

Effect of Steam Inhalation Versus Combination of Steam Inhalation and Various Yoga Postures on Chronic Sinusitis Patients: An Interventional Study

Supriya Kumari¹, Rajani S Pagare²

¹MPT Student (Cardiovascular and Respiratory Physiotherapy),
DES Brijlal Jindal College of Physiotherapy, Pune, Maharashtra, India

²Professor and Head of Department (Cardiovascular and Respiratory Physiotherapy),
DES Brijlal Jindal College of Physiotherapy, Pune, Maharashtra, India

Corresponding Author: Supriya Kumari

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ABSTRACT

Aim: The aim of this paper is to study the effect of steam inhalation versus the combination of steam inhalation and various yoga postures on chronic sinusitis patients. The need of the interventional study is to find out the efficacy of steam inhalation alone and steam inhalation with yoga posture effectiveness in chronic sinusitis individuals. Yoga posture given in this study is anatomically significant in quadruped position. This study also investigates the productiveness of steam inhalation when given in quadruped position.

Hypothesis: Null Hypothesis- There is no difference between the effect of steam inhalation alone and steam along with yoga postures on patients with chronic sinusitis.

Alternate Hypothesis: There is a difference between the effect of steam inhalation alone and steam along with yoga postures on patients with chronic sinusitis.

The **Objective** of this study are as follows:

1. To clinically diagnose the patient with chronic sinusitis according to the Rhino sinusitis task force and to evaluate and find the severity of the same; comparing the effects of chronic sinusitis using SNOT20.
2. To treat the patients in Group I with steam inhalation and group 2 with yoga postures alone for 6 weeks.
3. To compare the effects between steam inhalation with different yoga postures and steam inhalation alone according to SNOT 20 in 6 weeks intervention period.

Conclusion: In Conclusion, it was found that steam inhalation alone and steam inhalation with yoga postures are equally effective in chronic sinusitis patients; there is no statistical difference between these 2 groups.

Keywords: Steam inhalation, combination of steam inhalation and yoga postures, chronic sinusitis

INTRODUCTION

Chronic sinusitis is an inflammatory process involving the mucosa of the nose and one or more sinuses, it is multifactorial. The prevalence of allergic rhinitis is around 30% in adults and 45% in children^{1,2}. In India, studies estimated that more than 120 million Indians suffer from at least one episode of acute sinusitis every year.

Sinuses grow during childhood and early adult life. Radiologically maxillary sinuses can be identified at 4-5 months, ethmoid at 1 year, frontals at 6 years and sphenoid at 4 years⁸. The pathophysiology of acute infection destroys normal ciliated epithelium impairing drainage from the sinus. Pooling and stagnation of secretions within the sinus invites infection; it becomes

thick and polypoidal. Sub mucosa is infiltrated with lymphocytes and plasma cells and may show micro abscesses, granulations and fibrosis. Inflammation linked to rhino sinusitis can result in engorgement of nasal venous sinusoids, swelling of the anterior and inferior turbinate's and obstruction of nasal airflow, ultimately causing congestion because of increased vascular permeability. It could also be linked to common URTI disorders, rhinitis and rhinosinusitis¹¹.

Chronic sinusitis may present as:-

Chronic sinusitis without nasal polyps

Chronic sinusitis with nasal polyps

Allergic fungal rhino sinusitis.

The three cardinal symptoms of sinusitis are
Purulent drainage: green or yellow nasal discharge

Facial/dental pain: aching, fullness or pressure-like pain

Nasal obstruction: this can cause difficulty breathing from one or both nasal passages or cause mouth breathing. Recurrent sinusitis occurs with four episodes of sinusitis within one year².

According to The Infectious Disease Society of America (IDSA) Chronic sinusitis is diagnosed when at least two of the earlier four symptoms are present and occur for more than 12 weeks. Chronic sinusitis is less common than acute sinusitis. According to the Anatomy of different sinuses there are different positions which can help draining the fluid considering the type of sinus affected. So because of lack of evidences there was a need to find out how does steam inhalation alone and when given with yoga postures in quadruped position help in reducing the SNOT score. Acute sinusitis can last up to four weeks, while chronic sinusitis lasts for twelve weeks or longer².

MATERIALS AND METHODOLOGY

This comparative interventional study was conducted over a period of six weeks.

Inclusion criteria

- Clinically diagnose individuals according to RSTF

- Individuals willing to participate and ready for 6 weeks intervention
- Age group between 18-40
- Individuals without any facial or nasal surgery, Nasal deviation.
- Individuals who are not taking any medication for the last 3 months.

Exclusion criteria

- Any neurological disorders
- Any musculoskeletal disorders of chest
- Psychiatric or cognitive impairments
- Any respiratory disorder
- Any recent facial surgery.
- Individuals with vertigo, hypertension and smoking history.

Materials

- Consent form
- Information sheet
- Evaluation sheet -RSTF, SNOT20

Steam Vaporizer

Yoga mat

Stop watch

Pens and pencils

Sampling Technique: Purposive sampling

Sample Size: The total sample size was 34 individuals. Each group carried 17 individuals. Equal representation was given in each age group and gender. The sample size was calculated by the formula:

$$\text{Formula} = N = \frac{z^2 P x (1-p)}{d^2}$$

With 1.11% prevalence, 5% level of significance, 90% power of test, using the formula above (Daniel), the desired sample size would be 16.73 =17 in each group.

INSTRUMENT AND SCALE USED

In this study, Rhino sinusitis task force index, Sino nasal outcome test and crescent steam inhaler/vaporizer was used for intervention of 6 weeks.

Rhino sinusitis Task Force Criteria

A patient questionnaire was developed to identify the presence of sinusitis symptoms as specified by RSTF symptom diagnostic criteria.

The Snot: is a questionnaire determined to describe the severity of an individual

condition. It contains a 20 question survey measuring the physical impairments, functional limitations, disability and societal limitations.

Vaporizer was filled up till water level marking; there was no addition of salt or any other medication. Vaporizer was placed in a safe position, firm, and flat surface. After use the water was replaced for use by another person. Daily maintenance was done.

METHOD FOR DATA COLLECTION

Ethical clearance was obtained from the institutional ethics committee. Subjects were clinically diagnosed according to the Rhino sinusitis Task force scale and were chosen according to inclusion and exclusion criteria. The subject was asked to fill up SNOT 20 Questionnaire. Pre and post protocols were given and will be randomly assigned to different groups.

Group 1- Steam inhalation alone

Group 2 - Yoga postures along with steam inhalation.

Steam Inhalation: The steam inhalation procedure was explained to the patient, temperature of water was kept between 120-160°F or 54.5-76.7°C. Patients were in standing posture, bent forward, with elbows and hands supported on the table and steam inhalation was given for three minutes.

Yoga Postures: Patients were asked to blow their noses after steam inhalation and before giving yoga postures. Each yoga posture was held for a period of 45 seconds. Each of the following postures was repeated five times:

- Sasankasana
- Paschimottanasana
- Uttanasana
- Adhomukhsavasana

Further data analysis was done by using the appropriate statistical analysis and thus, the results were obtained.

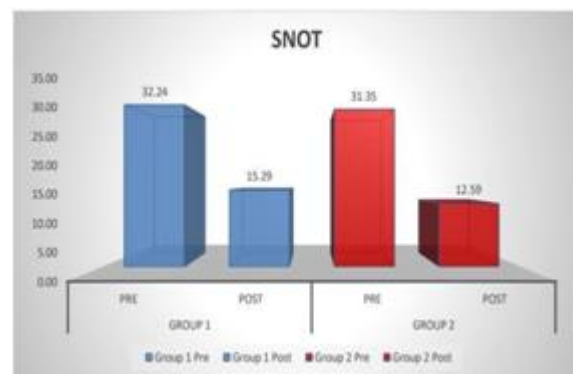
Data Analysis and Interpretation

The present study was conducted to investigate the efficacy of steam inhalation versus the combination of steam inhalation

and various yoga postures on chronic sinusitis patients. The statistical analysis for this study was done by using the software “SPSS”. The *Wilcoxon signed rank statistical test* was used for testing within the group, while the *Mann Whitney test* was used for comparing between the two groups.

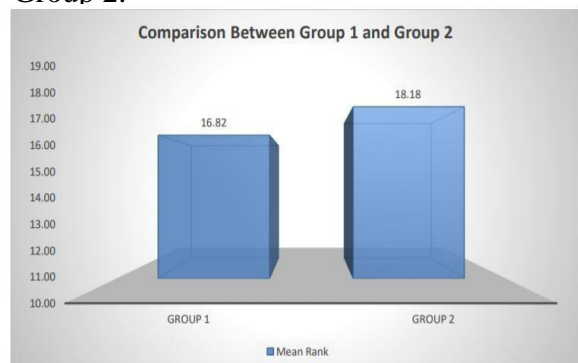
Table 1: Demographic data of the Patients

Age Group	Group 1		Group 2	
	N	%	N	%
18-20 years	5	29.41	0	0.00
21-25 Years	9	52.94	6	35.29
26-30 Years	1	5.88	4	23.53
31-35 Years	1	5.88	6	35.29
36-40 Years	1	5.88	1	5.88
Total	17	100.00	17	100.00



Graph 1: Comparison of SNOT score at baseline and after 6 weeks within group 1 and group 2.

INTERPRETATION: Wilcoxon Signed Rank Test is carried out to test significance in Group 1 and Group 2. From the data above, we observe that the P-Value for Group 1 and Group 2 is less than 0.05. Hence, we conclude that there is a significant change observed in Group 1 and Group 2.



Graph 2: Comparison of SNOT score at baseline and after 6 weeks within group 1 and group 2.

INTERPRETATION: For comparison between Group 1 and Group 2, we have

used the Mann Whitney U test. The data above suggests that the P-Value is greater than 0.05. Hence, we conclude that there is no significant difference between group 1 and group 2.

This study was done to find out the effect of steam inhalation versus the combination of steam inhalation and various yoga postures on chronic sinusitis patients over the period of 6 weeks. When the inflammatory process involves the paranasal sinus, it is sinusitis. It can often involve accompanying nasal airway inflammation. Chronic rhino sinusitis is one of the most common chronic conditions, and has a significant morbidity. The condition is known to exacerbate asthma and can even lead to meningitis and brain abscess formation, which increases morbidity and mortality. In rare cases, chronic sinusitis can also result in orbital and intracranial infections, leading to visual and neurological deficits.

This study provided evidence that there is significant difference in the values of the Sino nasal outcome test (SNOT) in the individuals pre and post treatment in both the groups. A sample of 34 individuals was included in the study. The sample population was divided into two groups - **Group1 (n=17):** only steam inhalation and **Group2 (n=17):** steam inhalation with yoga postures.

The Sino-Nasal Outcome test is one of the widely used disease-specific questionnaires for Chronic sinusitis; it is a modification of the 31-Item Rhinosinusitis Outcome Measure, and it contains 20 subjects related to nose, sinus and some general items. To complete the instrument, patients allocate how much they are affected in each area. SNOT used in the present study is an effective scale to assess the main problems in patients with chronic sinusitis. The SNOT score on the 1st day and after 6 weeks were considered for statistical analysis. The mean SNOT score in Group 1 was 32.24 ± 8.90 on the 1st day and 15.29 ± 7.08 after 6 weeks. The mean SNOT score in Group 2 was 31.35 ± 12.01 on the 1st day

and 12.59 ± 7.07 after 6 weeks. The result of comparison of mean SNOT score on 1st day and after 6 weeks in Group 1 and Group 2 showed significant reduction in the SNOT scores with P value less than 0.05 in chronic sinusitis individuals. This finding is consistent with the study by Ford et al, in which he had conducted cadaveric studies on human and goat maxillary sinus and compared drainage in upright and quadrupedal position. The result showed that drainage was significantly better. The quadrupedal head position as compared to upright in both species ($p < 0.01$)

The head downward position would appear to be the most effective way of decongesting the Ostia of the sinuses; the head down and backwards position has been advocated by Mygind, but radiological studies and clinical evidence supports the head down and forward position is most effective. A comparative study done by Sujeet Kumar, this study was conducted to compare and contrast the result and advantage of quadrupedal and non-quadrupedal head position for recovery on CRS. This study comprises of 100 patients which is categorized into group 1 (quadrupedal) and group 2 (non-quadrupedal head position), of CMS (chronic maxillary sinusitis) in whom we assess the result based on the overall Quality of Life and CT scan findings after 6 weeks treatment with medical treatment.

They concluded that CRS significantly impacts a patient's quality of life. From an analysis of quality of life and CT score, the study confirmed that quadrupedal head position significantly improved recovery from CMS. The study thus indicated that quadrupedal head position can be valuable adjuvant therapy for patients with CMS. We can also relate anatomically similar study done by Paul Merkus et al, who conducted a study on to determine the influence of individual anatomical differences on intra nasal drug deposition and found that Head position (gravity) seems to be having a substantial influence on drug delivery to middle

meatus. Increased amounts of dye are present in more lateral locations when using lateral head low position and in superior regions using the head down and forward position. This result supports the idea that gravity affects drug deposition. This study shows that when sinus is related anatomically, it may not drain on its own, if there is absence of pressure in the sinus. Thus, application of pressure into the sinuses loosens the mucus with the head pointed downward. This will lead to pressure into the sinus like blowing up a balloon. The pressure going in will force the fluid out. Eventually, all of the fluid will vacate and the pressure will equalize to normal leaving a drained sinus. This study has also compared steam inhalation with yoga posture with steam inhalation alone. Combination therapy of head tilting and steam inhalation is not only helpful for drainage but also reduces inflammation by gravity assisted positioning. This study showed that in some of the sinuses, the downward position of the head is favorable and the activity of cilia is favored by gravitation. According to YANKAUER this fact also brings into play a certain law of Physics as follows:

When a fluid is present in large quantities, the law of gravitation prevails and the fluid flows downwards. When the quantity of fluid is small, its gravity may be counteracted or even overbalanced by other properties such as adhesions, surface tension, tenacity, capillary attraction and siphonage. These properties are true to normal sinuses and diseased sinuses as well. Steam inhalation has been widely used to relieve nasal obstruction in patients with chronic sinusitis. Inhalation of hot and humid air increases the nasal mucosal temperature of patients with chronic sinusitis, resulting in inhibition of chemical secretion from mast cells. In this case, we have used steam inhalation in both the groups. Group 1 is only steam inhalation which showed that there was significant difference in SNOT score before and after 6 weeks, P-value was significant in group 1

Atishkumar B. Gujrathi focused on the effect of steam inhalation on nasal mucociliary clearance in normal individuals and also with nasal disease.

It was found that the nasal mucociliary clearance time in people before steam inhalation was $10.9 \pm$

4.4 and after 1 hour of steam inhalation reduced to 9.3 ± 4.2 and post 24 hours it narrowed down to 8.7 ± 4.1 . Similarly, the nasal mucociliary clearance time for the people before steam inhalation was $8.2 \pm$

3.8 . After 1 hour of steam inhalation, it reduced to 7.1 ± 3.2 and post 24 hours it got at 6.7 ± 3.2 . Hence, it is evident that Steam Inhalation improves Nasal Mucociliary Clearance and also symptomatology of patients were drastically reduced. This study also says that there is no statistical difference when compared between 2 groups. Considering the physiology, atmospheric conditions have an effect upon the state of nasal mucous membrane; hence exert a secondary influence upon the drainage of the sinuses. The inhalation of cold and dry air causes a swelling of venous channels upon the septum and turbinals thus causing narrowing of respiratory channels. In order to expand warm air should be inspired. According to Yankauer, when the atmosphere is warm and contains the proper amount of moisture, this engorgement of mucous membrane disappears. The physiological reaction of the turbinals

Changes in the surroundings affected through vasomotor nerves. He also stated that inhalation of steam can be used therapeutically as it can shrink the swollen mucous membrane, contract the engorged turbinals and the capillary spaces are restored to make openings of sinuses patent. When these 2 groups were compared within by the Wilcoxon signed rank test, p was significant and the intervention showed improvement in SNOT score but when these groups were compared by each other by using Mann Whitney U test, p was not significant which suggests that no group is

better than the other when compared. Otherwise, both groups are equally effective individually. The possible reason for this could be due to 52 dynamic posture given in group 2 which could not make a huge difference. Various asanas given in the study couldn't make any extra benefits according to SNOT score. This, in turn, supports the fact that only steam inhalation alone in a quadruped position is effective for sinus drainage.

RESULTS & INFERENCES

In the present study, we can conclude that steam inhalation alone and steam inhalation with yoga postures are equally effective in treating chronic sinusitis patients; the differences between them are not statistically significant.

Usage of steam inhalation with or without yoga postures is recommended in patients with chronic sinusitis which may result in self-sinusitis drainage. The results of this study can be utilized by giving quadruped position with steam inhalation for chronic sinusitis patients.

It can also be used as an adjuvant and prophylactic therapy. The main limitation encountered during the experiment was that it was not conducted for a prolonged duration. For future research, it would be prudent to bear in mind that the study can also be conducted using radiological outcome measures as well as clinically for a prolonged duration to verify the differences; it can also include variables of different disorders combined with sinusitis. Another variable that could be added to the study is-a prolonged time of quadruped phase of each yoga posture

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REFERENCES

1. Fokkens W, Lund V, Mullol J. European position paper on rhinosinusitis and nasal polyps 2007. *Rhinology. Supplement.* 2007; 20:1-36.
2. Khaltaev N, Bousquet J. Allergic Rhinitis and its Impact on Asthma Update (ARIA 2008) The Perspective From Spain. *J Invest Allergol Clin Immunol.* 2008; 18 (5):327-4.
3. Meltzer EO, Blaiss MS, Derebery MJ, Mahr TA, Gordon BR, Sheth KK, Simmons AL, Wingertzahn MA, Boyle JM. Burden of allergic rhinitis: results from the Pediatric Allergies in America survey. *Journal of Allergy and Clinical Immunology.* 2009 Sep;124(3):S43-70.
4. Dar AK, Lone AH. Demographic Study of Sinusitis in Patients Visiting Govt: Unani Hospital Srinagar and AyushCentres in Kashmir. *Medical Journal of Islamic World Academy of Sciences.* 2013 Jul;109(893):1-4
5. Wolf G, Anderhuber W, Kuhn F. Development of the paranasal sinuses in children: implications for paranasal sinus surgery. *Annals of Otolaryngology, Rhinology & Laryngology.* 1993 Sep; 102(9):705-11.
6. Naclerio RM, Bachert C, Baraniuk JN. Pathophysiology of nasal congestion. *International journal of general medicine.* 2010;3:47.
7. Kwon E, O'Rourke MC. Chronic Sinusitis.
8. Alt JA, Orlandi RR, Mace JC, Soler ZM, Smith TL. Does delaying endoscopic sinus surgery adversely impact quality of life outcomes? *The Laryngoscope.* 2019 Feb; 129(2):303-11.
9. Chowdhury NI, Mace JC, Bodner TE, Alt JA, Deconde AS, Levy JM, Smith TL. Does Medical Therapy Improve SinoNasal Outcome Test-22 Domain Scores? An Analysis of Clinically Important Differences. *Laryngoscope.* 2019 Jan; 129 (1):31-36.
10. Ford RL, Barsam A, Velusami P, Ellis H. Drainage of the maxillary sinus: a comparative anatomy study in humans and goats. *Journal of otolaryngology-head & neck surgery= Le Journal d'oto-rhinolaryngologie et de chirurgie cervico-faciale.* 2011 Feb; 40 (1):70-4.
11. Mygind N. Conventional medical treatment. *Nasal allergy, 2nd edition.* Oxford:

- Blackwell Scientific Publications.1979:257-70
12. Kumar S, Rai T, Aslami AN, Alwa B. A comparative study on quadrupedal and non quadrupedal head position on recovery from chronic maxillary sinusitis in a tertiary hospital of Rohtas district, Bihar, India. International Journal of Otorhinolaryngology and Head and Neck Surgery. 2018 Apr;26(4):686-9.
 13. Merkus P, Ebbens FA, Muller B, Fokkens WJ. Influence of anatomy and head position on intranasal drug deposition. European Archives of Oto-Rhino-Laryngology and Head & Neck. 2006 Sep 1;263(9):827-32.
 14. Yankauer S. The drainage mechanism of the normal accessory sinuses. The Laryngoscope. 1908 Jul;18(7):518-29.
 15. Gujrathi AB, Ambulgekar V, Handal A. Effect of Steam Inhalation on Nasal Mucociliary Clearance in Normal Individuals and Nasal Disease State. International Journal of Contemporary Medical Research. 2016.

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