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Immediate Effects of Jacobson's Progressive Relaxation Technique on Fatigue and Pain Among Post-Chemotherapy Patients with Breast Cancer.

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Abstract
Breast cancer being most common type of cancer throughout the globe. Treatment commonly opted for treating cancer is chemotherapy. This sudden introduction of high dosed drugs and cytotoxic chemicals has its drawbacks and patient complains of various side-effects such as fatigue and pain. Relaxation techniques have been used to treat fatigue as well as pain. Lesser literature is available on Jacobson's Progressive Relaxation Technique (JPRT) being performed for fatigue and pain. Various studies are done on chemotherapy induced nausea and vomiting, for adverse psychological effects of chemotherapy like anxiety, sleep disorders, depression, scant researches are found focusing on fatigue and pain. Thus this study aims to learn about immediate effect of JPRT on chemo-induced fatigue and pain. The objective is to determine the immediate effect of JPRT among immediate post-chemotherapy patients with breast cancer survivors for Fatigue and Pain. The study was done in Maharashtra among patients admitted for chemotherapy. 30 patients participated during the duration of 3 month. Cancer Fatigue scale and Numerical Pain Rating Scale was used for outcomes. Immediately after chemotherapy, Progressive Muscle Relaxation (PMR) was induced in patients. Pre-test and post-test were taken before and after intervention. Patient showed significant results after progressive muscle relaxation and felt relieved to some extent from fatigue and pain. The average score pre intervention for fatigue through Cancer Fatigue Scale (CFS) was 37.2 and post intervention was 31.03 which was quite remarkable. And the average score for pain before intervention by Numerical Pain Rating Scale (NPRS) was 8.19 and after intervention it was 6.57. The p-value for CFS and NPRS was <0.0001 and <0.0001 respectively. All patients showed decrease in symptoms to some extent. Fatigue and pain both are less explored divisions among side effects of chemotherapy even though these are the most commonly experienced effects. Immediate after chemotherapy is when patient encounters utmost intensity fatigue and pain. Rather making it worse with time, the sufferings can be reduced by simple performance of PRT.

1. Introduction

Breast cancer has ranked primary cancer among Indian females with age adjusted rate as high as 25.8 in line with 100,000 Females and mortality 12.7 consistent with 100,000 Females[1]. Less solutions are available and lesser are adopted into practice for the experienced side-effects of chemotherapy. Nearly all patients undergoing chemotherapy experience variety of side-effects. Most hospitals overlook this and do not manage side-effects or are managed symptomatically. Some prefer pharmacological treatment[2, 3, 4, 5], while some keep it untreated. Hydration and diet changes for betterment and prevention are advised[6]. Overall, there are several techniques that can be used to reduce the side effects of chemotherapy in India. By utilizing these techniques, patients can better manage the side effects of chemotherapy and improve their quality of life during treatment.

Fatigue has been found to be the most common, distressing, disruptive side-effect post-chemotherapy.[7, 8] Pain was another symptom that was experienced by most patients after chemotherapy[9]. Fatigue is a persistent feeling of tiredness, lack of energy, lethargy, and weakness that is unaffected by rest or sleeping. It is distinct from the sporadic exhaustion

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that a healthy person encounters and that is not a result of engaging in a specific activity or making an effort[10]. Pain involves an extension from the physical to the psychological, cognitive, affective, emotional, social, and spiritual regions[11].

There are many treatment options available for fatigue and well as pain which are pharmaceutical, Psychological, physical. Mustian KM et al found pharmacological treatment to be less effective than psychological and exercise and advised clinicians to prescribe exercise and psychological intervention as first line of therapy for fatigue[12]. Aman MM et al have suggested use of opioids, medications and radiotherapy for conservative management of pain associated with cancer[13]. De Paolis et al found guided imagery and PMR to be effective in reducing pain in a RCT[11].

Among all the researches done, most commonly used treatment for side effects was pharmacological and drugs which indeed has their own side-effects. We focused on finding an effective, easy, physiotherapeutic technique without any harmful effects to reduce the most commonly experienced side-effects of chemotherapy which are fatigue and pain. This study tries to find ways for improving quality of life in patients with chemotherapy induced side-effects which harness the day-to-day life and functioning. Since most extremes of side-effects are experienced after chemotherapy, we attempted to find a immediate and easy solution for the most commonly experienced side-effects.

Pragya et al found that progressive muscle relaxation (PMR) exercises are effective in reducing pain and fatigue among hospitalized patients receiving radiotherapy[14]. While there were no specific criteria for inclusion and all cancer patients were included in their study, we sought to be more specific by only including breast cancer patients. Since the original study did not provide any specifications about when to perform PMR and the protocol was long-term, we decided to intervene immediately after the chemotherapy session and keep it short-term with only one session to determine its effectiveness.

The Jacobson's Progressive Relaxation Technique (JPRT) is a method of deep muscle relaxation that involves tensing and relaxing different muscle groups in a systematic manner. The technique is based on the principle that physical tension in the body can contribute to feelings of fatigue and pain. JPRT is a non-pharmacological method that can be integrated into a patient's treatment plan and can be easily learned by patients themselves. The technique is simple and can be done in the comfort of one's own home or in a hospital set up which makes it accessible for patients who may have mobility issues. JPRT may also help to reduce the need for pain medication, which can have unwanted side effects.

Numerous studies reveal that muscle relaxation can reduce depression and anxiety and level up the quality of existence in most cancer patients[15, 16, 17]. In a study performed with the aid of Molassiotis, it showed that muscle relaxation reduces the chemotherapy complications in breast cancer patients[18]. Additionally, research has proven that muscle relaxation improves the sleep quality greatly[19]. Other researchers proved practice of PRT to have better mental health and psychological status[20, 21, 22, 23]. Researchers have found PRT to be effective on fatigue and generalized body pain. Studies have shown that JPRT can significantly improve sleep quality, reduce muscle tension and pain, and improve overall quality of life for these patients[24, 25]. While less literature is available regarding chemotherapy induced fatigue and pain, we tried to explore the section while searching for a physiotherapeutic treatment plan for breast cancer patients undergoing chemotherapy as it also expands the scope of physiotherapy. The objective of this study was to determine the immediate effect of Jacobson's Progressive Relaxation Technique (PRT) on fatigue and pain in breast cancer patients undergoing chemotherapy. Patients who experienced extreme side effects of fatigue and pain were recruited to assess whether inducing PRT would reduce these symptoms.

2. Methodology

The data generated by this study were used to test the hypothesis that there will be no significant effect of Jacobson's relaxation technique among immediate post-chemotherapy patients with breast cancer survivors for fatigue and pain. The data were also used to test the hypothesis that there will be significant effect of Jacobson's relaxation technique among immediate post-chemotherapy patients with breast cancer survivors for fatigue and pain. Data were generated from one group. Sample size was calculated

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through a given formula: sample size= $z^2 \times p(1-p)/e^2N$ where z- z score, p is standard deviation, e is margin of error and N is number of population. The prevalence of fatigue and pain in patients undergoing chemotherapy were taken from previous studies. Thus by taking average of both prevalence the sample size was calculated by assuming error to be 15%. Multiple sources from literature were used for gathering information and analysis.

This is an experimental study focusing on finding extent of immediate effects of Jacobson's Progressive Relaxation technique on chemotherapy patients complaining of fatigue after treatment. It was also found that patients suffer from pain in body after chemotherapy. This study checks effectiveness of immediately inducing Jacobson relaxation technique for fatigue as well as pain. For this study, patients with breast cancer undergoing chemotherapy were selected through simple random sampling method.

Participants included those diagnosed with breast cancer and undergoing chemotherapy. Participants were included irrespective of their stages of cancer. Only 18 years or older were included. Participants with initial stages of chemotherapy (2^{nd}, 3^{rd}, 4^{th}…) were included and not the one in first stage as the literature suggests that patient experienced more fatigue in 2^{nd}, 3^{rd} clinics than in 1^{st} (adjuvant chemotherapy). Patients undergoing adjuvant radiotherapy were excluded. The ones with other chronic disease in which fatigue is a potentially prominent symptom were not included. Patients diagnosed with any psychiatric condition were excluded. Patients with history of previous chemotherapy or cancer were excluded. Also, if they had history of epilepsy or any other serious condition, mental illness diagnosed by a doctor, they were not included in the study.

The research study was performed in patients who were admitted for chemotherapy in Krishna hospital, Maharashtra, India between April 2022 and June 2022. The counted sample size was 30 patients with 15% error calculated. After the patients completed their chemotherapy, they experienced fatigue and pain for which PRT was induced immediately. Before performing PRT data was collected under pre-test record. For data collection two scales were used, Cancer Fatigue scale and Numerical Pain Rating Scale for Fatigue and pain respectively. Fatigue and pain levels were noted for comparison with post-test outcomes. After explaining the procedure, the patients performed Relaxation technique under guidance and observation of the therapist. After intervention, post-test was taken for fatigue and pain and was compared with pre-test outcomes.

The JPRT was to be performed immediately after chemotherapy. To perform JPRT, all interventions were performed in a private room with sufficient light and warmth to make the patients feel relaxed during the study. No other individuals were allowed to enter the room during the sessions. While performing exercises, the patients were asked to wear casual and comfortable clothes. Muscle groups used for JPRT are toes, feet, legs, calves, butt, thighs, abdominal muscles, back muscles, chest, hands, biceps/triceps, shoulders, neck, face, and tongue. In the PMR exercise sessions, patients took 5 deep breaths in and out. Later as muscles were tightened, they were asked to hold the contraction up to very few seconds and they were relaxed, progressing from the foot up to the face muscles (i.e., bottom to top and top to bottom). In our study, PMR exercises were performed immediately after end of chemotherapy session and were continued for 10 minutes.

- The curriculum in each session included:
  - Providing a quiet environment and a comfortable position (supine or long sitting with back support),
  - Training contraction and loosening of muscles from the head to foot and vice versa,
  - Responding to the patients' questions about the relaxation technique, and the proper method of its implementation.
  - Abdominal breathing keeping breaths smooth and regular without gulps of long big breaths counting till four till inhale and then slowly counting till four during exhale[26].
  - The hold was for 5 sec and relaxing was supposed to be 10 sec[27]
- Patients were commanded as following
  - Start by lying or sitting down. Relax your entire body. Take five deep, slow breaths through nose and expire through mouth slowly.
  - Lift your toes upward. Hold, relax. Then let go. Pull your toes downward. Hold, relax.
  - Next, tense your calf muscles, then relax
  - Move your knees toward each other. Hold, relax.
  - Squeeze your thigh muscles. Hold, relax.

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- Clench your hands. Pause, relax.
- Tense your arms. Hold, relax
- Squeeze your buttocks. Hold, relax.
- Contract your abdominal muscles. Hold, relax.
- Inhale and tighten your chest. Hold, then breathe out and relax.
- Raise your shoulders to your ears. Hold, relax.
- Purse your lips together. Hold, leave.
- Open your mouth wide. Hold, and then relax.
- Close your eyes tightly. Pause, then release.
- Lift your eyebrows. Hold, then release
- Maintain breathing though and after every contraction.[28]

Patients were advised to regularly perform the JPRT while at home or whenever then felt uneasy. The data obtained were finally analysed using software Instat. All the value Percentages for each demographic variable was calculated. Data was calculated. MS Excel was used for drawing various graphs with given frequencies and for master chart.

The NPRS is a self-rating scale consists of Numerical point scale with extremes of No Pain and Extreme Pain. The scale is set most-commonly on a horizontal line ranging from 0 to 10. It can be administered verbally or in written form. The test-retest reliability of NPRS exhibited to be moderate to high varying from 0.67 to 0.96. The NPRS is determined to have a convergent validity of 0.79 to 0.95.[31]

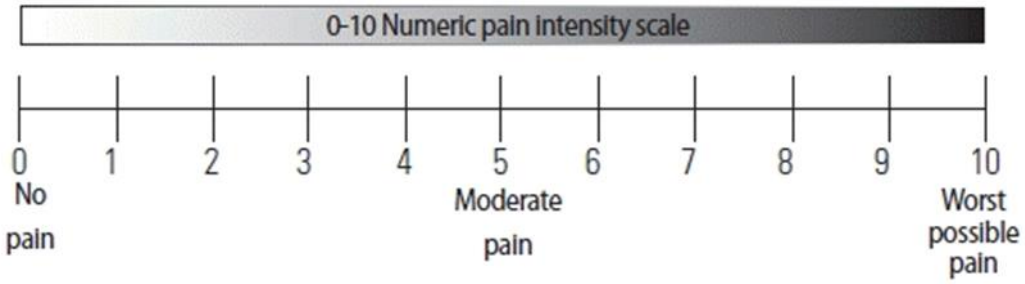

Figure no. 1: Numerical pain rating scale

The CFS scale is designed to assess phenomenology and severity of fatigue experienced by cancer patients. It has 15 questions that are required to make precise judgement. It has 3 subscales under. It calculates Physical, Affective and Cognitive changes. The internal consistency of this scale is 0.88 and test-retest reliability is 0.69.[29] The scale's 15 items are broken down into three factor-generated subscales: physical, affective, and cognitive. The physical symptoms of fatigue include a tendency to get exhausted rapidly, the desire to lie down, exhaustion, a feeling of being heavy and exhausted, being fed up, reluctance, and a lack of direction. Lack of energy, lack of interests, lack of attention, and a lack of motivation are all affective characteristics of fatigue. Forgetfulness, linguistic mistakes, slower thinking, and carelessness are cognitive symptoms of fatigue. Patients are asked to circle the number that best characterises their current state as they rate each thing on a scale from 1 (not at all) to 5 (very lot). Physical, affective, and cognitive subscales each have a possible answer range of 0 to 28, 0 to 16, and 0 to 16 respectively. The top overall score is 60. More acute weariness is revealed by higher scores[30].

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Right now . . .	No	A little	Somewhat	Considerably	Very much
1 Do you become tired easily?	1	2	3	4	5
2 Do you have the urge to lie down?	1	2	3	4	5
3 Do you feel exhausted?	1	2	3	4	5
4 Do you feel you have become careless?	1	2	3	4	5
5 Do you feel energetic?	1	2	3	4	5
6 Does your body felt heavy and tired?	1	2	3	4	5
7 Do you feel that you more often make errors while speaking?	1	2	3	4	5
8 Do you feel interest in anything?	1	2	3	4	5
9 Do you feel fed-up?	1	2	3	4	5
10 Do you feel you have become forgetful?	1	2	3	4	5
11 Can you concentrate on certain things?	1	2	3	4	5
12 Do you feel reluctant?	1	2	3	4	5
13 Do you feel that your thinking has become slower?	1	2	3	4	5
14 Can you encourage yourself to do anything?	1	2	3	4	5
15 Do you feel such fatigue that you don't know what to do with yourself?	1	2	3	4	5

Figure no. 2: Cancer fatigue scale

3. Results

According to inclusion criteria and exclusion 30 participants remained in the study and participated willingly so there was no sample loss during the research. There was no scope for gender distribution as the whole population under study belongs to single gender and that was female. Their age ranged from 30-70 years old and were mostly married, majorly housewives with no academic degrees. Some comorbidities they suffered from were diabetes mellitus and hypertension 13% and 13% respectively. Some had addictions of *mishri* (36%) and tobacco (13%). As patients with 1st Chemotherapy sessions were excluded, patients ranged from 2nd session to 8th. Number of patients on 2nd were 7, on 3rd were 10, on 4th were 6 and on 5th, 6th, 8th were 2, 1, 1 respectively.

Table 1: Age Distribution

Age	No. of Subjects	Percentage
30-40	5	16.6%
41-50	11	36.7%
51-60	8	26.7%
61-70	6	20%

Table 2: Completed Chemotherapy Sessions (At the time of intervention)

Chemotherapy Sessions	No. of Subjects	Percentage
2	7	26.6%

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3	10	36.6%
4	6	20%
5	2	6.6%
6	1	3.3%
8	1	3.3%

Table 3: Comorbidities

Comorbidities	No. of Subjects	Percentage
Hypertension	4	13%
Diabetes	4	13%
None	22	74%

Table 4: Habits

Habits	No. of Subjects	Percentage
Mishri	11	36%
Tobacco	4	13%
None	15	51%

According to the results the mean score for fatigue before intervention were 37.2 ± 3.890 and reached 31.03 ± 4.319 after intervention according to CFS. And for of pain were 8.196 ± 1.032 before intervention and after 6.577 ± 1.302 through NPRS. The p-value for CFS and NPRS was <0.0001 and <0.0001 respectively. T value for CFS and NPRS turned out to be 10.262 and 11.412 respectively. The difference was significant between pre-intervention and post-intervention results for fatigue as well as pain.

Table 5: Cancer fatigue scale results

CFS	**Mean**	**SD**	**p-value**
Pre-intervention CFS	37.2	3.890	>0.10
Post-intervention CFS	31.03	4.319	>0.10

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Table 6: Numerical pain rating scale results

NPRS	Mean	SD	p-value
Pre-intervention NPRS	8.196	1.032	0.0488
Post-intervention NPRS	6.577	1.302	>0.10

4. Discussion

As fatigue and pain are the most common side effects of chemotherapy, and due to the limited availability of effective solutions[3, 19], we aimed to find a treatment plan that is both effective and easy to implement. This study's goal was to find out how Jacobson's Progressive Relaxation Technique (PRT) affected fatigue and discomfort in breast cancer patients receiving chemotherapy right away. To determine whether initiating PRT might lessen these symptoms, patients with severe pain and fatigue side effects were sought out.

Most patients diagnosed with cancer are prescribed adjuvant chemotherapy treatment if they are at risk of recurring or metastasizing cancer. Chemotherapy is responsible for 98.30% of patients experiencing fatigue post-treatment, and incidence of pain as a side effect is also seen in most patients[32]. Early studies on the prevalence of pain among cancer patients reveal high numbers, ranging from 52% to 77%.[33] A recent meta-analysis suggested the pooled pain prevalence was 40% (95%CI 0.29-0.51) with a high degree of heterogeneity of 96%.[34]

There is no fixed or particular treatment for fatigue or pain experienced post-chemotherapy. Most of the studies found related to PRT were concerned with psychological and emotional factors such as anxiety, depression, sleep, nausea, vomiting, and quality of life, but comparatively lesser literature is available regarding pain and fatigue, even though fatigue has been found to be the most commonly experienced side effect of chemotherapy.

Soliman HM et al. (2022) combined PRT with antiemetic to determine its effectiveness in decreasing vomiting, nausea, retching, and improving anxiety induced by chemotherapy[35]. Similarly, Kareem M et al. (2022) compared two groups, one was given PRT and the other was given regular nursing care to find that the PRT group experienced less anxiety and depression than the other group[36]. Neither study considered fatigue or pain as factors in their studies while studying PRT, showing the need for this study to be conducted. In a study, MK Sinha et al. (2021) primarily focused on psychological factors such as stress, anxiety, depression, and mood while less focused on nausea, pain, fatigue, and quality of life, finding progressive muscle relaxation with guided imagery effective in alleviating mood, improving quality of life, and reducing anxiety and stress. Fatigue and pain were understated and reviewed vaguely, as only one study proved PRT to be effective on fatigue and pain[37].

In most of the studies mentioned above, fatigue and pain were understudied or not researched at all. This lack of research motivated us to further study the less researched section, as no clear study regarding PRT effects on chemotherapy-induced side effects was found.

M. Demiralp et al. (2010) found PRT as a promising approach as it improved sleep quality in breast cancer patients and improved fatigue[38]. However, in this study, PRT was performed before chemotherapy on the first and fifteenth sitting, as well as at home and unsupervised (self-induced). In contrast, patients in our research were given complete attention throughout the treatment and were supervised by the therapist. More research is needed to determine whether PRT should be performed before or after chemotherapy for better results.

Zehra Gok Metin et al. (2019) studied PRT and mindful meditation on fatigue, coping styles, and quality of life in early breast cancer patients for a total of 12 weeks and found significant reductions in fatigue[39]. However, since it was a long-term protocol and did not consider pain, our study aims to reduce both fatigue and pain levels immediately after chemotherapy and is found to be very effective.

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H N Anugrahini et al. studied PRT effects on various domains such as fatigue, nausea-vomiting, pain, insomnia, appetite, and dyspnea, but it was a 13-day protocol[40]. While all studies focused on reducing anxiety, depression, nausea, vomiting, mood, and quality of life, limited literature is available focusing on fatigue or pain induced by chemotherapy in breast cancer patients. Although Tan L et al. (2022) concluded that PRT is less effective in his RCT that assessed a number of outcomes for cancer patients, the quality of evidence was moderate to low regarding the effects of PRT on fatigue[26]. In India, PRT was found to be effective in chemotherapy-induced side effects. Nevertheless, our concern was not to find the effectiveness of Jacobson's PRT but to find its immediate effects after chemotherapy, which was not concerned about a variety of side effects experienced by patients undergoing chemotherapy and was only centred on fatigue and pain induced after chemotherapy.

Rather than studying numerous other components and explaining complicated, lengthy procedures while performing and maintaining the record, the already tired patients might have gotten fed up and confused, resulting in alterations in results. Keeping this in mind, an easier method was chosen without combinations, keeping it simple to understand and perform. This study was proven effective in reducing fatigue as well as pain in patients immediately after chemotherapy, as they experienced worse levels of fatigue and pain right after chemotherapy.

The study was conducted to investigate the immediate effect of Jacobson's relaxation technique in post-chemotherapy patients, as no such study has been conducted primarily for fatigue, and to check the effectiveness of relaxation techniques on chemotherapy-induced pain. Progressive muscle relaxation focuses on the repetitive contraction and relaxation of specific muscle groups, so we aimed to study its effect on muscular pain experienced by patients after chemotherapy. As the alternative hypothesis is proven, it will further help reduce chemotherapy-induced fatigue and pain. Limited studies are available about progressive relaxation in breast cancer patients undergoing chemotherapy treatment. This study shall help in building a physiotherapeutic protocol for the less explored division of side effects associated with chemotherapy.

Various studies have been performed on and about chemotherapy, but very limited literature

The research results were remarkable, with astounding outcomes as patients reported feeling less fatigue and pain post-intervention with just 10 minutes of exercise. Of the 30 participants, all felt relaxed after practicing the relaxation technique and continued to practice it at home. The results showed that fatigue was reduced more significantly than pain. As the extent of relief felt by the patients was entirely subjective, the results were based on their responses through outcome measures and verbal communication.

However, it should be noted that the shorter duration of the study and the small sample size are limitations of this study. The results may not be generalizable to the entire population and are limited to one geographical location and population. Additionally, the outcome measures used are both subjective and self-rated, which may affect the accuracy of the results. To increase precision, this study can be performed on a larger population and with more details. Further research can also be conducted to properly assess the subjects and determine the efficacy of PRT on fatigue and the extent and quality of pain post-chemotherapy.

The outcomes of this study can serve as a reference for evaluating and addressing fatigue and pain in breast cancer patients. Hospitals and healthcare professionals can use this information to develop programs aimed at reducing fatigue and pain in chemotherapy patients. Practicing relaxation techniques not only helps reduce physical fatigue and pain but also psychological distress patients experience during and after chemotherapy, as numerous studies have shown.

5. Conclusion

Immediately inducing Jacobson progressive relaxation technique for fatigue in patients with breast cancer was found to be remarkable in most of the participants, as it immediately helped them reduce fatigue levels in the included patients as the CFS shows and decrease pain showed by NPRS right after treatment protocol. The average score pre intervention for fatigue through cancer fatigue scale was 37.2 and post intervention was 31.03 which was quite

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remarkable. And the average score for pain before intervention by numerical pain rating scale was 8.19 and after intervention it was 6.57. The p-value for CFS and NPRS was <0.0001 and <0.0001 respectively. Average score of Cancer fatigue scale and numerical pain rating scale were significantly low showing that the PRT is effective in patients undergoing chemotherapy for reducing fatigue as well as pain. No combination was used to maintain the simplicity, for better understanding and the technique performed immediately after chemotherapy when the patient feel most of the symptoms at extremes. Since all outcome measures were subjective and self rating, a better scale or means of measurement should be incorporated in later studies for more accuracy and reduce errors.

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