

# Assessment of the effect of Yoga therapy on Sinusitis by using Infra Red Thermal Imaging System

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## Abstract

Sinusitis is an inflammatory disorder of the nasal sinuses. Yogic techniques have the potentiality to prevent and cure such conditions of nose by relieving the inflammation and by increasing the resistance against the infection. Even though several studies on the effect of Yoga on Sinusitis have been done<sup>15-23</sup>, no study was conducted with proper parameters for evaluation. The present study intends to show the improvement, by normal parameters with a special parameter, Infra Red Thermal Imaging System (IRTIS), which is a non-invasive method. The instrument IRTIS-200 is brought from Russia under the project sanctioned by the Department of Science & Technology. The efficacy of the yoga therapy on Sinusitis was studied with 20 sinusitis patients of age group 19-53 years along with a control group. Yoga therapy was given for a period of 6 months including follow-up. The temperature variation recorded by the reading of IRTIS-200 was selected as the main parameter for the present study. Similarly the blood tests for ESR, Total W.B.C. count, and Differential count were also considered as other parameters.

The result obtained is analyzed using paired 't' test. The experimental group has shown a highly significant change in the IRTIS reading in both right and left frontal sinus areas with t stat = 9.8856, p <0.001 and t stat =10.4401, p <0.001 respectively. This is also correlated by the significant improvement in the blood test readings. These statistical significant changes were not seen in control group. The IRTIS reading difference for control group has got t stat = 1.3739, p =0.1854 and t stat = 0.1838, p =0.8561 respectively for right and left frontal sinus areas. Similarly, there is no significant change in the blood test readings of control group. This shows that yoga therapy helped to relieve the inflammation and improved the resistance of the body against the infection. The present study has also shown that Infra Red Thermal Imaging System can be used as a parameter to analyze and monitor the efficacy of yoga therapy on Sinusitis.

**Key words:** Yoga therapy, Sinusitis, Infra Red Thermal Imaging System, Thermal Temperature

## Introduction:

Great Indian sages developed Yoga, which is a divine gift to the mankind to realize our own nature. Yoga is one of the ancient sciences prevalent from time immemorial. The system of yoga on one hand is a

theoretical study and on the other, it is a practical step for self-realization. 'Yoga Shastra', the science of Yoga has to be studied systematically to realize the hidden truth in this great ancient science.

Maharshi Patañjali defines yoga as ‘*yogah cittavrtti nirodhah*’<sup>1</sup>. He explains about the distractions of the mind and the development of disease (*vyādhi*), their symptoms and methods to overcome from them.<sup>2</sup> Classical yogic texts like *Hathapradīpika*, *Gheranda Samhita* and *Śiva Samhita* describe different yogic techniques to overcome various disorders of body and mind. We can systematically adopt these therapeutic values in the prevention, curing and management of the diseases. Healing the health problems using the techniques of yoga is called ‘Yoga Therapy’. One has to find out the suitable set of *āsanas* and other yogic practices observing the patient carefully.<sup>3</sup>

Recently, there has been an increased awareness in health through natural methods like yoga in all parts of the world. The origin of most of the diseases is in the mind according to yogic thought. The mind influences the body in every possible way. If it is not taken care properly, later it manifests in physical level and which in turn affects normal body functions. Manifestation of a disease by the influence of mind is called psychosomatic disease.<sup>4</sup> Day by day such psychosomatic diseases are increasing by the influence of modern lifestyle. Yoga is the unique solution, which can directly control the mind and helps to maintain healthy body and mind. Holistic approach of yoga has the potentiality to heal the patients completely from their ailments.

Research in yoga therapy is very essential to assess and standardize the efficacy of yogic techniques in the treatment and to understand their potentiality in curing and prevention of various diseases which may be physical, mental or psychosomatic. A lot of research is undertaken in various aspects of yoga in relation to health, disease, physiological and psychological benefits of yoga. More and more systematic scientific research studies to be done with sufficient subjects and control

groups to assess and standardize the efficacy of yoga therapy. But most of the research studies are done without proper parameters. There is a scarcity of parameters to show the extent of improvement achieved by yoga therapy. It is the common experience that every patient feels the improvement and freshness after yoga therapy. But there is a difficulty to measure it quantitatively using scientific parameters available at present in most of the cases. Therefore there is a need of development of new parameters based on scientific ground for the assessment of the effect of yogic practices in the treatment.

The present research work is such a unique scientific approach to assess and standardize the effect of yoga therapy. For this purpose the assessment of the effect of yoga therapy on sinusitis is undertaken for study. The assessment is done by using Infra Red Thermal Imaging System (IRTIS). It is hypothesized that the effect of yoga therapy on sinusitis can be assessed by using IRTIS and it can be used as a parameter to study the effect of yoga therapy.

### **Infrared Thermal Imaging System**

The IRTIS is a precise scanning infrared device for the measurement and visualization of the thermal field. It can be used for checking the condition of power stations, high-power transformers, high-voltage electric circuits and contacts, heat supply systems, investigating heat losses from buildings/constructions and in public health for examining the inflammations in a human body.<sup>9</sup>

Thermography is a noninvasive procedure that images the infrared radiation (heat) emitted from the body surfaces based on the principle that alterations in a variety of body functions will alter the cutaneous vascular supply that heats the skin.<sup>10</sup> IRTIS can indicate abnormality based on variations in thermal temperatures (TT) in

any part of the human body. Total non-invasiveness is the major benefit of Thermal Imaging System.

The system may be used for early diagnosis of skin cancer, visualization of the patient reaction to different stimuli, observation of vascular diseases and in other applications.<sup>11</sup> Increased temperature is found over the areas involved with an inflammatory process.<sup>10</sup> Sinusitis is an inflammatory disorder.<sup>12</sup> Therefore there will be an increase in TT at the areas of sinuses where there is an inflammation. It can be measured by using IRTIS and variation in TT recordings can be monitored by using this instrument. Therefore, the IRTIS is selected as the main parameter for the present study. Blood tests for ESR (Erythrocyte Sedimentation Rate), T.C (total white blood cell count) and DC (Differential count) are the other parameters considered.

### **Materials and Methods**

The assessment of the effect of yoga therapy on Sinusitis is studied with 20 subjects of age group 19-53 years along with a control group having 20 subjects of age group 19-52 years. The sinusitis subjects were finalized after taking the detailed case histories of the subjects.

The study was done at the Department of Human Consciousness and Yogic Sciences, Mangalore University, Mangalagangothri, Karnataka. Yoga therapy was given to the experimental group for a period of 6 months including follow-up. The IRTIS recordings were monitored in frontal sinus areas before starting the yoga therapy. Similarly, the blood tests for E.S.R, T.C and D.C were done before starting the therapy. No yoga therapy was given for the control group. However the IRTIS recordings were taken and blood tests were done for the control group before starting the study.

The following yogic practices were systematically taught for the experimental group. While giving therapy individual care has been taken and practices were taught separately to each subject for better results and precision in yoga practices.

The Yogic practices given include *Jalaneti kriyā, Sūtraneti kriyā, Kapālabhāti, Svastikāsana, Vajrāsana, Suptavajrāsana, Simhāsana, Tadāsana I, Trikonāsana, Parśvakonāsana, Pāścimatānāsana, Purvatānasana, Pavanamuktāsana, Bhujangāsana, Śalabhāsana, Dhanurāsana, Bharadwājāsana, Ardhamatśyendrāsana, Viparītakarānī, Halāsana, Uttānapādāsana, Ujjayī Prānāyāma, Anuloma-Viloma Prānāyāma, Bhastrikā Prānāyāma and Shavāsana* depending on their severity and causes of the Sinusitis condition.

All the practices were gradually taught for the first 15 days and a complete course of yoga therapy was taught for the next 15 days. There after 5 months follow up was done in all the subjects and the IRTIS recordings were monitored at regular intervals in experimental group. Similarly after six months, the IRTIS recordings were monitored and the blood tests were done. In control group also after the duration of six months once again the IRTIS recordings were taken and blood tests were done.

### **Observations and Results**

It is observed that all the subjects either relieved or reduced from their sinusitis condition in the experimental group. But no such changes were found in case of control group. The observations were correlated with data collected through IRTIS recordings and blood test. The data collected for different parameters were analyzed using Student paired 't' test. The obtained values are tabulated in the next pages.

**IRTIS readings –Experimental group**

Right Frontal Sinus area							
IRTIS readings	Mean TT (in °C )		S.D.		t stat value	p-value	Significance
	Before	After	Before	After			
Spot 1 *	33.12	32.54	0.6363	0.5311	3.3534	0.0033	HS
Diff. between spot 1 & spot 2 **	1.184	0.172	0.4787	0.1543	9.8856	< 0.001	HS

Spot 1- a spot in frontal sinus area, Spot 2 - a spot about 15c.m upward vertical distance from spot 1,

TT - Thermal Temperature, HS- Highly Significant

Left Frontal Sinus area							
IRTIS readings	Mean TT (in °C )		S.D.		t stat value	p-value	Significance
	Before	After	Before	After			
Spot 1 *	33.11	32.61	0.6442	0.4605	3.0904	0.006	HS
Diff. between spot 1 & spot 2 **	1.1295	0.2365	0.4714	0.2184	10.4401	< 0.001	HS

Spot 1- a spot in frontal sinus area, Spot 2 - a spot about 15c.m upward vertical distance from spot 1,

TT - Thermal Temperature, HS- Highly Significant

**IRTIS readings –Control group**

Right Frontal Sinus area							
IRTIS readings	Mean TT (in °C )		S.D.		t stat value	p-value	Significance
	Before	After	Before	After			
Spot 1 *	33.23	33.19	0.6354	0.5713	0.28616	0.7779	NS

Diff. between spot 1 & spot 2**	0.8445	0.9535	0.4982	0.5147	1.37397	0.1854	NS
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Spot 1- a spot in frontal sinus area, Spot 2 - a spot about 15c.m upward vertical distance from spot 1,

TT - Thermal Temperature, NS- Non Significant

Left Frontal Sinus area							
IRTIS readings	Mean TT (in °C)		S.D.		t stat value	p-value	Significance
	Before	After	Before	After			
Spot 1*	33.18	33.08	0.6192	0.6259	0.6451	0.5266	NS
Diff. between spot 1 & spot 2**	0.762	0.7755	0.4575	0.4307	0.1838	0.8561	NS

Spot 1- a spot in frontal sinus area, Spot 2 - a spot about 15c.m upward vertical distance from spot 1,

TT - Thermal Temperature, NS- Non Significant

#### Blood test–Experimental group

Blood test	Mean		S.D		t stat value	p value	Significance
	Before	After	Before	After			
ESR (mm/hr)	14.2	9.5	10.8657	9.0117	4.3085	0.0004	HS
T.C. (/ ml)	7783.25	6772.5	2362.01	1162.74	2.1191	0.0475	S
Neutrophils (%)	56.9	63.05	8.0844	3.7483	3.9994	0.0007	HS
Lymphocytes(%)	37.95	32.95	7.4018	4.0585	3.4374	0.0028	HS
Eosinophils (%)	4.4	3.3	1.8750	1.7199	2.7277	0.0134	S
Monocytes (%)	0.7	0.65	1.2183	0.9881	0.3697	0.71	NS

S- Significant, HS- Highly Significant, NS- Non Significant

#### Blood test–Control group

Blood test	Mean		S.D		t stat value	p value	Significance
	Before	After	Before	After			
ESR (mm/hr)	13.25	13.3	10.351	8.67	0.0507	0.9601	NS

T.C. (/ml )	7434.75	7330	1138.54	1033.19	1.0905	0.2891	NS
Neutrophils (%)	60.55	60.85	5.4818	4.0946	0.4457	0.6609	NS
Lymphocytes(%) )	34.65	34.55	4.7047	3.3478	0.1487	0.8833	NS
Eosinophils (%)	4.25	4.2	1.7434	1.43637	0.1951	0.8474	NS
Monocytes (%)	0.4	0.35	0.5982	0.5871	1	0.3299	NS

NS- Non Significant

### Discussion

The experimental group has shown highly significant reduction in the mean thermal temperatures(TT) in the IRTIS readings of a spot (near supra-orbital foramen) in frontal sinus area (spot 1) in both right and left frontal sinuses from 33.12<sup>0</sup>C to 32.54<sup>0</sup>C and 33.11<sup>0</sup>C to 32.61<sup>0</sup>C with t stat = 3.3534, p =0.0033 and t stat = 3.0904, p =0.006 respectively. The decrease in the IRTIS reading indicates the reduction in inflammation of the sinuses.<sup>10</sup> However naturally there will be a temperature variation in different parts of the body. Similarly, other external facts may also affect the body temperature. To nullify this fact the difference between the TT of spot 1 and a near by spot, spot 2 (about 15cm upward vertical distance from spot 1) were calculated by recording the TT of these two spots. The experimental group has shown highly significant reduction in the TT difference of IRTIS readings (from 1.184<sup>0</sup>C to 0.172<sup>0</sup>C & from 1.1295<sup>0</sup>C to 0.2365<sup>0</sup>C) with t stat = 9.8856, p < 0.001 and t stat = 10.4401, p < 0.001 for right and left frontal sinuses respectively. However, symptomatically all the subjects in experimental group were got relief from their symptoms of sinusitis. This improvement is statistically proved by the readings of IRTIS. It is important to know that this is correlated by the significant improvement in the blood test readings.

The total white blood cell count (T.C) decreased significantly from 7783.25/ml to 6772.5/ml with t=2.1191 and p=0.0475.

The ESR also significantly reduced from 14.2 mm/hr to 9.5 mm/hr with t stat = 4.3085, p= 0.0004 indicating a significant reduction in the inflammation. Neutrophil percentage has been normalized with t=3.9994 and p=0.0007. Lymphocytes percentage has been decreased from 37.7857 to 34.5 with t stat = 3.4374, p= 0.0028 indicating a reduction in the infections. Eosinophils percentage significantly reduced from 4.4 to 3.3 with t stat = 2.7277, p= 0.0134 indicating a reduction in the allergic reaction and an increase in body resistance against the allergens. But these significant statistical changes were not seen in control group. There is no significant change in mean TT of control group at spot1 in right and left frontal sinuses (before=33.23<sup>0</sup>C; after=33.19<sup>0</sup>C & before=33.18<sup>0</sup>C; after=33.08<sup>0</sup>C) with t stat = 0.28616, p =0.7779 and t stat = 0.6451, p =0.5266 respectively. Control group has got statistically non significant values for TT difference (before=0.8445<sup>0</sup>C; after=0.9535<sup>0</sup>C & before=0.762<sup>0</sup>C; after=0.7755<sup>0</sup>C) with t stat = 1.7688, p =0.1004 and t stat = 0.9351, p =0.3668 respectively for right and left frontal sinuses. Similarly all the statistical values for ESR, T.C and D.C were non significant in case of control group.

Above discussion shows that yoga therapy helped to relieve the inflammation of sinusitis and improved the resistance of the body in experimental group. In the present study it is important to observe that this improvement is clearly shown by Infra

Red Thermal Imaging System. There is no such instrument which can assess the improvement in the treatment of sinusitis. Thus the research study scientifically proved that the effect of yoga therapy on sinusitis can be assessed by Infra Red Thermal Imaging System. Hence IRTIS which is a totally non-invasive method can be used as an effective tool to assess the efficacy of yoga therapy.

### Conclusion:

Based on the discussion of the data obtained we can conclude that the effect of

yoga therapy on Sinusitis can be assessed by using Infra Red Thermal Imaging System. Present research work showed that Infra Red Thermal Imaging System, which is a totally non-invasive method, can be used to diagnose the Sinusitis and other inflammatory diseases and it can be used as a parameter to assess the efficacy of yoga therapy. This study shows that Yoga can be used as a better therapeutical method in the treatment of Sinusitis. Anyhow more number of subjects may give us further improvement in the result.

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