



## RESEARCH ARTICLE

### EFFECT OF CONTINOUS VERSUS PULSED ULTRASOUND IN CHRONIC RHINOSINUSITIS

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#### ABSTRACT

**Introduction:** Chronic rhinosinusitis (CRS) has a substantial negative impacts on quality of life. Although, Ultrasound (US) modality held an effective role for CRS, there are great conflicting opinions concerning in CRS management. **Aim of Study:** to compare therapeutic effects of continous US versus pulsed US in treatment of chronic rhinosinusitis. **Material and Methods:** Thirty CRS patients, their ages were 20 to 40 years old of both genders recruited from Suez Canal University Hospital, then randomly allocated into equal two groups; first group (A) received pulsed US, while second group (B) received continous US. Sinusitis Symptom Score (SSS) was verified to assess both groups prior and after treatment protocol along twelve consecutive sessions. All participants' data regarding SSS were measured before starting the treatment and after four weeks of intervention, the measurements data were collected, tabulated then statistically analyzed. **Results:** There were statistically significant among groups regarding demographics. Statistical analysis for present study results revealed a statistically significant improvements post study treatment protocol represented in values of SSS in all study population with superiorly improved for pulsed US modality group. **Conclusion:** Both therapeutic pulsed US and continous US were beneficial for chronic rhinosinusitis management based on twelve consecutive weeks with superior efficient gains by using pulsed therapeutic US therapy.

#### INTRODUCTION

According to the International Classification of Diseases (ICD-10), chronic rhinosinusitis refers to disorders with special features including; nasal mucosa inflammation in addition to paranasal sinuses, which might extend to more than four consecutive months (Hunsaker and Leid, 2008). Pathophysiologically, bacterial biofilm addressed as the essential pathogenesis in Chronic Rhinosinusitis with Nasal Polyps (CRSwNP). On contrary, clearly determined null correlation between positive bacterial swabs with clinical features of CRS (Psaltis et al., 2008). Furthermore, antibiotics were almost ineffective for bacterial biofilms management, and there is actual need for seeking another therapeutic maneuvers for inflammatory CRS feature (Bartley and Young, 2009). Therefore, actual support for therapeutic US role for biofilms management based on known anti-inflammatory benefits was needed that clinically addressed by significant improvements of symptomatic manifestations of CRS (Ansari et al., 2007).

Unless, published medical literature revealed a clear gap concerning scientific trials examining pulsed forms of US modality in compare with versus continous mode for CRS management.

**Purpose:** The purpose of current study was to compare therapeutic effects of continous versus pulsed US modality in treatment of CRS.

#### METHODS

Thirty CRS patients, their ages were 20 to 40 years old of both genders recruited from Suez Canal University Hospital, then randomly allocated into equal two groups; first group (A), had received pulsed US, while second group (B) received continous US. Sinusitis Symptom Score was verified to assess both groups prior and after treatment protocol along twelve consecutive sessions. After approval of the ethical committee of Faculty of Physical Therapy, Cairo University- Egypt, the procedures of the present study were discussed thoroughly and all the participants were asked to sign a written informed consent.

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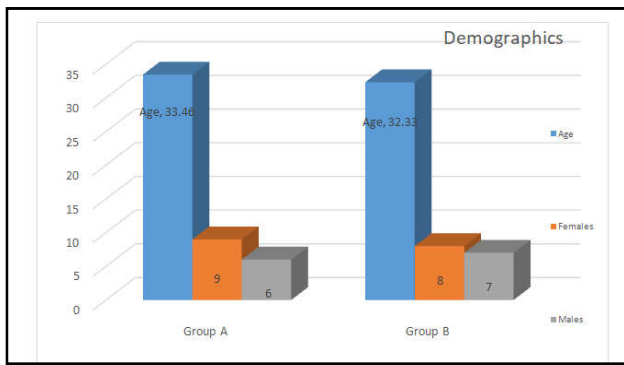


Figure 1. Current study population demographics

Participants were excluded if they had any malignancies, current antibiotics, anti-allergic or analgesics, as well in case of be prohibited for US modality.

**Instruments**

**Measurement Instrument and Tools**

**Sinusitis Symptom Score (SSS);** used for clinical scoring to evaluate chronic rhinosinusitis clinical features according to known diagnostic criteria; including facial pain, headache, nasal discharge and obstruction, as well postnasal discharge (PND), plus hyposmia and/ or cough and fatigue, as well generalized discomfort. Sinusitis Symptom Score was applied at baseline and after study treatment protocol then participants were classified based on improvement percentages (Dykewicz, 2003).

**Treatment Instrument and Tools**

**Therapeutic Ultrasound;** Astar, Manufactured by Poland), with circular plane applicator across defined geometric area of 1.4 cm<sup>2</sup>, generated effective radiating spot of 0.8 cm<sup>2</sup>. Generated beam non-uniformity ratio value is 5.0 max. Plus, US transmission gel (Sonogel, Germany) to lubricate site under transducer head.

**Procedures:** Protocol was explained in detail for every patient and a written consent form was assigned by each one. Sinusitis Symptom Score was applied at baseline and after study treatment protocol. Each participant has examined for his/ her clinical features and has been given a score of 0–3 (absent, mild, moderate to severe) then calculated given scores from 0-27 for all participants. Final total score calculated for both pre- and post-total score (Ansari et al., 2007). Group (A) receives pulsed US three sessions per week, total of twelve sessions, with selected parameters according to basis of Kahn’s guidelines, (2000); set as follows: 1MHz; 1 & 0.5 W/cm<sup>2</sup> for maxillary and frontal sinuses, respectively, as well pulsed mode with duty cycle; 1:9 over 1 cm<sup>2</sup> along 5 & 4 minutes for each maxillary and frontal sinuses, respectively. Overall sites were cheeks and forehead for maxillary and frontal sinuses, respectively. Localized apply through a tight and small circular motion of device head (Ansari et al., 2007). Group (B) receives Continuous US three sessions per week, total of twelve sessions. Overall sites were cheeks and forehead for maxillary and frontal sinuses, respectively, as well along 5 & 4 minutes for each maxillary and frontal sinuses, respectively. Localized apply through a tight and small circular motion of device head using a slow continuous technique, as well US device was calibrated and the accuracy of power output (W) and intensity

(W/cm<sup>2</sup>) is ±1. Type: continuous. Frequency: 1 MHz (Ansari et al., 2007).

**RESULTS**

There were no statistically significant differences among groups regarding demographics at the baseline of study as represent in figure (1). Statistical analysis for present study results revealed a statistically significant improvements post study treatment protocol represented in values of Sinusitis Symptom Score (SSS), in all study population with superiorly improved for pulsed US modality group.

Table 1. Comparison of pre and post treatment total score of SSS between both groups.

Item	Pre- treatment		Post- treatment	
	Group A	Group B	Group A	Group B
$\bar{x}$	23.06	23.2	8	13.26
SD±	1.7	2	1.81	2.01
MD	-0.14			-5.26
T-value	-0.19			-7.52
p- value	0.84			0.0001
Sig.	NS			Sig. ↓

$\bar{x}$ = Mean. SD; Standard deviation MD: Mean difference P-value: Probability level NS: Non significant

**DISCUSSION**

According to published literature concerning rhinosinusitis, CRS addressed as multifactorial etiologies those were poorly explained, pathophysiology (Helms and Miller, 2006). Therefore, no sole therapeutic maneuver recommended for CRS management (Chan and Kuhn, 2009). Up to date, antibiotics found to have limited efficiency for CRS management. Therefore, surgical intervention always considered the final step in CRS management addressed to reserve therapeutic goals for whom not respond to medicines or other therapeutic maneuvers, unless surgical approaches not often successfully managed CRS (Bartley and Young, 2009). Therefore, there were no efficient medical or surgical CRS management approach that concave us to explore alternative therapeutic strategy. Therapeutic US was previously advised for managing of CRS. As well, therapeutic US was commonly verified by Physical Therapists to accelerate affected tissues repair, gain muscular relaxation as well modulate existed pain, plus control underlying inflammation, recently US has been applicable for chronic rhinosinusitis (Ansari 2007; Rocha, 2011). Earlier clinical trial was conducted by Ferguson and Stolz, (2005) ensured clinical manifestations recalcitrant in CRS with pharmacological agents given, which only cured by mechanical and/ or surgical removal. Previous studies reported therapeutic US benefits including control chronic inflammatory process through modulating cellular membranes’ permeability, which accelerates sinus inflamed mucosal repair in CRS (Healy et al., 2008). In addition, Ansari and his co-workers, (2012), studied mechanical therapeutic benefits of pulsed US in CRS and reported an obvious reduction of inflammatory features, plus loosen stagnant secretions, both were responsible for facilitating associated sinus drainage. Furthermore, low intensity pulsed US (1:9 ratio generates temporal intensities ~0.1W/cm<sup>2</sup>) might explains mechanical therapeutic benefits in CRS individuals. Thus, we could suggest that gained lethal therapeutic benefits of pulsed US applications for biofilms in same line with positive gains on inflammatory features in CRS clinical manifestations.

## Conclusion

According to current study therapeutic pulsed US twelve sessions for management of chronic rhinosinusitis gains favorable improvements, thus could provide as scientific treatment protocol for Physical Therapists, Otolaryngologists to assist in chronic rhinosinusitis manifestations; pain modulation, control inflammation, as well enhance CSR patients' quality of life.

## Recommendations

Depending on our findings, it was recommended to add therapeutic ultrasound modality as an integral item for chronic rhinosinusitis management protocol, as well organize meetings at outpatient's clinics to explain essential role of therapeutic physical therapy modalities for chronic rhinosinusitis.

**Conflict of interest:** The authors confirmed that this article content has no conflict of interest.

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