	1.350 ±0.109	0.600	0.503	0.112	5.339	P=<0.001

Table no.9.Effect on WOMAC score on 14th day

MEAN		DIFFERENCE IN MEANS	PAIRED 't' TEST			
BT (±SE)	AT (±SE)		SD	SEM	t	P
2.850 ±0.0819	2.050 ±0.0500	0.800	0.410	0.0918	8.718	P=<0.001

GRADINGS

1. Visual analogue scale (Pain) of knee joint

Pain	VAS Score	Grade
Nil Pain	0	0
Not very severe	0-25	1
Quite severe	25-50	2
Severe	50-75	3
Very severe	75-100	4

2. Morning Stiffness of knee joint

Stiffness of knee joint	Score	Morning Time	Grade
None	0	0 hrs	0
Mild	0-2	0 – 1:15hrs	1
Moderate	2-4	1:15 – 1:30hrs	2

Severe	4-6	1:30 – 1:45hrs	3
Extreme	6-8	1:45 - 2hrs	4

3. Swelling of knee joint measured by measurement Tape

Swelling of knee joint	Diameter of knee joint in cm	Grade
None	0	0
Mild	0-35cm	1
Moderate	35-40cm	2
Severe	40-45cm	3
Extreme	45-50cm	4

4. Assessment of knee joint Tenderness

Tenderness	Grade
No Tenderness	0
The patient says the joint is tender	1
The patient winces	2
The patient winces and withdraws the affected part	3
The patient will not allow the joint to be touched	4

5. Range of knee movement flexion

Range of movement	Movement Angle	Grade
None	>130o	0
Mild	130o-120o	1
Moderate	120o-110o	2
Severe	110o-100o	3
Extreme	100o-90o	4

Functional Ability

6. Time taken to walk 30 meters

Time taken to walk 30 meters	Time	Grade
Easily	0	0
With mild difficulty	0-30sec	1
With moderate	30sec-1min	2
With marked difficulty	1min-1min30sec	3
Impossible	1min30sec-2min	4

7. Time taken to do 10 sit ups

Time taken to do 10 sit ups	Time	Grade
Easily	0	0
With mild difficulty	0-30min	1
With moderate	30min-1hrs	2
With marked difficulty	1hrs-1:30hrs	3
Impossible	1:30hrs-2hrs	4

8. Time taken to climb 10 steps

Time taken to climb 10 steps	Time	Grade
Easily	0	0
With mild difficulty	0-1min	1
With moderate	1min-2min	2
With marked difficulty	2min-3min	3
Impossible	3min-4min	4

9. WOMAC Score Grading

WOMAC Questions	WOMAC Score	Grade
None	0	0
Mild	0-26	1
Moderate	26-52	2
Severe	52-78	3
Extreme	78-104	4

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