Clinical Research

Clinical evaluation of *Boswellia serrata* (Shallaki) resin in the management of *Sandhivata* (osteoarthritis)

P. K. Gupta¹, S. M. S. Samarakoon², H. M. Chandola³, B. Ravishankar⁴

¹MD (Ayu), Senior Medical Officer, Dehradun, Uttarakhand, India, ²Senior Lecturer, GWAI, University of Kelaniya, Sri Lanka, ³Professor and Head, Department of Kayachikitsa and Roga Nidana and Vikriti Vijnana, ⁴Director, R and D, SDM Research Centre for Ayurveda and Allied Sciences, Udupi, Karnataka, India

**Abstract**

*Sandhigata vata* is described under *Vatavyadhi* in all Ayurvedic texts. Charaka was the first to describe separately “Sandhigata anila”, but it was not included under 80 types of *nanatmaja vatavyadhi*. Osteoarthritis is the most common degenerative joint disease that begins asymptotically in middle age with progressive symptoms in advancing age. Majority of people by the age 40 years may develop osteoarthritis, especially in weight bearing joints. Females are prone with 25% prevalence, whereas males have a prevalence of 16%. In the present study, 56 patients fulfilling the diagnostic criteria of *Sandhigata vata*, divided into two groups. Patients of first group were administered with 500 mg capsule of Shallaki, 6 g per day (in three divided doses) with lukewarm water (*n*=29) and the second group) capsule Shallaki as above along with local application of Shallaki ointment on the affected joints (*n*=23). After a course of therapy for 2 months, symptomatic improvement was observed in both the groups at various levels with promising results in the patients of first group.

**Key words:** *Boswellia serrata*, degenerative diseases, osteoarthritis, *Sandhigata vata*, Shallaki

**Introduction**

Osteoarthritis (OA) is the most common form of arthritis, which is degenerative in nature. It is characterized by progressive disintegration of articular cartilage, formation of new bone in the floor of the cartilage lesions (eburnation) and at the joint margins (osteophytes), and leads to chronic disability at older ages. Clinical manifestations of OA range from mild to severe, and affect the joints in hands and weight bearing joints such as knees, hips, feet and spine. OA is a clinical syndrome characterized by joint pain, tenderness, limitation of movements, crepitus, occasional effusion and disability at older ages.

According to epidemiology, the prevalence of OA in India is 22-39%. Radiographic evidence of OA is present in majority of people over age 65; among them, 80% people are over 75 years. Approximately, 11% of those over 65 have symptomatic OA of the knee. In India, 5.3% males and 4.8% females are aged more than 65 years. OA strikes women more often than men and it increases in prevalence, incidence and severity after menopause. The etiology of OA is multifactorial. Various morphological as well as biochemical changes result in a softened, ulcerated and malfunctioning articular cartilage. It has been postulated that age, gender, body weight, repetitive trauma and genetic factors are the risk factors which play an important role in the manifestation of OA.

Sushruta has described the disease in *Vatavyadhi* chapter under the heading of *Sandhigata vata*, while Charaka has described *Sandhigata vata* under the *Vatavyadhi* as *Sandhigata Anila*. The diseases produced by morbid *vatadosha* are more common in *jaravastha* (old age). The vitiated vata combines with other vitiated *dosha*, *rakta*, *ama* etc and gets located in the joint to produce the disease. Being a disease related to *madhyamarogamarga*, *Sandhigata vata* is either *Kastasadhya* or *Asadhya*. On the basis of symptomatology and nature of the disease, *Sandhigata vata* is much similar to OA, which is the most common degenerative joint disease in older people.

**Aims and objectives**

The present study was carried out to assess the efficacy of Shallaki (*Boswellia serrata* - Resin) on *Sandhigata vata* (OA) and to assess the comparative effect of Shallaki capsule given orally with combined therapy of Shallaki capsule given orally with Shallaki ointment applied externally.

**Materials and Methods**

A total of 56 patients with signs and symptoms of *Sandhigata vata*...
(OA), irrespective of age, sex, occupation etc who attended OPD of Department of Kayachikitsa in IPGT and RA Hospital, Gujarat Ayurved University, Jamnagar, were selected for the clinical trial. Out of these, 49 patients could complete the study and 07 patients discontinued the treatment.

**Inclusion criteria**
Patients between 40 to 70 years of age, presenting with clinical signs and symptoms of Sandhivata, viz. Shula (joint pain), shotha (joint-swelling), stambha (stiffness), sparsha asahyata (tenderness), sphutana (crepitus), akunchana prasarana vedana (pain during flexion and extension of the joint) etc and patients without any anatomical deformity were included.

**Exclusion criteria**
Patients below 40 years and above 70 years of age, suffering from uncontrolled diabetes, joint pathologies other than OA (psoriatic arthritis, gouty arthritis, systemic lupus erythematosis, bone 'TB'), having other serious systemic disorders were excluded from the study.

**Ethical issues**
This study was cleared by the institutional ethics committee. Before starting the treatment, written consent was taken from the patients and detailed clinical history was taken in the clinical research proforma based on modern and Ayurvedic parameters. The study was conducted as a randomized, single-blind clinical trial.

**Dose, duration and diet**
The patients of group A were treated with Shallaki capsule 6 g in three divided doses with lukewarm water after meal, whereas patients of group B were treated with Shallaki capsule in the same dose, duration, frequency and anupana along with local application of Shallaki ointment.

**Criteria for assessment**

i. **Subjective criteria:** Signs and symptoms were provided with scoring depending upon their severity and assessed before and after treatment. Total improvement was categorized as follows: No improvement: 0-25%, mild improvement: >25-50%, moderate improvement: >50-75%, marked improvement: >75-<100% and complete remission: 100%.

ii. **Radiological findings:** Improvement was assessed on the basis of joint space, subarticular sclerosis, articular margin, articular erosion, any soft tissue abnormalities, ankylosis, synovial effusion, deformity, osteophytes and marginal erosion in comparison to initial finding.

iii. **Mental state:** Patient’s mental state was evaluated by ‘Jung self-rating anxiety scale’ and ‘Jung self-rating depression scale’.

iv. **Objective criteria:** The routine hematological and biochemical investigations, urine analysis and estimation of C reactive protein (CRP) were carried out before and after treatment. The results obtained were analyzed by student’s test (paired and unpaired).

**Observation and Results**

**Effect of therapy on chief complaints**
In group A, sandhishula (joint pain) was relieved by 73.68% and 70.96% in left and right knee joint, respectively, 100% in spine (P<0.001) and 85.33% each in both the shoulders (P<0.01), while in group B, pain was relieved 67.24% and 70.37% in left and right knee joint, respectively, 100% in spine (P<0.001) and 66.67% relief was reported in both left and right shoulders (P<0.01).

**Sandhishotha** (joint swelling) improved by 60% and 68.42% in left and right knee joint, respectively, and 100% in left ankle (P<0.001) in group A, while in group B, it improved by 87.50% and 82.14% in left and right knee joint, respectively, and the improvement was 100% in both the shoulders (P<0.001) in group A. Akunchana prasaranaayoh vedana (pain during movement) improved in group A to the extent of 73.33% and 74.46% in left and right knee joint, respectively, 100% in both hip joints and 87.50% in right ankle (P<0.001); this symptom was not found in left ankle of any patient. In group B, it improved by 71.11% and 69.56% in left and right knee joints, respectively, and 100% improvement was observed in spine (P<0.001). Stambha (stiffness) improved by 69.25% and 74.19% in left and right knee joint, respectively, in group A, while it was 74.07% and 77.78% in left and right knee joint, respectively, in group B. All the values were statistically highly significant (P<0.001). 56.62% and 56.41% improvement was reported in sandhissphutana (crepitations) in left and right knee joint, respectively, in group A, while in group B, crepitation improved to the extent of 44.83% and 46.67% in the same joints. Improvement of crepitation in the above joints was statistically highly significant (P<0.001). Sparsha asahyata (tenderness) of left and right knee joint improved by 73.07% and 77.42%, respectively, in group A, and by 77.78% and 76.00%, respectively, in group B. All the values were statistically highly significant (P<0.001) [Table 1].

**Effect of therapy on vataavridhhi**
Among the symptoms of vata-avridhhi, 77.27% and 66.67% relief was reported in gatrasphurana (fasciculation) and asthishula (pain in bones), respectively, in group A (P<0.001), while the improvement in these symptoms was 50% and 63.89% respectively in group B. The relief in gatrasphurana was significant (P<0.01) and that of asthishula was highly significant (P<0.001). Atopa improved by 44.83% in group B, which was highly significant (P<0.001).

Among the symptoms of vata-kshaya, alpa chesta (reduced activity) improved by 36.67% and 30.76% in group A and group B respectively, which were statistically highly significant (P<0.001). Angasada (looseness of body parts) and apraharsa (unhappiness) improved by 38.89% and 16.67%, respectively, in group B, which were statistically significant (P<0.01).

Symptoms of pittavriddhi, i.e. glani (fatigue) and balahani (loss of strength), improved by 6.25% and 16.67% respectively in group A, which was statistically in significant. While in group B 25% improvement was found in each of glani, balahani and angasada, which was statistically significant (P<0.01).

Among the symptoms of pitakshaya, 57.14%, 66.67% and 22.22% improvement was reported in stambha (stiffness), toda (pricking pain) and gaurava (heaviness), respectively, in group A (P<0.001), while in group B, stambha (stiffness) and gaurava (heaviness) improved by 61.11% and 25%, respectively (P<0.001). Among kapalavriddhi symptoms, 16.66% improvement was found in sandhivishlesha (looseness...
of joint) in group A (P<0.01), while 41.67% improvement was found in group B (P<0.001). Among the kaphakshaya symptoms, udvestana (calf muscles pain) improved by 55.56% (P<0.001); and 35.71% and 40% improvement was found in angamarda (bodyache) and sandhishathihita (looseness of joint), respectively, which was statistically significant (P<0.01), while in group B, udvestana (70.59%) and angamarda (56.25%) improved in a statistically highly significant manner (P<0.001) and toda (50%) and sandhishaithila (50%) improved in non-significant manner (P<0.01).

### Effect of therapy on srotas

In rasavahasrotas, gaurava (heaviness) and angamarda (bodyache) improved by 19.23% and 16.66%, respectively, in group A (P<0.01), while angamarga (65.21%) improved in a statistically highly significant manner (P<0.001) and angasada (16.67%) in an insignificant manner (P<0.01) in group B. In medovahasrotas, karapadayoh suptata dha (numbness of palms and soles) and alasya (laziness) improved by 17.6% and 13.63%, respectively which was statistically significant (P<0.025) in group A, while 16.67% improvement in karapadayohosuptata dha and 23.08% improvement in suptatachaangeshu (numbness of body parts) was observed in group B, which was significant (P<0.01).

### Effect on asthivahasrotas

Asthishula (pain in bones) and asthibhedha (cutting type of pain) improved by 58.69% and 60.87% respectively in group A, while improvement of these was to the extent of 58.33% and 75% respectively in group B (P<0.001). Among the symptoms of majjavahasrotas, in group A, asthiparvapida and sthulamulaparvas improved by 54.76% and 60% respectively (P<0.001) and 41.67% improvement was found in parvepidika (P<0.025), while in Group B, asthiparvapida (59.09%) and parvepidika (58.53%) improved in a statistically highly significant manner (P<0.001) and sthulamulaparvas (50%) improved in an insignificant manner (P<0.01).

Being an age associated disease and due to its chronic nature, OA is undoubtedly linked with disturbed mental health. Assessment of mental status revealed that out of 56 patients, 5.36% patients (n=3) had mild to moderate anxiety and 12.5% patients (n=7) had mild to moderate depression.

### Effect of therapy on X-ray examination

In group A, joint space, subarticular sclerosis and synovial effusion improved by 66.67%, 57.14% and 87.50%, respectively, which was statistically highly significant (P<0.001), and 50% improvement in each of articular erosion and osteophytes was found, which was statistically significant (P<0.01), while in group B, 46.67% and 100% improvement was found in joint space and synovial effusion, respectively, which was statistically highly significant (P<0.001) and osteophytes improved by 62.50%, which was statistically significant (P<0.01).

### Effect of therapy on biochemical parameters

CRP and serum triglycerides reduced by 68.41% and 34.35%, respectively in group A, which was statistically highly significant (P<0.001), while serum triglycerides decreased by 23.90% which was statistically highly significant (P<0.001). The CRP increased by 57.19% (P>0.05) in group B, which was insignificant.

### Discussion

OA is a degenerative inflammatory disorder, where joint inflammation initially causes pain (sandhishula) and later swelling (sandhishotha). Due to pain and swelling, the mobility of joints is restricted (stambha), and on movement results in excruciating pain (prasarana akunchanayoh vedana), which becomes unbearable even on mild touch in the form of tenderness (sparsha asahyata). The degenerative changes later result in manifestation of crepusus (sandhisphutana). Sandhigata vata and OA are quite similar diseases found in clinical practice in which the etiopathogenesis and symptoms overlaps.

Shallaki possesses tiktta (bitter), madhura (sweet) and kashaaya (astringent) rasa (taste); guna (quality) of Shallaki is ruksha (dry), laghu (light) and tikshna; vipaka (post-digestive effect) is katu (pungent); whereas viyra (strength or effect) is ushna. The doshabhara is kapha-pitta shama. According to classics, Shallaki has potent vata-kaphahara properties.[29] The key constituents of Shallaki are volatile oil (4-8%), acid resin (56-65%) and gum (20-36%). The triterpenoids are the active constituents and are collectively called boswellic acids. The

---

**Table 1: Effect of therapy on cardinal symptoms on knee joints**

| Knee joint | Group A | Group B |
|------------|---------|---------|
|            | BT      | AT      | % Relief | t     | P       | BT      | AT      | % Relief | t     | P       |
| Sadhishula | Left    | 2.47    | 0.56    | 73.68   | 9.34  | <0.001  | 2.64    | 0.77    | 67.24   | 10.23 | <0.001  |
|            | Right   | 2.48    | 0.68    | 70.96   | 9.50  | <0.001  | 2.24    | 0.68    | 70.37   | 9.79  | <0.001  |
| Sandhishotha | Left   | 1.25    | 0.50    | 60      | 4.58  | <0.001  | 1.60    | 0.20    | 87.50   | 10.69 | <0.001  |
|            | Right   | 1.58    | 0.50    | 68.42   | 7.29  | <0.001  | 1.65    | 0.29    | 82.14   | 11.32 | <0.001  |
| Akunchana prasararana vedana | Left   | 2.04    | 0.50    | 73.33   | 9.50  | <0.001  | 2.25    | 0.60    | 71.11   | 11.96 | <0.001  |
|            | Right   | 2.13    | 0.50    | 74.16   | 10.16 | <0.001  | 2.19    | 0.67    | 69.56   | 10.27 | <0.001  |
| Stambha    | Left    | 1.37    | 0.47    | 69.23   | 18.00 | <0.001  | 1.69    | 0.37    | 74.07   | 8.66  | <0.001  |
|            | Right   | 1.72    | 0.50    | 74.19   | 11.76 | <0.001  | 1.59    | 0.35    | 77.78   | 7.67  | <0.001  |
| Sandhisphutana | Left  | 1.78    | 1.50    | 56.62   | 5.78  | <0.001  | 1.93    | 1.13    | 44.83   | 4.52  | <0.001  |
|            | Right   | 1.95    | 0.85    | 56.41   | 5.77  | <0.001  | 1.67    | 0.94    | 46.67   | 4.08  | <0.001  |
| Sparsha asahyata | Left   | 1.37    | 0.31    | 73.07   | 9.24  | <0.001  | 1.42    | 0.26    | 77.78   | 6.53  | <0.001  |
|            | Right   | 1.72    | 0.33    | 77.42   | 9.52  | <0.001  | 1.47    | 0.35    | 76.00   | 7.68  | <0.001  |
Gupta, et al.: Shallaki in the management of sandhivata (osteoarthritis)

gum resin of B. serrata usually contains 43% boswellic acids, which contain a combination of six major constituents, namely 3 acetyl, 11 keto, boswellic acids (AKBA), which help to preserve the structural integrity of joint cartilage and maintain a healthy immune mediator cascade at a cellular level,[10] which is active against pain and inflammation by inhibiting leukotriene synthesis. Specifically, it inhibits the activity of the enzyme 5 lipoxygenase through a non-redox reaction in OA.[11]

In the present study, improvement was seen in the chief complaints, sandhishula, sandhishotha, akunchana prasaranayosh vedana, stambha, sandhisphutana and sparsha asahyata, due to shothahara and vedanasthapana properties of Shallaki. The main site of sandhivata is sandhi which is the site of shleshakapha. Due to its tiktarasa, katuvipaka and ushnavirya, Shallaki pacifies vata and vata dosha, resulting in reduction of shotha, shula and other related symptoms. The pacified vata in the sandhi helps to rearrange shleshaka kapha and thereby improves the symptoms of sandhivata. Shallaki possesses analgesic and antiarthritic properties, which are responsible for its analgesic and anti-inflammatory activities. It also acts as COX-2 inhibitor and reduces the pain and inflammation without affecting the gastric mucosa. It soothes the joints and also helps treat levels of synovial fluid, making the entire structure lubricated and easy to rotate or to move.[11]

Symptoms of vata vridhi improved due to Shallaki as it has ushna virya, and according to some classics, due to tikshna guna it acts as vata shamak. Shallaki also increases dhavagni by its tikta rasa, leading to proper nutrition of dhatu, whereas improvement of the symptoms of vata kshaya is due to rasayana (immunomodulator) and brihaminiya prabhava of Shallaki.[12] The symptoms of pitta vridhi improved due to tikta, kashaya, madhura rasa and snigdha guna, and pitta shamaka activity, while improvement in the symptoms of pitta kshaya was reported due to ushna virya and katuvipaka. The kapha vridhi symptoms improved by its tikta rasa, ruksha and laghu guna, ushna virya and katu vipaka, consequently it pacifies kapha. Shallaki having tikshna guna and katu vipaka, acts against increased kaptha and improves the symptoms of kaptha kshaya.

The symptoms of rasavaha srotas such as gaurava and angamardha improved due to its tikta rasa and ushna virya, whereas the symptoms of medovaha srotas, i.e. karanapadayoh suptata dahah, alasya and suptatachaangeshu (numbness of body parts) improved due to its ruksha, laghu guna and ushna virya; it also reduces medas. The symptoms of ashtivaha srotas and majjavaha srotas improved due to tikta rasa and katuvipaka, as they counteract the pathogenic process of sandhivata. The main site of sandhivata is sandhis which are the site of shleshaka kapha. By pacifying kaphadosha, tikta rasa leads to proper nutrition of the other dhatu.

The improvement in radiological findings such as joint space, subarticular sclerosis, synovial effusion, articular erosion and osteophytes was due to the anti-inflammatory activity of B. serrata resin. It soothes the joints and also helps treat levels of synovial fluid, making the entire structure lubricated and easy to rotate or to move. AKBA helps preserve structural integrity of the joint cartilage and maintains a healthy immune mediator cascade at a cellular level. Shallaki is mediated through the vascular phenomenon; it improves blood supply to joints and restores integrity of vessels obliterated by spasm of internal damage.[13] Decrease in biochemical parameters, mainly, CRP, serum triglycerides and erythrocyte sedimentation rate (ESR), is due to anti-inflammatory activity.

Like other age related symptoms, excess free radical production and free radical induced damage may be a key cause of OA. Chronic pain, joint instability, gait difficulties and deformities disturb daily activities of the patient, and consequently the quality of life is impaired. This chronic pathological process in turn affects mental health resulting in stress, depression etc.

**Overall effect of therapy**

The patients reported complete remission (11.54%), marked improvement (15.38%), moderate improvement (57.69%), mild improvement (11.54%) in group A, while in group B none of the patients got complete remission. 8.69% patients showed marked improvement, 69.36% moderate improvement and 21.74% showed mild improvement. Overall assessment suggests that improvement was better in group A. Majority of the registered patients in this group were of less chronicity, younger age and with mild symptoms. This also may be cause for the significant results.

**Conclusion**

Patients’ mobility was improved significantly in both the groups, which indicates the efficacy of Shallaki over chief complaints. Reduction in serum triglycerides was seen in both the groups, which confirms that Shallaki has hypolipidemic effect. Remission in sandhishula, stambha and radiological improvement was found to be better in oral Shallaki group. Remission in sandhishotha was maximum in group B patients treated with Shallaki both orally and locally, whereas equal improvement in sparshaasahyata was observed in both the groups. Some patients in group A showed complete relief. Overall effect of therapy suggests that Shallaki provided moderate improvement in maximum subjects.

**References**

1. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PW, et al. The effect of specific medical condition on the functional limitations of elders in the Framingham study. Am J Public Health 1994;84:351-8.
2. Keutner KE, Goldberg VM. Introduction. In: Kuettner, KE, Goldber, VM, editors. Osteoarthritis disorders. Rosemont IL: American Academy of Orthopaedic Surgeons; 1995. p.21-5.
3. Sharma MK, Swami HM, Bhatia V, Verma A, Bhatia SP, Kaur. An Epidemiological study of correlates of osteo-arthritis in geriatric population of UT Chandigarh. Vol. 32. Available from: http://www.indmedica.com. [Last accessed on 2010 Aug 20].
4. Sharma MK, Swami HM, Bhatia V, Verma A, Bhatia SP, Kaur. An Epidemiological study of correlates of osteo-arthritis in Geriatric population of UT Chandigarh, Vol. 32, Available from: http://www.indmedica.com. [accessed on 2010 Aug 20].
5. Pai XC, Rymer WZ, Chang RW, Sharma L. Effect of age and osteoarthritis on knee proprioception. Arthritis Rheum 1997;40:2260-5.
6. Charaka Samhita with Hindi translation by Brahmanand Tripathi, (ed and trans), ChaukhambaVaranasi: SurbharatiPrakashan; 2008, 28-37: 940.
7. Bhava Prakasha, Karpooradi-varga51, 2006, Ganga Sahaya Pande and Krishna Chandra Chunekar, Chaukhamba Bharati Academy, Varanasi, 221001:212.
8. Bhava Prakasha, Vatadi-varga 22-23, 2006, Ganga Sahaya Pande and Krishna

---

AYU | Oct-Dec 2011 | Vol 32 | Issue 4 481
Gupta, et al.: Shallaki in the management of sandhivata (osteoarthritis)

9. Kimmatkar N, Thawani V, Hingorani L, Khiyani R. Efficacy and tolerability of Boswellia serrata extract in the treatment of osteoarthritis of knee: A randomized double blind placebo controlled trial Phytomedicine; Jan, 10, 2003. p. 37.
10. Dev SA. Selection of Prime Ayurvedic Plant Drugs: Ancient-modern Concordance. New Delhi: Anamaya Publishers; 2006. p. 113-7.
11. Menon AK and Kar A. Analgesic and psycho-pharmacological effects of the gum resin of Boswellia serrate, Planta Med 2005;24:19-33.
12. Honstanska K, Daum G, Saller R. Cytostatic and apoptosis-inducing activity of boswellic acids toward malignant cell lines in vitro. Anticancer Res 2002;22:2853.
13. Altman A, Fischer L, Schubert-Zsilavecz M, Steinhilber D, Werz O. Boswellic acids activate p42 (MAPK) and p38 MAPK and stimulate Ca(2+) mobilization. Biochem Biophys Res Commun 2002;290:185-90.

हिंदी सारांश

सन्धिवात कह चिकित्सा में शालकी निर्यास के प्रभाव का अध्ययन

पी. के. गुमा, एस. एम. एस. समरकून, एच. एम. चन्दोला, बी. रविशंकर

सन्धिवात का वर्णन सभी आयुवृद्ध ग्रंथों में वाल्याथिक के अन्तर्गत किया गया है। आयुवृद्ध चर्क ने सन्धिवातक-अनिल का पृथक रूप से वर्णन किया है, परंतु वाल्य के अतिरिक्त नानातम विकारों में समलित नहीं किया है। ऑस्टीयोआर्थ्रोसिस सन्धियाँ में होने वाली सन्धिवातक प्रवाहित क्षयमान व्याधि है, जो धर्मय वय में लक्षणविहृद रूप में प्रारम्भ होती है और अवस्था के बढ़ने के साथ उत्सर्जित लक्षण व्यक्त होने लगते हैं। अधिकांश लोगों में यह रोग ४० वर्ष की आयु तक विशेषतः भारतीय सन्धियों को प्रभावित करने लगता है। पुरुषों (१६ प्रतिशत) की अपेक्षा यह व्याधि महिलाओं में (२५ प्रतिशत) अधिक पायी जाती है। इस अध्ययन में सन्धिवातक के नेत्रिक नानातम को पूर्ण करने वाले ५६ रोगियों को दो वर्गों में विभाजित कर निम्न ओषधियाँ दी गयीं। १. केप्सूल शालकी ६ प्रांतीतिवर (तीन विभाजित मात्रा में) कोण जल के साथ, २. केप्सूलशालकी उपरोक्त अनुसार के साथ - साथ प्रभावित सन्धि पर शालकी मतलब का स्थानिक प्रयोग। चिकित्सा की अवधि आठ सप्ताह ही। इस अध्ययन में व्याधि के प्रमुख लक्षणों के रूप में सन्धिशूल, सन्धिस्फुटन एवं आकुलन प्रसारण वेदना पायी गयीं। दोनों ग्रंथों के रोगियों की चलने-फिरने की क्षमता में महत्वपूर्ण सुधार पाया गया, जो रोग के लक्षणों में शालकी के प्रभावी होने की ओर एंधित करता है। दोनों वर्गों में पायी गयी सीरम ट्राइल्सराइड केन्द्र में गिराउंद, शालकी के हाइपोलिमनिम्विक प्रभाव को निर्धारित करती है। सन्धिशूल तथा स्तम्भ में लाभ और एक-२ में होने वाले सुधार, शालकी के अन्त: प्रयोग वाले वर्ग में अधिक मिले, जबकि सन्धिशूल में अधिकतम सुधार, शालकी के अन्त: तथा स्थानिक प्रयोग वाले वर्ग ‘ब’ में मिला। वर्ग ‘अ’ के कुछ रोगियों में पूर्ण स्वास्थ्य लाभ देखने को मिला है। चिकित्सा का कुल प्रभाव दर्शाता है कि शालकी अधिकांश रोगियों में मध्यम सुधार प्रदान करती है।