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Research Article

STUDY OF COMBINED EFFECT OF SELECTIVE *YOGA* TECHNIQUES AND *STHANIKA ABHYANGA* IN THE MANAGEMENT OF *GRIDHRASI* - SCIATICA

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ABSTRACT

Gridhrasi is a *Rujapradhana nanatmaja vata vyadhi*, intervening with the functional ability of low back and lower limbs. Low back pain is the major cause of morbidity throughout the world affecting mainly the young adults. Life time incidence of low back pain is said to be 50-70% with the incidence of Sciatica more than 40%. **Objective:** The present study intended to focus on the disease evaluation i.e., *Gridhrasi*– Sciatica and combined effect of selective *Yoga* techniques and *Sthanika Abhyanga* in the management of *Gridhrasi*- Sciatica is undertaken. **Study Design:** Total study duration was 60 days, treatment duration was 30days. 30 patients full filling the inclusion criteria of *Gridhrasi* were randomly selected and divided in to 2 groups, Group A- *Yoga* Techniques. Group B- *Yoga* techniques and *Sthanika Abhyanga* with *Tilataila* in morning. **Results:** Group 'A', Group 'B' shown significant effect after the treatment. Comparatively Group 'B' (*Yoga* techniques & *Sthanika Abhyanga*) shown better result than Group 'A' (*Yoga* Techniques).

KEYWORDS: Yoga Techniques, Gridhrasi, Sciatica, Vata Vyadhi.

INTRODUCTION

Certain occupations are also directly producing the deformities in the bones and joints of the body, specially the joints of back and even more on lumbar vertebrae. The disease mostly affects the age group between 18 to 60 yrs with occupations like heavy weight lifting, continuous pressure on the back etc are main causative factors and leads to sciatica.^[1]

Sciatica is a condition where patients suffer from immobilizing and shooting pain starting from low back which refers to lower limb either unilateral or bilateral. Hence movement of affected leg is restricted and patient is unable to walk properly.^[1]

According to Ayurvedic texts Sciatica can be correlated to *Gridhrasi*. Here mainly *Vatadosha* is vitiated.^[2,3] The origin of disease according to Ayurveda, is at *Katipradesha* (lumbo-sacral region). The symptoms of *Gridhrasi* are *Ruk*, *Toda*, *Sthamba*, *Spandana* in the *Sphik*, *Kati*, *Prishtha*, *Uru*, *Janu*, *Jangha* and *Pada* in *Anukrama*.^[4,6]

If it is not treated in time, it may lead to serious complications like alteration in bowel and bladder function, loss of sensation in lower limbs etc.^[7] So in this condition easy and effective treatment is required. Since *Gridhrasi* is *Vatavyadhi* and *Vatahara* treatment like *Abhyangab* is beneficial^[8-11] and the *Yogasanas* may stretch, stimulate nerves and tone up the back muscles in turn increase the blood supply. *Asanas* may also release pressure and compression on sciatic nerve. Thus *Yoga* helps to relieve pain and discomforts of sciatica.^[12] *Yoga* and *Abhyanga* offers natural and effective remedies.

MATERIALS & METHODS

Source of Data

Drug source: *Tila Taila* was prepared as according to classical texts^[13] at S.J.G. Ayurvedic Medical College pharmacy, Koppal.

Literary source: Classical text books of *Ayurveda*, Text books of contemporary science, Text books of Yoga, Published articles from periodicals, journals and other magazines, Authenticated websites.

Clinical source: The size of sample was 30 excluding dropouts. Patients of *Gridhrasi* attending Swasthavritta O.P.D, and camps conducted by S.J.G Ayurvedic Medical College, P.G Studies and Research center, Koppal.

Selection of the patient

A. Inclusive criteria

- Patients presenting with classical signs and symptoms of *Gridhrasi* like *Ruk*, *Toda*, *Stambha*, Spandana was selected.
- Patients of age group between 20-60 yrs age.
- Above clinical symptoms with or without radiological changes.

B. Exclusive criteria

- Patients affected with IVDP (Inter vertebral disc prolapse), spinal injuries, Infection of spine, Congenital deformities etc.
- Pregnancy
- Patients associated with systemic other disorders.
- Patients unfit for Yogasanas and Sthanika Abhyanga (Like Vata-Kaphaj Gridhrasi etc)

C. Grouping of patients

Patients of Gridharasi were randomly divided in to three groups

1. Group A- 15 patients were advised Yoga in morning.

2. Group B-15 patients were advised Yogasanas and Sthanika Abhyanga in morning.

Procedures

A) Yoga Techniques:

1. ArdhaKatichakrasana

2. Ardha Shalabhasana (half locust pose)

3. *Shalabhasana* (full locust pose)

4. Bhujangasana

B) Sthanika Abhyanga: It was performed according to classical texts. The procedure is continued for 15 -20 minutes depending upon the severity of disease and up to Samyak Lakshanas of Abhyanga are seen.

Assessment of Variables: The improvement in the patient is assessed mainly on the basis of relief in the cardinal signs and symptoms of disease. To assess the effect of therapy subjectively and objectively, all the signs and symptoms are given scoring depending upon their severity.

A) Subjective

1. Stambha(stiffness) 2. Ruk(pain) 3. Toda(pricking sensation) 4. Spandana(twitching)

B) Objective

1) SLR test

Investigations: If required hematological tests and radiological tests.

Assessment Criteria

Ruk

No pain-0

Painful, walks without limping - 1

Painful, walks with limping but without support-2

Painful, can walk only with support-3 Painful, unable to walk- 4 Stambha No stiffness -0 Mild stiffness (1-10 min) – 1 Moderate stiffness (11-20 min) -2 Severe stiffness (21-30 min) -3 Very severe stiffness (more than 30 min) - 4 Toda

Absent - 0 Mild, occasionally in a day - 1 Moderate not persistent - 2 Moderate and persistent - 3 Severe and persistent - 4

Spandana

No twitching - 0

Mild twitching (1-10 min) - 1

Moderate twitching (11-20 min) -2

Severe twitching (21-30)-3

Very Severe twitching (more than 30 min)-4

SLR Test

Is assessed as positive at 0° to 90° with pain, negative at 90⁰ (without pain).

More than 90°- 0 710-900-1

510-700-2

 $31^{\circ} - 50^{\circ} - 3$

Up to 30⁰- 4

Collection of data: By using assessment parameter (subjective and objective) data was collected before treatment, after treatment follows up.

Assessment of clinical improvement: Clinical improvement of the disease was based on improvement in the clinical finding and reductions in the severity of symptoms of the disease after treatment and after post treatment follow up.

Grading for the clinical improvement for individual variables

CI-III: Excellent i.e., 3 degree reduction in the severity score, against the initial score i.e. severe normal

CI-II: Good i.e., 2 degree reduction in the severity score, against the initial score i.e., reduction from moderate - normal, severe - mild.

CI-I: Encouraging i.e., 1 degree reduction in the severity score, against the initial score i.e. reduction from mild - normal, moderate - mild and severe moderate.

C.S: Clinically stable i.e. severity score remaining as against the initial score.

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C.D: Clinically deteriorated i.e. increased in severity score

Gradation index for overall response

- Poor response Less than 25% of the obtained result.
- Mild relief 25% to 50% of the obtained result.
- Moderate relief 50% to 75% of the obtained result.
- Marked relief More than 75% of the obtained result.

Observation & Results for Individual Group

• Complete relief – 100% relief in the obtained result.

Statistical Analysis

The data were collected from all groups, before, after treatment, and after follow up (at the end of follow up) and statistically analyzed by using student paired 't' test in consultation with biostatistician.

Assessment Criteria – B.T, Group –A: Degree of assessment criteria before treatment

S.No.	Assessment			Yoga techniques BT									
	Criteria	NR Go	%	MLD G1	%	MDR G2	%	SVR G3	%	VSVR G4	%		
1	Ruk	-		0	-	8	53.33	6	40	1	6.66		
2	Sthmbha	-		2	13.33	8	53.33	5	33.33	0	-		
3	Toda	-		2	13.33	6	40	5	33.33	1	6.66		
4	Spandan	-		0	-	7	46.66	6	40	2	13.33		
5	SLR	-		1	6.66	10	66.66	4	26.66	-	-		

Assessment Criteria – A.T, Group –A: Degree of assessment criteria after treatment

S.No.	Assessment		Yoga techniques AT									
	Criteria	NR Go	%	MLD G1	%	MDR G2	%	SVR G3	%	VSVR G4	%	
1	Ruk	-	-	1 Juan	6.66	12	80	2	13.33	0	-	
2	Sthmbha	-	-	4	26.66	9	60	2	13.33	0	-	
3	Toda	-	-	2	13,33	6	40	5	33.33	0	-	
4	Spandan	-	-	1	6.66	6	40	7	46.66	0	-	
5	SLR	-	-	5	<mark>33</mark> .33	7	46.66	3	20	0	-	

Assessment criteria – B.T, Group –B: Degree of assessment criteria before treatment

S.No.	Assessment	Yoga te	oga techniques & Sthanika Abhyanga B.T									
	Criteria	NR Go	%	MLD G1	%	MDR G2	%	SVR G3	%	VSVRG4	%	
1	Ruk	-	•	-	-	5	33.33	8	53.33	2	13.33	
2	Sthmbha	-	•	2	13.33	9	60	3	20	1	6.66	
3	Toda	-	•	2	13.33	7	46.66	6	40	0	-	
4	Spandan	-	•	1	6.66	5	33.33	7	46.66	2	13.33	
5	SLR	-	-	-	-	12	80	3	20	-	-	

Assessment Cciteria - AT, Group -B Degree of assessment criteria after treatment

S.No.	Assessment	Yoga te	Yoga techniques & Sthanika Abhyanga A.T									
	Criteria	NR Go	%	MLD G1	%	MDR G2	%	SVRG3	%	VSVR	%	
1	Ruk	-		3		10		2		0	-	
2	Sthmbha	-		9		4		1		0	-	
3	Toda	-		2		6		7		0	-	
4	Spandan	-		5		5		5		0	-	
5	SLR	-		3		11		1		0	-	

Showing the effect of *Yoga techniques* on *Ruk*

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	Significance
ВТ	2.53	0.467	19.56	0.516	0.133	3.500	0.004	S
AT	2.07							

The mean score observed in *Ruk* before the treatment was 2.53, after the treatment 30days of Yoga the Mean difference between B.T and A.T was 0.467 and percentage improvement was 19.55%. The 't' test value was 3.500 which is statistically significant and P value 0.004. This shows that yoga practice also has an analgesic effect by decreasing the pain of the individual.

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	Significance
BT	2.20	0.333	15.33	0.488	0.126	2.646	0.019	S
AT	1.87							

Showing the effect of Yoga techniques on Stambha

The mean score observed in *Stambha* before the treatment was 2.20, after 30days of Yoga the Mean difference was 0.333and percentage improvement was 15.33%. 't' test value was 2.646 which is statistically significant P value 0.019. The yogic practices may shows reduce intensity of the stiffness it may happened due to practicing *Asanas* muscles will be relaxed.

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	Significance
BT	2.20	0.267	11.81	0.458	0.118	2.256	0.041	S
AT	1.93							

Showing the effect of Yoga techniques on Toda

The mean score observed in *Toda* before the treatment was 2.33, after 7days of Yoga the Mean difference was 0.267 and percentage improvement was 11.81%. The 't' test value was 2.256 which is statistically P value 0.041. This must have occurred as a result yoga practices may stretch low back region. This may happen because Yogic practices might have relieved pressure on spinal nerve.

Showing the effect of *Yoga techniques* on *Spandana*

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	Significance
BT	2.67	0.267	10	0.458	0.118	2.256	0.041	S
AT	2.40			ST C				

The mean score observed in *Spandana* before the treatment was 2.67 after 30 days of Yoga the Mean difference was 0.267 and percentage improvement was 10%. 't' test value was 2.256 which is statistically significant P value 0.041. Results may be due to mobility and stretching effect of *Asanas*.

Showing the effect of *Yoga techniques* on SLR

		_	- 0-		0			
Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	significance
BT	2.20	0.333	15.13	0.488	0.126	2.646	0.019	S
AT	1.87							
AT	1.67							

The mean score observed in SLR Test before the treatment was 2.20 after 30days of Yoga the Mean difference was 0.333 and percentage improvement was 15.13%. 't' test value was 2.646 which is statistically significant and P value 0.019. And this might have relieved pressure on sciatic nerve, which may lead to improvement in SLR.

Showing the effect of *Yoga techniques & Sthanika Abhyanga* on *Ruk*

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	significance
BT	2.80	0.867	30.96%	0.516	0.133	6.500	< 0.001	HS
AT	1.93							

The mean score observed in *Ruk* B.T was 2.80, after 30days of *Yoga* Techniques and *Sthanika Abhyanga* the Mean difference between B.T and A.T was 0.867 and percentage improvement was 30.96%. 't' test value was 6.500 which is statistically highly significant P value <0.001. The results are due to affect of *Tilataila Abhyanga* which is *Vatahara* and pain relieving affect of *Yoga*.

Showing the effect of Yoga techniques & Sthanika Abhyanga on Stambha

Assessment	Mean	BT- AT	Diff%	SD of diff	SE of diff	't' test value	P value	significance
BT	2.27	0.933	41.10	0.258	0.067	14.00	< 0.001	HS
АТ	1.33							

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The mean score observed in *Stambha* B.T was 2.27, after 30days of Yoga techniques and *Sthanika Abhyanga* the Mean difference B.T and A.T was 0.933 and percentage improvement was 41.10%. 't' test value was 14.00 which is statistically highly significant P value <0.001. *Tilataila*, which is used in *Sthanika Abhyanga* having three *Dosahara* properties, so may have relieved *Stambha*. Practicing asana muscles will be relaxed.

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Showing the	effect of Yoga technique	es and Sthanika Abh	yanga on Toda

showing the effect of roga teeninques and schullka holyanga on roua								
Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	significance
BT	2.27	0.867	38.19	0.352	0.91	9.539	< 0.001	HS
AT	1.40							

The mean score observed in *Toda* B.T was 2.27, after 30days of Yoga Techniques and *Sthanika Abhyanga* the Mean difference B.T and A.T was 0.867 and percentage improvement was 38.19%. 't' test value was 9.539 which is statistically highly significant. P value <0.001. Yogic practices might have relieved pressure on spinal nerve and due to *Vata* mitigation by *Abhyanga* with *Tilataila*.

Showing the effect of Yoga techniques & Sthanika Abhyanga on Spandana

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	significance
ВТ	2.67	0.667	24.98	0.617	0.159	4.183	0.001	HS
AT	2.00							

The mean score observed in *Spandana* before the treatment was 2.67 after 30days of Yoga techniques and *Sthanika Abhyanga* the Mean difference B.T and A.T was 0.667 and percentage improvement was 24.98%. 't' test value was 4.183 which is statistically highly significant P value 0.001. It may happen mobility and stretching effect of *Asanas* and *Vatahara* properties of *Abhyanga*.

Showing the effect of *Yoga techniques* & *Sthanika Abhyanga* on SLR

Assessment	Mean	BT-AT	Diff%	SD of diff	SE of diff	't' test value	P value	significance
BT	2.20	0.553	25.13	0.516	0.133	4.00	0.001	HS
AT	1.67			See Co	5			

The mean score observed in SLR Test B.T was 2.20, after 30days of Yoga techniques and *Sthanika Abhyanga* the Mean difference B.T and A.T was 0.553 and percentage improvement was 25.13%. 't' test value was 4.00 which is statistically highly significant P value 0.001. And this might have relieved pressure on sciatic nerve, which may lead to improvement in SLR.

Results after Treatment in Sciatica Results A.T: Group A

Parameter	CI IV	%	CI III	%	CIII	%	CII	%	CS	%	CD	%
Ruk	0	0	0	0	0	0	7	46.66	8	53.3	0	0
Sthamba	0	0	0	0	0	0	6	40	9	60	0	0
Toda	0	0	0	0	0	0	4	27.66	11	73.33	0	0
Spandana	0	0	0	0	0	0	4	27.66	11	73.33	0	0
SLR	0	0	0	0	0	0	5	33.33	10	66.66	0	0

In group A, in case of *Ruk*, Among 15 patients 7(46.66%) showed Grade 1 clinical improvement remaining 8 (53.33%) were stable. In case of *Stambha* 6 (40%) patients had Grade I improvement remaining 9 (60%) were stable. In case of Toda 4 (27.66%) had Grade I improvement and remaining 11 (73.33%) were stable. In case of *Spandana* 4 (27.66. %) had Grade I improvement and 11 (73.33%) were stable. In case SLR 5 (33.33%) had Grade I improvement and rest 10 (66.66%) were stable after treatment.

Parameter	CI IV	%	CI III	%	CI II	%	CI I	%	CS	%	CD	%
Ruk	0	0	0	0	0	0	11	73.33	4	26.66	0	0
Sthamba	0	0	0	0	0	0	14	93.33	1	6.66	0	0
Toda	0	0	0	0	0	0	13	86.66	2	13.33	0	0
Spandana	0	0	0	0	1	6.66	8	53.33	6	40	0	0
SLR	0	0	0	0	0	0	8	53.33	7	46.66	0	0

Results after Treatment: Group B

In Group B, in case of *Ruk* among 15 patients 11 (73.33%) showed Grade 1 clinical improvement in *Ruk* category remaining 4 (26.66%) were stable in *Ruk* category. In case of *Stambha* 14 (93.33%) patients had

Grade I improvement, 1 (6.66%) were stable. In case of Toda 13 (86.66%) had Grade I improvement and 2 (13.33%) were stable. In case of Spandana 8 (53.33%) had Grade I improvement, 1 (6.66%) had Grade II improvement and rest 6 (40%) were stable. In case SLR 8 (53.33%) had Grade I improvement and rest 7 (46.66%) were stable after treatment.

Overall Results

Group A: Showing the overall effect of <i>Yoga</i> Techniques						
Response	No of pt	Percentage				
No relief	12	80%				
Mild relief	3	20%				
Group B: Showing the ov	verall effect of <i>Yoga</i> techniqu	es & Sthanika Abhyanga				
Response	No of pt	Percentage relief				
No relief	5	33.33%				
Mild relief	7	46.66%				

Comparison of Both Therapies								
Response	<i>Yoga</i> Grp in %	Yoga & <i>Sthanika Abhyanga</i> grp in %						
No relief	80%	33.33%						
Mild relief	20%	46.66%						
Moderate relief	0	20						
Marked relief	0	0						
Complete relief	0	0 1000						

In compared to A Group, *Yoga* and *Sthanika Abhyanga* group had better result in the study. DISCUSSION

3

Discussion on *Gradhrasi* (Sciatica)

Moderate relief

The disease Gridhrasi is one of the major problems throughout the country. The disease is known since Vedic period in our country and since many centuries in western world.

Intervening with the functional ability of low back and lower limbs, it is particularly seen in most active period of life, involving working class people causing hindrance in routine life.

It is a neuro-muscular disorder, which poses a serious threat to quality of life in the most productive group of population in India today. The chances of occurrence of Gridhrasi is expected to increase in the coming years due to increased tendency of computerization, hectic routines, obesity, active life style, mental stress, unwholesome diet and excessive travelling.

'Sciatica' term in general indicates neuralgia along the course of sciatic nerve, most often with pain radiating into the buttock and lower limb. Low back pain is the major cause of morbidity throughout the world

Discussion on Yoga Techniques **Overall Effect of Asanas in Gridhrasi**

• In *Asanas* the muscle are stretched by assuming the various body position which will automatically apply an elongation to the particular muscle under consideration. A muscle slowly and gradually stretched by practice, so that it can eventually extend well beyond its normal limitations. This elongation squeezes out stagnant blood and allows it to be replaced by pure oxygenated blood when the muscle resumes its normal shape.

20%

- The *Asanas* does merely contraction of the muscle and nerves; it provides the good relaxation to the active muscle which is involved, so the Asanas can be continued for a prolonged duration without any difficult or complication.
- Improves the working capacity of the muscle and nerves of back and leg.
- To stretch the muscle it is important that they are fully relaxed. If muscles are tense they will automatically resist any attempt made to stretch them. This relaxation of muscles can be developed with practice and one can gain control over them systematically.
- The spine is the major channel, which carries all nervous impulses from the brain to the body. Spine interferes with this system by impeding nerve connection. Efficient nerves require a good blood supply.
- Gridhrasi (Sciatica) having symptoms like Ruk, Stambha. Toda. Spandana.
- The Asanas like Ardhakatichakrasana, • Shalabasana, Ardhashlabasana, Bujangasana are widened the intervertebral spaces by pulling the

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back muscles downward this is the yogic traction. This lengthens the muscles of the back and it causes relief from symptoms like *Ruk, Toda* etc.

3). Discussion on Abhyanga

A person should resort to *Abhyanga* every day if he wants to keep himself healthy. In classic, *Abhyanga* has been mentioned as the part of *Dincharya* i.e., daily routine. It is very useful before performing physical exercises.

Commentator *Dalhana* has explained in detail about the absorption of *Sneha* used in *Abhyanga* procedure. According to that the oil used in *Abhyanga* may reach up to the different *Dhatus* one by one like *Ksheera Dadhi Nyaya* and *Kedar Kulya Nyaya*, if it is applied for the sufficient time.

Hence it is clear that the drug used in *Abhyanga* gets absorbed by the skin through *Bhrajaka Pitta* and *Dhatvagni. Snehana* drug reached to the particular *Dhatu* and subsides symptoms of *Gridhrasi.*

Discussion on Observations

Age: In this study it was found that the incidence was highest in the age group of 31-40 years constituting 50% of total numbers of patients. Occupation: Maximum number of patients was and hard laborers and business which constituted 43.33% and 36.66% respectively. Nature of work: Majority of suffers were have the active working style, which accounting for 90%. Whereas 10% the patients were of the sedentary working style. Dietary Habits: Maximum number of patients (53.33%) was registered in the group of mixed diet habit. Chronicity: Out of total 30 cases, 80% had the chronicity of 3-6 months, 16.66% had the chronicity between 6 months to 1yr and 3.33% had the chronicity less than 3 months. This suggests that the disease is Shool Pradhana and needs early management.

DISCUSSION ON RESULTS

The patients of age group between 20-60 yrs selected from the OPD of S.J.G Ayurvedic Medical College, Hospital P.G. Research center Koppal. 33 cases were registered and from that 30 cases were selected for the study. Observed features in the patients during the study were recorded in the case sheets and these results were analyzed and tabulated after completion of clinical study. These result findings are discussed below.

Discussion on effect of therapy in Group A

Analysis of overall effect of the treatment in the patients of *Gridhrasi* showed good improvement. The treatment was given with thirty days of *Ardha Katichakrasan, Bujangasana, Ardha Shalabasana, Shalabasana,* there was considerable reduction in the symptoms of Sciatica. None of the patients develop any complications or any untoward symptom or any side effects during the course of treatment in the study group and therefore the treatment modalities is safe and is of therapeutic value. The above said observations indicate that patients have shown improvement in all the criteria of assessment of *Gridhrasi.*

Discussion on effect of therapy in Group B

Analysis of overall effect of the treatment in the patients of *Gridhrasi* showed encouraging improvement. The treatment was given with thirty days of *Yogasanas* and *Sthanika Abhyanga* which was significant reduction in the symptoms of *Gridhrasi*. None of the patients develop any complications or any untoward symptom or any side effects during the course of treatment in the study group and therefore the treatment modalities is safe and is of therapeutic value. The above said observations indicate that patients have shown improvement in all the criteria of assessment of *Gridhrasi*.

CONCLUSION

Gridhrasi comes under Vata Vyadhi which commonly associated with the Shoola in Sphik, Kati, Prushta, Uru, Janu and Jangha is a prominent feature in its manifestation. The Yoga is alone sufficient to manage mild cases of Sciatica. The mild to moderate form of cases of sciatica Yoga and Sthanika Abhyanga helpful in management. In the present study both groups showed statistically significant result in subjective and objective parameters. Whereas Yoga and Sthanika Abhyanga group shown better result than Yoga group. To gain the benefits, one must practice Asanas regularly over a period of time and the benefits will last longer. The conclusions were drawn on the basis of discussion on Yoga techniques and Sthanika Abhyanga, observation and results.

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