ORIGINAL ARTICLE

Immediate Effect of Combination Therapy (Ultrasound and Interferential Therapy) on Pain in Adhesive Capsulitis Patients

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Abstract

Background: Another name for adhesive capsulitis is frozen shoulder, is a debilitating illness that is marked by pain and progressive restriction in shoulder mobility, often due to synovial inflammation and capsular adhesions. The condition is particularly prevalent among females aged 40–65 and individuals with concomitant conditions such as diabetes and thyroid dysfunction. Conservative management, including therapeutic exercises and electrotherapy, is the standard approach, although limited access to physiotherapy in underserved areas necessitates strategies that yield immediate relief. **Objectives:** This study aimed to evaluate the immediate effects of combination therapy using Interferential therapy (IFT) and therapeutic ultrasound (US) on pain reduction in individuals suffering from adhesive capsulitis, compared to US therapy alone. **Methods:** An observational research with a prospective design was carried out using 78 participants diagnosed with adhesive capsulitis, randomly allocated into two groups. Group A received combination therapy (IFT + US) with tailored physiotherapy, while Group B received only US with physiotherapy. Pain intensity was measured before and after a single treatment session using the numeric pain rating scale (NPRS). Statistical analysis was conducted using paired and independent *t*-tests, with significance set at $P < 0.05$. **Results:** Both groups showed statistically significant reductions in NPRS scores post-treatment. However, Group A demonstrated a greater mean reduction (1.62) compared to Group B (1.03), with $P = 0.000$, indicating superior efficacy of combination therapy in immediate pain relief. **Conclusion:** Combination therapy involving IFT and US significantly reduces pain in a single session in individuals suffering from adhesive capsulitis, outperforming US alone. This approach may be especially beneficial in resource-limited settings where regular therapy sessions are not feasible. The findings support integrating multimodal electrotherapy strategies for more effective short-term management of adhesive capsulitis.

Key words: Combination Therapy; Ultrasound; Interferential Therapy; Immediate effect; Adhesive Capsulitis

INTRODUCTION

Another name for adhesive capsulitis is frozen shoulder, is pathology that affects the shoulder capsule.[1] The synovial inflammation causing adhesions in the capsule resulting with a noticeable decrease in passive movement in several directions, pain, and restricted mobility are the main issues. Restricted external rotation is a very significant clinical indication that can significantly influence the treatment strategy, particularly when the arm is at the side or at varying degrees of shoulder abduction.[2,3] Clinicians should be aware that those with thyroid conditions or diabetes mellitus are more likely to get adhesive capsulitis,[2,4-7] those between the ages of 40 and 65 are more likely to develop adhesive capsulitis, female,[7] I have experienced adhesive capsulitis on the contralateral arm in the past.[8]

Conservative management in the adhesive capsulitis are exercises to improve the range of motion of the shoulder joint and to strengthen the surrounding muscles.[9-12] To reduce the pain, electro modalities are used like therapeutic ultrasound (US), interferential current therapy, etc.[13-16] It takes 4–6 months of physical therapy to reach to functional range

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of motion (ROM). But, in many clinical settings, particularly in rural or underserved regions, patients often attend only a single physiotherapy session due to logistical challenges such as long travel distances, financial constraints, or time limitations. This limited access underscores the importance of identifying therapeutic strategies that can provide immediate and meaningful pain relief within a single session.

Literature is scarce which discusses the impact of the combination therapy in shoulder pain, which includes one of the electro modalities as US. Evidence on the immediate effects of combination therapy are limited. However, in such literature the treatment has been given for a few days or weeks. Therefore, this study aims to fill a critical gap in the literature by evaluating the immediate effect of combination therapy (IFT with US) on reducing pain in patients with adhesive capsulitis. The findings could inform practice guidelines, enhance clinical decision-making, and enhance treatment outcomes, especially for individuals who encounter obstacles to accessing regular physiotherapy care.

METHODS

This research was a prospective observational one started after receiving the Institutional ethical approval (SVIEC/ON/PHYS/BNMPT21/D22019). All the patients were recruited as per the inclusion criteria; those were patients with adhesive capsulitis, age range 30–60 years. We screened 98 patients with shoulder pain, either unilateral or bilateral. Of these 98 patients, a total of 78 patients were recruited for the study and 20 patients were excluded because of trauma, cervical pain referring to the shoulder, rotator cuff pathology, etc. All the patients willing to take part in the research signed the informed consent forms. All patients were provided with a participation information sheet outlining the important details of the study, such as its benefits, risks, procedure employed, confidentiality measures, and contact details, which helped the participants, make well-informed choices on their participation in the study. Adhesive capsulitis patients were randomly allocated to either Group A or Group B.

Group A received combined treatment made up of interferential current therapy and Therapeutic US, along with tailor-made physiotherapy. The dosimetry for Group A physical agents: Interferential therapy (model -Vectrodyne-100) - the dosage was 4KHz at 4 pole vector 45 for 20 min with US (model-Electromed) - 1 MHz; from 0.8 to 1 Watt/cm^2; continuous for 10 min. Group B was given only therapeutic US along with tailor-made physiotherapy. The dosimetry for Group B physical agents: Therapeutic US - dosage was 1 MHz; from 0.8 to 1 Watt/cm^2; continuous for 10 min.

Before giving the treatment, the patients were asked to quantify the pain on numeric pain rating scale (NPRS). The patient was given a paper on which a 10 cm line was drawn. 1–10 numbers were written on the line. The patient was explained to quantify the pain on this scale where zero means no pain and 10 means extreme or unbearable pain. They were also informed that increase in the number

Table 1: Demographic data of patients

Variables	Number/mean/%
Male	34 (44)
Female	44 (56)
Mean age	47.84 years
Group A (combination therapy: Ultrasound+interferential therapy)	39
Mean age	48.23 years
Male	15
Female	24
Right-hand dominance	36
Left-hand dominance	03
Right shoulder involvement	29
Left shoulder involvement	09
Bilateral involvement	01
Occupation in group A	
Housewives	16
Farmers	04
Business man	03
Medical staff	04
Unemployed/retired	12
Patients with comorbidities in group A	
Diabetes mellitus	05
Hypertension	04
Thyroid dysfunction	01
No comorbidities	27
Group B (therapeutic ultrasound only)	39
Mean age	47.46 years
Male	19
Female	20
Right-hand dominance	35
Left-hand dominance	04
Right shoulder involvement	20
Left shoulder involvement	19
Bilateral involvement	00
Occupation in group B	
Housewives	12
Farmers	10
Business man	04
Unemployed/retired	13
Patients with comorbidities in Group B	
Diabetes mellitus	12
Hypertension	05
No comorbidities	22

Table 2: Comparison of NPRS with in the group A (pre-treatment and post-treatment) using paired *t*-test

Group A	*n*	Mean	Standard deviation	Standard error mean	Mean difference	*P*-value
Pre NPRS	39	4.97	1.18	0.19	−1.62	0.000
Post NPRS	39	3.36	1.06	0.17		

NPRS: Numeric pain rating scale

Table 3: Comparison of NPRS within group B (pretreatment and post-treatment) using paired *t*-test

Group B	*n*	Mean	Standard deviation	Standard error mean	Mean difference	*P*-value
Pre NPRS	39	5.90	1.17	0.19	−1.03	0.000
Post NPRS	39	4.87	1.42	0.23		

NPRS: Numeric pain rating scale

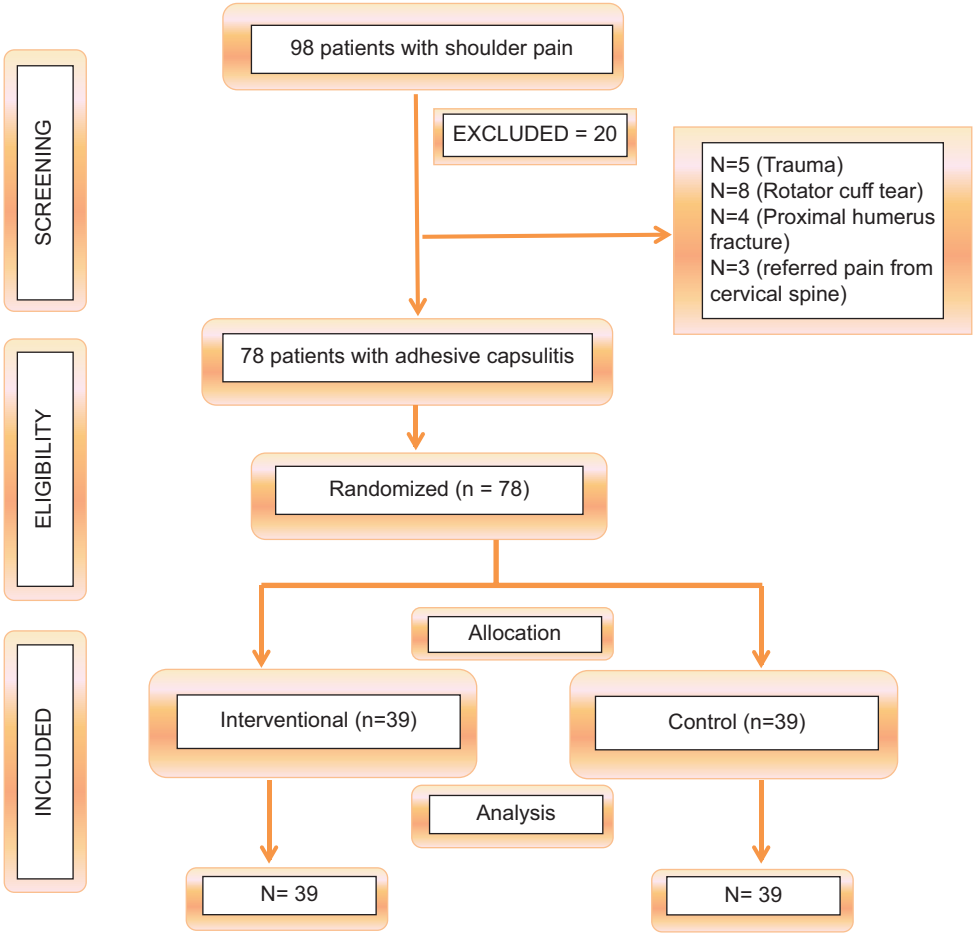

Figure 1: The preferred reporting items for systematic reviews and meta-analyses consort flow diagram showing the process of study selection

indicates increase/severity of the pain. The same was asked after the treatment. The detailed methodology mentioned above outlines the patients' participation and measurement technique, which motivates the reproducibility of the study. The data were tabulated in Microsoft Excel for the data analysis. A descriptive analysis of demographic data was done. The data were analysed using the Statistical Packages for the Social Sciences -26 statistical software. The software ran an independent *t*-test, which helped explore the differences between pre-treatment and post-treatment NPRS. The significance level was declared at $P < 0.05$ for all the data analysis.

RESULTS

A total of 78 patients [Figure 1] with adhesive capsulitis were recruited from the physiotherapy outpatient department, Dhiraj Hospital, Sumandeep Vidyapeeth Deemed to be University, comprising 34 males (44%) and 44 females

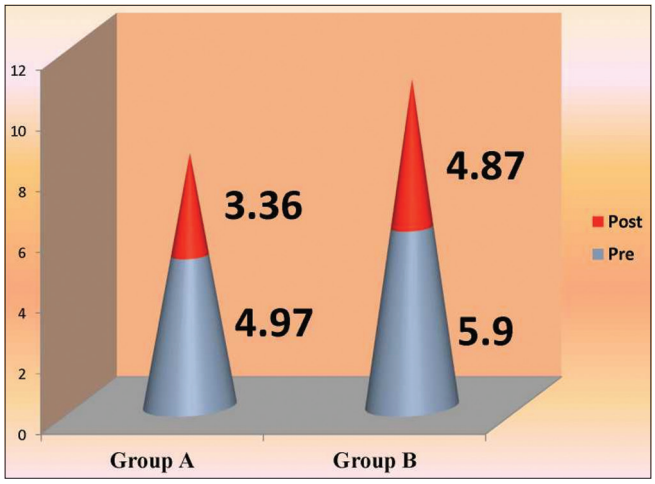

Figure 2: Bar graph shows pre and post -physiotherapy comparison of pain between Groups A and B

(56%), with a mean age of 47.84 years.

DISCUSSION

This study evaluated the immediate effect of combination therapy (interferential therapy [IFT] + US) on adhesive capsulitis patients' discomfort. Adhesive capsulitis, often referred to as frozen shoulder, predominantly affects individuals over 40 years of age, with females being more commonly affected than males.[7] A study by Zreik *et al*.,[7] stated that females are prone to develop adhesive capsulitis by 56 years of age. In our study, the mean age of the participants was 47.84 years, which aligns with findings from prior research. For example, a study on the prevalence of adhesive capsulitis mentioned that their participants who had adhesive capsulitis were in the age 40–50 years.[17]

Another study suggested that females may be more prone to adhesive capsulitis due to reduced use of the shoulder joint and hormonal influences.[18] These findings emphasize the need to consider demographic factors when designing treatment protocols for adhesive capsulitis.

Occupation also appears to play a significant role in the development of adhesive capsulitis. Our study included participants from diverse occupational backgrounds, and findings showed that repetitive overhead activities, heavy manual labor, and awkward postures are associated with an increased risk of shoulder injuries, as supported by previous studies.[19-21] Occupations requiring prolonged physical strain on the shoulder joint can lead to microtrauma and inflammation, eventually progressing to adhesive capsulitis.[20] These insights underscore the importance of incorporating ergonomic education and preventive strategies into rehabilitation programs for at-risk populations.

Comorbidities such as diabetes mellitus and thyroid dysfunction are well-documented risk factors for adhesive capsulitis. It has been hypothesized that hyperglycemia-induced glycation of collagen inside the capsule of the shoulder joint contributes to restricted mobility and pain. Additionally, hyperthyroidism has been associated with a twofold increased risk of developing adhesive capsulitis compared to the general population.[4,5] These findings highlight the need for early screening and tailored interventions for individuals with metabolic disorders who present with shoulder pain. A research study that identified a prevalence of adhesive capsulitis stated that there is over 10% of individuals with diabetes mellitus.[22] In our study, 5 participants in Group A (combination therapy) and 12 participants in Group B were diabetic.

In terms of pain reduction, this research showed that combined treatment of IFT and US was significantly more effective than therapeutic US alone. The mean pre-treatment NPRS values were 4.97 in Group A and 5.90 in Group B, while the post-treatment values were 3.36 and 4.87, respectively [Figure 2]. The difference in NPRS reduction between the two groups was statistically significant (P = 0.000) [Tables 2 and 3]. Within Group A (combination therapy), the mean NPRS reduction was 1.62, compared to 1.03 in Group B. These results underscore the immediate efficacy of combination therapy in alleviating pain in adhesive capsulitis.

The superiority of combination therapy is attributable to the synergistic effects of IFT and US. IFT uses low-frequency electrical currents to stimulate deeper tissues, reduce muscle spasms, and promote local blood circulation, while US delivers mechanical energy to the tissues, enhancing cellular repair and reducing inflammation. When combined, these modalities provide a dual mechanism of action that targets pain at multiple levels, resulting in more effective pain relief.[23,24] Previous studies have similarly concluded that combination therapy provides better outcomes in terms of pain reduction and increased mobility compared to single-modality treatments.[25-27]

Additionally, one study reported that combination therapy involving IFT and US reduced pain intensity and trigger points in patients with fibromyalgia over 12 treatment sessions.[28,29] Another study demonstrated significant pain reduction following a 2-week follow-up of combination therapy in patients with musculoskeletal conditions.[30-32] These findings support the broader application of combination therapy beyond adhesive capsulitis, indicating its potential utility in managing various chronic pain conditions.

The present study also found that IFT's versatility in adjusting beat frequencies allows for targeted stimulation of different tissues, further enhancing its therapeutic effects. Research suggests that IFT, when used alone, is more effective than transcutaneous electrical nerve stimulation in reducing pain and improving ROM.[33] Similarly, US has been shown

to reduce localized inflammation and promote tissue healing. While both modalities are individually effective, their combination maximizes therapeutic benefits while minimizing the risk of adverse effects, as lower intensities can be used for each modality without compromising efficacy.

Despite the proven benefits of combination therapy, it remains underutilized in clinical practice, particularly for adhesive capsulitis. Many therapists rely on single-modality treatments such as therapeutic US or diadynamic currents, which may not provide the same level of pain relief as combination therapy. By integrating IFT and US, clinicians can offer a more comprehensive approach to pain management, addressing both the mechanical and neurological components of pain.

Electrotherapy modalities, including combination therapy, have a well-established role in reducing pain and improving function. The findings of this study suggest that combination therapy provides immediate and statistically significant pain relief for patients with adhesive capsulitis. Given the chronic and often debilitating nature of this condition, the use of combination therapy offers a promising alternative for patients who require rapid symptom management. Future research should focus on evaluating the long-term benefits of combination therapy, exploring its effects on ROM, functional outcomes, and quality of life in patients with adhesive capsulitis.

CONCLUSION

This study highlights the efficacy of combination therapy (IFT + US) in providing immediate pain relief for adhesive capsulitis. The results underscore the importance of adopting multimodal approaches in the management of musculoskeletal conditions, particularly those characterized by chronic pain and restricted mobility. The use of combination therapy not only enhances therapeutic outcomes but also offers a safe and efficient option for managing adhesive capsulitis in clinical practice.

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