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## Comparative Effectiveness of Jade Stone Mobilisation, Non-Abrasive Cupping, and Manual Drainage Technique in Subjects with Chronic Sinusitis: A Randomized Clinical Trial

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## Abstract

**Purpose:** Sinusitis in recent times has been known as one of the major causes for reduced quality of life and work absenteeism. Chronic sinusitis being one of the health hazards affecting QOL of subjects of any age and gender requires a specific therapeutic intervention. Clinical trials that can demonstrate the effectiveness of manual therapy intervention in sinusitis cases are lacking. Hence, this study aims to evaluate and compare the effectiveness of three manual therapy techniques in subjects with chronic sinusitis. **Method:** The current study is a prospective, parallel arm, randomised clinical trial performed at physiotherapy OPD, tertiary health centre, Belagavi. Forty-five subjects who had chronic sinusitis were randomised and allocated into three different manual therapy groups with 15 subjects each study group.

Sample size was calculated using the formula  $n = Sd^2[Z\alpha + Z\beta]^2/d^2$  where  $\alpha$  value was set at 1.96 and  $\beta$  was set at 0.842. Both male and female subjects between 18-45 years of age with chronic sinusitis for more than 3 months were included in the study (with 1 dropout due to loss to follow-up). Subjects in group A received jade stone mobilization, group B received non-abrasive cupping, and group C received manual drainage technique for 3 times a week for 2 weeks with a follow-up at the 6<sup>th</sup> week from the baseline. As an outcome measure pressure algometer and SNOT-22 questionnaire were taken to assess pressure pain threshold and quality of life of sinusitis subjects respectively. **Results:** The results showed significant improvement between and within all the three study groups post 2 weeks of intervention in terms of pain pressure threshold and quality of life. However, at 6<sup>th</sup> week follow-up, the jade stone group showed greater improvement than the other two groups. **Conclusion:** The study concluded that all the three manual interventions are safe and effective manual therapy techniques to treat the cases of chronic sinusitis.

The trial was prospectively registered under the clinical trial registry of India with trial number CTRI/2020/10/028321.

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## Author Bio(s)

Monali Gandhi MPT, has completed her master of physiotherapy postgraduation specialized in Orthopedic Physiotherapy from KLE Institute of Physiotherapy, affiliated to KLE Academy of Higher Education of Research, Belagavi, Karnataka, India. She is certified in dry needling, jade stone mobilization and orthopedic manual therapy. Presently employed in a pvt. clinical firm at Mumbai as clinical physiotherapist.

Peeyoosha Gurudut MPT is presently pursuing her PhD in physiotherapy. She is working as an Associate Professor in Dept. of Orthopedic Physiotherapy, KLE Institute of Physiotherapy, affiliated to KLE Academy of Higher Education of Research, Belagavi, Karnataka, India with 15 years of research academic and clinical teaching experience. She is certified manual therapy practitioner for Mulligan's, Maitland, IASTM, jade stone mobilization techniques. She is also trained in Pilates method.

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### ABSTRACT

**Purpose:** Sinusitis in recent times has been known as one of the major causes for reduced quality of life and work absenteeism. Chronic sinusitis being one of the health hazards affecting QOL of subjects of any age and gender requires a specific therapeutic intervention. Clinical trials that can demonstrate the effectiveness of manual therapy intervention in sinusitis cases are lacking. Hence, this study aims to evaluate and compare the effectiveness of three manual therapy techniques in subjects with chronic sinusitis. **Method:** The current study is a prospective, parallel arm, randomised clinical trial performed in the Outpatient Physiotherapy Department of the District Civil Hospital in Belagavi, India. Forty-five subjects who had chronic sinusitis were randomised and allocated into three different manual therapy groups with 15 subjects each study group. Sample size was calculated using the formula  $n = Sd^2[Z\alpha + Z\beta]^2/d^2$  where  $\alpha$  value was set at 1.96 and  $\beta$  was set at 0.842. Both male and female subjects between 18-45 years of age with chronic sinusitis for more than 3 months were included in the study (with 1 dropout due to loss to follow-up). Subjects in group A received jade stone mobilization, group B received non-abrasive cupping, and group C received manual drainage technique for 3 times a week for 2 weeks with a follow-up at the 6<sup>th</sup> week from the baseline. As an outcome measure pressure algometer and SNOT-22 questionnaire were taken to assess pressure pain threshold and quality of life of sinusitis subjects respectively. **Results:** The results showed significant improvement between and within all the three study groups post 2 weeks of intervention in terms of pain pressure threshold and quality of life. However, at 6<sup>th</sup> week follow-up, the jade stone group showed greater improvement than the other two groups. **Conclusion:** The study concluded that all the three manual interventions are safe and effective manual therapy techniques to treat patients with chronic sinusitis.

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**Key Words:** Chronic Sinusitis, Physiotherapy, Alternative therapies, Manual Therapy, Cupping, Drainage, Mobilization

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## INTRODUCTION

Sinusitis in recent times has been known as one of the major causes of reduced quality of life and work absenteeism. The air-filled spaces present within some bones surrounding the nasal cavities which open through its lateral wall are known as sinuses.<sup>1</sup>

A short-term inflammation that lines the nose and surrounding sinuses is known as acute sinusitis. Any inflammation of the nasal sinuses which lasts for twelve weeks or more is known as chronic sinusitis.<sup>2</sup> Chronic rhinosinusitis (CRS) is a common condition that affects the population worldwide. It is more prevalent in places which have high levels of atmospheric pollution, places with damp temperatures, and places with high humidity in the climate.<sup>3</sup>

Khan and Siddiqui reported that the fifth most common disease which is treated with the help of antibiotics is chronic rhinosinusitis. Chronic rhinosinusitis holds 46.1% prevalence worldwide.<sup>4</sup> In India, CRS affects nearby 5-15% of urban inhabitants, indicating that the prevalence of chronic sinusitis is very high; 146 out of 1000 people are affected.<sup>5</sup> Pain and discomfort in people with chronic sinusitis make them seek additional adjunct therapy.<sup>6</sup> It also affects the quality of life of individuals suffering from it and unwillingly increases their medical expenditures.<sup>7</sup>

Subjects diagnosed with sinusitis experience symptoms of pain, nasal discharge, which may or may not be foul-smelling, nasal resonance, dry cough, ear fullness, epistaxis, malaise, headache, and fever.<sup>8</sup> One of the examination tools for assessing the quality of life of patients having sinusitis is the Sino-nasal outcome test (SNOT-22) questionnaire which is specially designed for individuals suffering from sinusitis.<sup>9</sup> As sinusitis is diagnosed most commonly in clinical settings, it becomes a common reason for general practitioners to prescribe antibiotics.<sup>10</sup>

Physiotherapy is recommended as a treatment approach in sinusitis, including the use of various electrotherapeutic modalities, manual drainage techniques, suboccipital release for sinus headaches, kinesio taping, nebulization, stretching of the neck muscles, dry needling, and rhino flow therapy.<sup>11</sup> Except for the electrotherapeutic modalities, there are few manual therapy techniques that have been proven effective in improving the symptoms of chronic sinusitis, though it is biologically plausible that these techniques would be effective. Hence, there is a need to study the effectiveness of manual therapy techniques for treatment of chronic sinusitis.

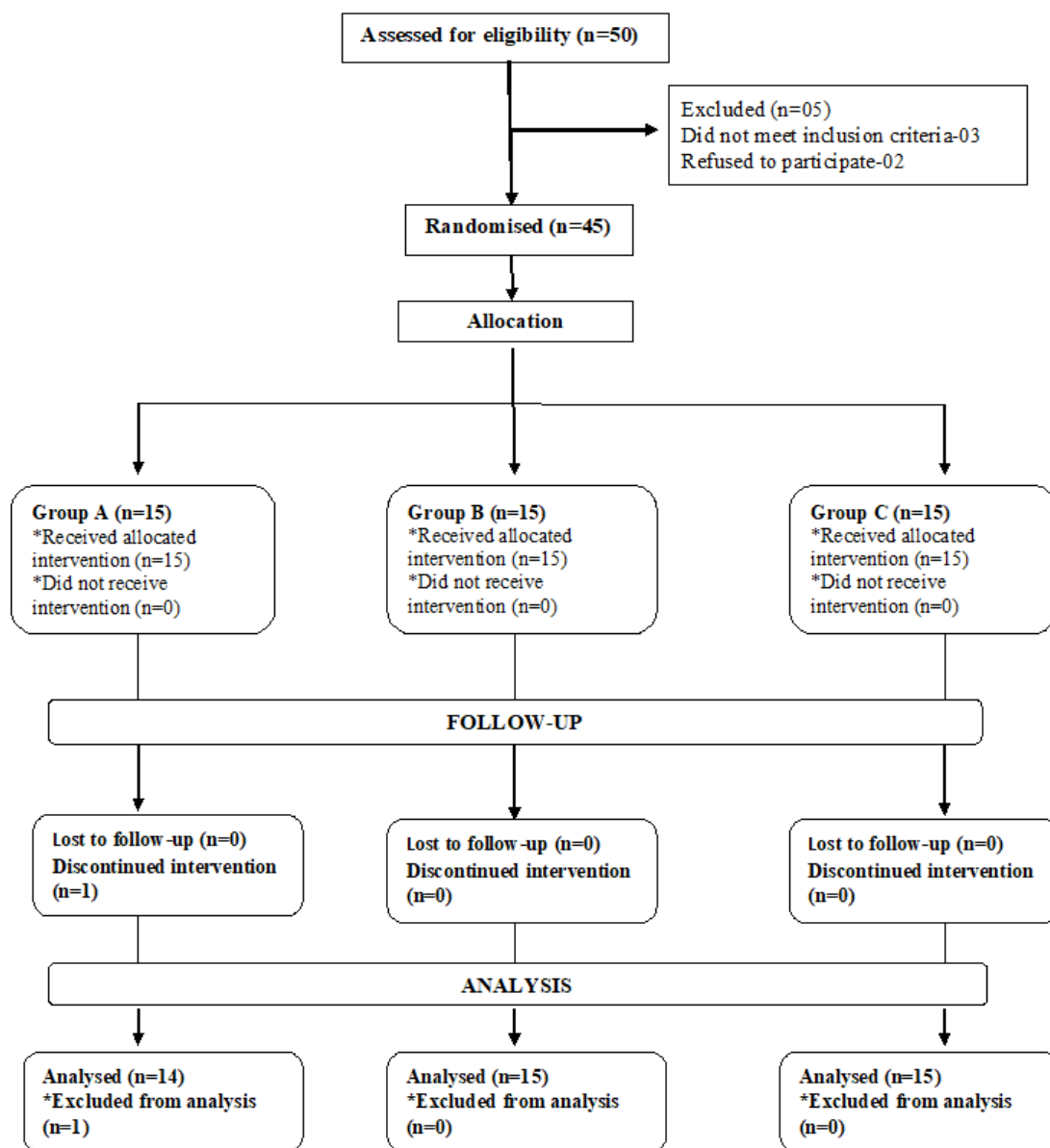
## METHODS

The study is a prospective parallel-arm randomized clinical trial performed on volunteer subjects having chronic sinusitis for more than three months and are between 18 and 45 years of age. The study was approved by the Institutional Research and Ethical Committee in Belagavi, Karnataka, India. The approval number KIPT/SI No.707/7.08.2020. Subjects signed the written consent after which they were enrolled in the study. A written informed consent form was also secured to publish the photographs of the subjects with a concealed identity. The trial is prospectively registered under the clinical trial registry of India with trial number CTRI/2020/10/028321.

Forty-five subjects who had chronic sinusitis were randomised and allocated into three different manual therapy groups with 15 subjects each study group. Sample size was calculated using the formula  $n = Sd^2[Z\alpha + Z\beta]^2/d^2$  where  $\alpha$  value was set at 1.96 and  $\beta$  was set at 0.842. Both male and female subjects between 18-45 years of age with chronic sinusitis for more than 3 months were included in the study. Subjects in group A received jade stone mobilization, group B received non-abrasive cupping and group, and group C received manual drainage technique respectively. (Figure 1)

Subjects included in the study were clinically diagnosed by an ENT surgeon with chronic sinusitis and referred to the physiotherapy outpatient department. These subjects had two or more major symptoms, or one major symptom plus two minor symptoms,<sup>12</sup> had sinusitis for three months or more (frontal and maxillary sinus), were between 18-45 years of age, and were willing to participate in the study. Subjects excluded were those having a history of space-occupying lesions or malignancy, involvement of  $\geq 2$  sinus areas, were taking any medications for sinusitis, were performing yoga or pranayama within the last month before the study started, were radiologically diagnosed with a nasal polyp, had any neurological or cognitive deficits, and who had any skin allergies or diseases.

The outcome measures used in the study were a pressure algometer to assess the pain pressure threshold and the SNOT-22 questionnaire for assessing QOL. A pressure algometer is a clinical tool used to identify the pressure and/or force eliciting a pain pressure threshold.<sup>13</sup> The device was held perpendicular to the sinus area being assessed, it was then pressed against the area by increasing the force. The principal investigator/assessor who was also a certified physiotherapist stopped increasing the force when pain/pressure was felt for the first time by the subject. The unit ( $\text{kg}/\text{cm}^2$ ) at which the subject perceived the pain was noted. The assessment was taken at baseline and post-intervention (6 weeks from the baseline).



**Figure 1.** CONSORT Flow Diagram

The quality-of-life questionnaire specifically designed for sinusitis subjects<sup>14</sup> consisted of 22-item sinus-specific questions which were administered to the subjects; the total sum of all items was recorded based on the severity of the subject's condition and the score was calculated. Subjects were assessed at baseline, post 2 weeks, and at follow-up (6 weeks from the baseline). In the 6<sup>th</sup> week, the questionnaire was filled via telephonic communication for the ones who could not attend in-person.

Subjects having chronic sinusitis were screened for inclusion and exclusion criteria and were informed about the aims and procedure of the study. Demographic details like age, gender, BMI, and duration of affliction were noted at the baseline.

The subjects in group A were given intervention using a jade stone. They received mobilization over frontal and maxillary sinuses using the jade stone mobilization technique. A pea size amount of moisturizer or gel was applied over the sinus area being treated. The jade stone was held at a 30-45-degree angle from the skin surface and the mobilization was done in the direction of lymphatic channels towards the tonsillar lymph nodes in order to drain the excess secretions. Not more than 30 strokes were given in one treatment session, and after every 5 strokes, 30 seconds of rest interval was given to the patients. (Figure 2a & b).

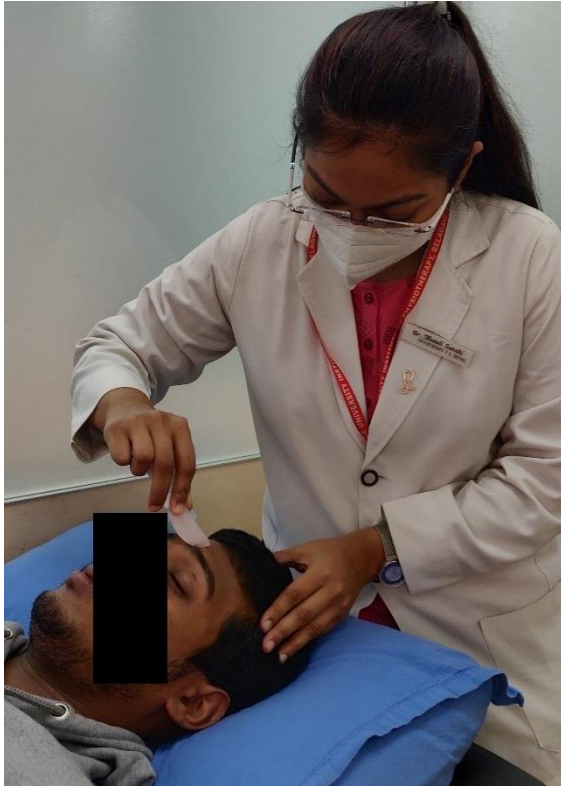
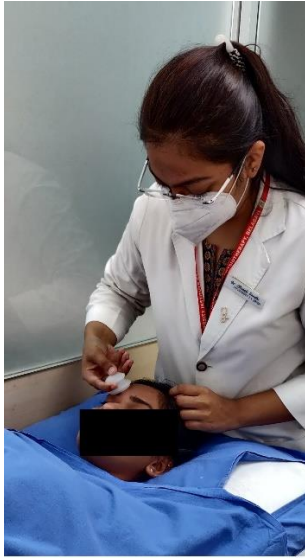


Figure 2a. Application of Jade Stone Manual Therapy for Maxillary Sinus



Figure 2b. Application of Jade Stone Manual Therapy for Maxillary Sinus

Group B received intervention using non-abrasive cups of 3.5cm×4.5cm size. A pea size amount of moisturizer or any gel was applied over the sinus to be treated, vacuum was created into the cup and it was placed over the sinus to be mobilized. Due to the vacuum created the cup adhered to the skin which was then slightly lifted and dragged towards the tonsillar lymph nodes in order to drain the excess secretions. No more than 30 strokes in one session were administered and a 30-second rest interval was provided after every 5 strokes. (Figure 3 a & b).



**Figure 3a.** Application of Cupping Therapy for Frontal Sinus



**Figure 3b.** Application of Cupping Therapy for Frontal Sinus

Group C received intervention using a manual drainage technique. For manual drainage of the frontal sinus, the therapist placed his/her thumb over the frontal sinuses so as to apply direct pressure and then drained the sinuses by moving the thumb inferiorly towards the tonsillar lymph node while staying in front of the ears. This was performed seven times.<sup>13</sup> For manual drainage of the maxillary sinus, the therapist placed his/her thumb over the maxillary sinuses of the patient so as to apply direct pressure and then drained the sinuses by moving the thumb inferiorly until just below the ears towards the tonsillar lymph node. This was performed seven times. (Figure 4 a & b).



Figure 4a. Application of Manual Drainage Technique for Frontal Sinus



Figure 4b. Application of Manual Drainage Technique for Frontal Sinus

## RESULTS

For obtaining results the data obtained were entered in a Microsoft Excel spreadsheet, and statistical analysis was performed using SPSS version 20. Data were summarized as mean  $\pm$  standard deviation for continuous variables and categorical variables were represented as percentages. The normality distribution of the data was performed using the Kolmogorov Smirnov test. Categorical data was compared using the Chi-Square Test. The between- group analysis was done using ANOVA/ Kruskal Wallis test. The within- group analysis was done using paired t-test/ Wilcoxon sign rank test/Repeated measure ANOVA followed by a suitable post hoc test.  $p$ -value $<0.05$  was considered as statistically significant. 45 subjects were randomised in total with 15 subjects in each group. During analysis 44 subjects were analysed as there was one dropout in group A (JS). Details on descriptive statistics i.e., age, gender, BMI, duration of affection to sinusitis and the baseline characteristics of the subjects included in the study is presented in (Table 1).



**Table I.** Duration, BMI, Age, and Gender Distribution

Basic variables	Jade-Stone		Cupping		Manual-Drainage		ANOVA test	P-value
	Mean	SD	Mean	SD	Mean	SD		
Duration	3.71	2.525	4.00	2.236	3.60	2.261	F=0.116	0.891
BMI (kg/m <sup>2</sup> )	22.014	6.462	22.867	3.068	24.213	4.955	F=0.721	0.492
Age (Years)	25.57	5.543	25.13	4.406	23.20	2.336	F=1,285	0.287
Gender	n(%)							
	M	F	M	F	M	F	X <sup>2</sup>	P
	3(21.1)	11(28.6)	1(6.7)	14(93)	4(26.7)	11(73)	2.5	0.2865
Insignificant								

SD-standard deviation, n(%) - no. of subjects, X<sup>2</sup>-Chi square test

Assessment of pain pressure threshold at frontal sinuses in all three groups showed significant improvement post 2 weeks of intervention with the percentage difference between pre and post-test intervention in group A was 19% with P value of <0.0001. (Table 2). For group B the percentage difference between pre and post-test intervention was 16.7% with P value of <0.001. (Table 2). Similarly for group C the percentage difference between pre and post-test intervention was 21% with P value equals to 0.001. (Table 2).

**Table 2.** Within Group Comparison for Three Study Groups for (Pressure Pain Threshold) using Pressure Algometer on Frontal Sinuses

Effect-of-Treatment	Wilcoxon signed-rank test						
	Descriptive			Change-in-means N(%)	Wilcoxon signed-rank test		
	N	Mean	±SD		Z	P	Remarks
<b>Group-A</b>							
PRE	15	2.664	0.951	0.636(19)	5.592	<0.0001	HS
POST	15	3.300	0.782				
<b>Group-B</b>							
PRE	15	2.480	0.393	0.5(16.7)	5.592	<0.001	HS
POST	15	2.980	0.3550				
<b>Group-C</b>							
PRE	15	2.460	0.754	0.653(21)	3.180	0.001	HS
POST-2WK	15	3.113	0.530				

Group A- Jade stone group, Group B - Non-abrasive cupping, Group C- Manual Drainage, HS- Highly significant

Assessment of pain pressure threshold at maxillary sinuses in all the three groups showed significant improvement post 2 weeks of intervention with the percentage difference between pre and post-test intervention in group A was 25% with P value of <0.001 (Table 3). For group B the percentage difference between pre and post-test intervention was 23.1% with P value of <0.001. (Table 3) Similarly for group C the percentage difference between pre and post-test intervention was 20.0% with P value of <0.001. (Table 3). The assessment of quality of life using SNOT-22 questionnaire also showed significant improvement in all the three groups post intervention with the P values being <0.0001 for all the three groups respectively. (Table 4) Between group analysis for all the three groups at frontal and maxillary sinuses in terms of PPT also showed improvement post 2 weeks of intervention with their P value of 0.119. (Table 5), Similarly for maxillary sinuses the P value was 0.624 post 2 weeks of treatment. While comparing all the three study groups in terms of quality of life (QOL) using SNOT-22 questionnaire the data shows that the average P value at baseline was 0.141, from baseline to 2 weeks was P=0.064 and from weeks to 6th week was P=0.0046 this indicated that there was high correlation between the study groups from 2 weeks to 6th week post intervention. To confirm the findings, post hoc test was performed which indicated Jade stone group (A) and Manual Drainage group (C) post 6th week of intervention had high correlation with P value <0.01. However, there was no significant correlation between jade stone and cupping group and cupping and manual drainage group post 6th week of intervention having P values of >0.05 respectively. (Table 6,7).

**Table 3.** Within Group Comparison for Three Study Groups for (Pressure Pain Threshold) using Pressure Algometer on Maxillary Sinuses

Effect of Treatment	Descriptive			Change in means N (%)	Wilcoxon signed rank test		
	N	Mean	±SD		Z	P	Remarks
	<b>Group A</b>						
PRE	15	2.164	0.6512	0.72(25)	3.213	<0.001	HS
POST	15	2.886	0.6837				
<b>Group B</b>							
PRE	15	2.380	0.579	0.66(23.17)	4.669	<0.001	HS
POST 2WK	15	3.040	0.599				
<b>Group C</b>							
PRE	15	2.460	0.3488	0.613(20)	3.494	<0.001	HS
POST	15	3.073	0.308				

Group A- Jade stone group, Group B - Non-abrasive cupping, Group C- Manual Drainage, HS- Highly significant

**Table 4.** Within Group Comparison for Three Study Groups for (quality of life) using SNOT-22 Questionnaire

Effect of Treatment							
	Descriptive			Change in means N (%)	Repeated measures of ANOVA		
	N	Mean	±SD		F	P	Remarks
<b>Group A</b>							
PRE	15	37.79	15.900		51.21	<0.0001	HS
Post 2 weeks	15	20.80	12.007	17(45)			
6th WEEK	15	22.93	11.532	14.8(39.3)			
<b>Group B</b>							
PRE	15	39.53	7.836		77.46	<0.0001	HS
POST	15	24.53	6.081	15(38)			
6th WEEK	15	28.47	5.630	11.06(28)			
<b>Group C</b>							
PRE	15	43.60	7.557		24.87	<0.0001	HS
POST 2 weeks	15	28.00	5.782	15.6(36)			
6th Week	15	32.00	4.840	11.6(27)			

Group A- Jade stone group, Group B - Non-abrasive cupping, Group C- Manual Drainage, HS- Highly significant

**Table 5.** Between Group Comparison for all Three Groups on PPT using (Pressure Algometer) on Frontal Sinuses and Maxillary Sinus

	Jade Stone		Cupping		Manual drainage		ANOVA/Kruskal-Walli's test	P value
	<b>Frontal Sinus</b>							
	Mean	SD	Mean	SD	Mean	SD		
PRE	2.664	0.951	2.480	0.393	2.460	0.754	F=0.5503	0.581
POST	3.300	0.782	2.980	0.355	3.113	0.530	KW=4.256	0.1192
<b>Maxillary Sinus</b>								
PRE	2.164	0.651	2.380	0.579	2.460	0.348	F=0.8936	0.417
POST	2.886	0.683	3.040	0.599	3.073	0.308	KW=0.9410	0.624

SD- standard deviation, F value= ANOVA, KW= Kruskal Wallis test

**Table 6.** Between Group Comparison for all Three Groups on QOL using SNOT-22 Questionnaire

SNOT-22	Jade Stone		Cupping		Manual drainage		ANOVA/Kruskal -Wallis's test	P value
	Mean	SD	Mean	SD	Mean	SD		
PRE	37.79	15.90	39.53	7.836	43.60	7.557	KW=3.916	0.1411
Post 2 weeks	20.80	12.00	24.53	6.081	28.00	5.782	F=2.930	0.0647
6th Week	22.93	11.5	28.47	5.63	32.00	4.840	F=6.139	0.0046*
Insignificant								

SD- standard deviation, F value= ANOVA, KW= Kruskal Wallis test

**Table 7.** Tukey Kramer Multiple Comparisons test for all three groups on QOL using SNOT-22 questionnaire (post hoc test)

SNOT-22	Comparison Between		Significance	Remarks
Post 6 <sup>th</sup> week	Jade Stone	Cupping	>0.05	NS
		Manual drainage	<0.01	HS
	Cupping	Manual drainage	>0.05	NS

NS- Not significant, HS- highly significant

## DISCUSSION

A randomized clinical trial was performed to evaluate the effectiveness of three manual therapy techniques in subjects having chronic sinusitis. The results showed significant improvement in outcome measures post- intervention when compared within and between groups. Comparison between groups showed highly significant improvement in QOL at the 6-week follow-up between jade stone and manual drainage groups. However, there was no significant improvement between JS and NABC groups and between NABC and MD groups.

In the present study, the mean age of the subjects suffering from chronic sinusitis is 23.20 – 25.75 years of age, however, the inclusion criteria for the study were subjects between 18-45 years of age. According to a study performed by Lone and Dar, the demographics of sinusitis in patients visiting the government hospital in Kashmir show the mean age of patients visiting the hospital with sinusitis complaints was 34 years, and 70% of the patients visiting the hospital had chronic maxillary sinuses inflammation.<sup>15</sup>

The present study recruited participants who fulfilled at least 3 major and 2 minor criteria of the task force classification for rhinosinusitis which includes facial pain/pressure, nasal obstruction, nasal blockage, nasal discharge, headache, foul smell, fever, and fatigue. These criteria designed by Benninger et al in 2003 are one of the most common criteria to assess and diagnose symptoms of sinusitis. A study done by Ansari et al on evaluating the effect of continuous ultrasound for sinusitis used similar criteria for their participant recruitment which showed significant improvement in the outcome measures post- intervention.<sup>16</sup> This justifies the inclusion of the criteria in the present study.

The results of the present study demonstrated significant increase in the pressure pain threshold at post- intervention as assessed by a pressure algometer on frontal and maxillary sinuses. The positive effect can be due to the thermal effects produced at the sinuses because of the manual therapy intervention that helped in draining the excess secretions that cause inflammation to their nearby lymph nodes. This technique in turn helped in reducing inflammation and pain at the sinuses. Thus, it suggests that the pressure algometer is a reliable and valid tool for assessing the trigger points and not for diagnosis. A similar study was done by

Park G et al in assessing the reliability and validity of pressure algometer in subjects with myofascial syndrome. The conclusion of that study was similar to the present study.<sup>17</sup>

The results of the current study showed that the Sino-nasal outcome test (SNOT-22) questionnaire was proved to be a reliable questionnaire in assessing the quality of life of patients suffering from chronic sinusitis. The possible reason for this improvement can be a reduction in inflammation of the sinuses which could be due to the therapeutic effect of the three manual therapy techniques performed in this study. A similar study supporting the present study analysis was performed to evaluate the benefit of the SNOT-22 questionnaire in mirroring the quality of life (QOL) and symptom control for patients with acute rhinosinusitis. In this study, the SNOT-22 proved its utility in assessing the QOL and symptom control in allergic rhinosinusitis (AR).<sup>14</sup>

The literature states that mucosal inflammation leads to blockage of the sinus ostium which in turn causes secretion retention that is blocked in sinus cavities. This restriction in the smooth drainage of the secretions leads to inflammation and pain at the paranasal sinuses. In the present study, application of the manual drainage technique showed significant improvement in the pain post-treatment. The possible reason for this could be that the effect of manual drainage technique produces an effect similar to the thermal effect produced by any of the electrotherapy modalities used in physical therapy set up that helps to loosen up the secretions which can be later drained into the nearby lymphatic channels. A study partially similar to the present study was performed to compare the effectiveness of therapeutic ultrasound (US) versus short wave diathermy (SWD) with suboccipital release and manual drainage techniques on subjects with chronic sinusitis showed similar results from their data analysis.<sup>13</sup>

In the present study, the jade stone group showed significant improvement in the post-treatment assessment in terms of pain threshold and quality of life of the subjects suffering from chronic sinusitis. This can be due to a reduction in the inflammation of the sinuses and the opening up of the blocked sinuses which improves the drainage of the secretions. The primary reason for this kind of improvement is that jade stone is said to be one of the stones of Chinese origin which were used for massage in older times and gives a soothing effect; however, there is no such literature supporting this notion. Applying strokes of jade stone over the infected sinus areas may loosen up of the secretions and improves blood circulation to that sinus which in turn hastens the healing process. A study was done to assess the advantages of massage and stretching when used as an adjunct to other treatments whether or not proven effective in reducing the sinusitis symptoms. The results of that study confirmed the effectiveness of massage and stretching techniques on subjects having chronic sinusitis.<sup>18</sup>

A controlled trial performed on baseball players having inflammation of the trapezius was performed to create a quantitative dry cupping device that could measure negative pressure attenuation and soft tissue pull-up during cupping in order to quantify soft tissue compliance. The results of which showed that there was an obvious lift in the tissue post 4 weeks of intervention; however, there was no significant difference in the tissue compliance. The aim of this study was to see the effect of non-abrasive cupping on the pain and quality of life of subjects with chronic sinusitis. The result of the present study showed significant improvement in the functional status which is similar to the results of the previous study. One of the reasons for this improvement can be the petechia or the micro perfusion of the skin which occurs during the cupping intervention. The microvasculature produced increased blood flow to the part to be treated in turn increases the oxygen supply to that part which induces faster tissue healing hence reducing pain and improving functional status.<sup>19</sup>

The results of the present study showed significant improvement in all the outcome measures post intervention within the three study groups. Also, while comparing between groups, there was an improvement in all the three groups. The jade stone group showed slightly better improvement at follow up post 6 weeks in terms of the quality of life of subjects. The possible reason for the improvement in all the study groups can be due to the frequent vasodilatation caused by jade stones in the sinuses which increased blood flow at the sinuses, increases oxygen supply to the tissues, and reduces inflammation. A similar comparative study was done where instrument assisted soft tissue mobilization (IASTM) was compared with stripping massage on subjects having myofascial trigger points at the right upper trapezius. The study was conducted for 4 weeks and showed similar results as the present study.<sup>20</sup>

## CONCLUSION

The study is indicative of the use of manual therapy techniques in patients with chronic sinusitis in terms of pain threshold and quality of life. This study is the first one to assess and evaluate the effectiveness of three different manual therapy techniques individually on subjects with CRS. There were a few limitations experienced in the present study. Due to affordability constrained and exposure of the radio waves to the face, the use of advanced radiographic equipment was not possible for assessment. Few of the subjects in the non-abrasive cupping group showed increased inflammation at their sinus areas post first intervention session and the only subjective outcome measure was assessed at follow-up.

In future, various clinical trials can be performed by using the newer advanced physiotherapeutic modalities such as Matrix Rhythm therapy or Low-level LASER therapy on subjects with CRS. Also, combination of manual therapy and electrotherapy can be studied to assess their effects in sinusitis cases.

The study concluded that all three intervention groups showed significant improvement in terms of their pain thresholds and quality of life. When compared between the groups at the 6<sup>th</sup> week follow-up, a highly significant reduction in symptoms was seen between the JS group and MD group, whereas no significant improvement was seen between the other two groups. Hence, the clinical implication of the study is that the three novel manual therapy techniques are safe and effective and can be further used as a mode of treatment for chronic sinusitis cases.

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