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To Compare the Effectiveness of Phonophoresis with Scapular Stabilization Exercise versus Interferential Therapy with Scapular Stabilization Exercise in Subacromial Impingement Syndrome

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Abstract: ***Background: About 44–65% of all shoulder-related complaints are caused by Subacromial Impingement Syndrome (SAIS), one of the most common shoulder disorders. Conservative management includes therapeutic exercise and electro-physical modalities. This research contrasted the efficacy of interferential therapy (IFT) combined with scapular stabilisation exercise versus phonophoresis in SAIS patients. Methods: A randomized comparative study was conducted on 60 patients with SAIS, allocated into two groups (n=30 each). Group A underwent diclofenac gel phonophoresis using ultrasound combined with scapular stabilisation exercises. Group B received IFT along with scapular exercises for stabilisation. Ten sessions were held for both groups, five days a week for two weeks. Results were assessed using the Pressure Pain Threshold and the Shoulder Pain and Disability Index (SPADI),(PPT), and a goniometer was used to measure shoulder range of motion (ROM). Statistical analysis was performed using paired and independent t-tests with significance set at p<0.05. Results: Both groups showed significant improvement in pain and ROM post-intervention (p<0.05). However, Group A demonstrated greater improvement in SPADI (47.7% vs. 32.8%), PPT, and ROM (flexion, abduction, internal and external rotation) compared to Group B. Conclusion: Phonophoresis combined with scapular stabilisation exercise was more effective than IFT with exercise in reducing pain, improving shoulder mobility, and enhancing functional outcomes in SAIS patients. Better outcomes could be explained by phonophoresis's increased drug delivery effect.***

Keywords: Subacromial impingement, Phonophoresis, Interferential Therapy, Scapular Stabilization Exercises, Shoulder Pain and Disability Index, Pain pressure threshold

1. Introduction

Subacromial Impingement Syndrome (SAIS) is one of the most common musculoskeletal shoulder conditions, accounting for nearly 44–65% of shoulder-related complaints encountered in physiotherapy and orthopaedic practice (1). It causes pain during overhead activities, decreased range of motion, and functional limitation as a result of compression or irritation of the rotator cuff tendons and subacromial structures (2). Exercise therapy, ultrasound, interferential therapy, and pharmacological interventions are examples of conservative management techniques. Phonophoresis is a non-invasive pain management technique that uses ultrasound waves to improve the transdermal absorption of anti-inflammatory medications (3). Interferential therapy (IFT) is another frequently used electrotherapy technique providing analgesic and anti-inflammatory effects through deep tissue stimulation (4).

Exercises for scapular stabilisation have been demonstrated to enhance shoulder function and kinematics via increasing scapular control. However, limited research explicitly compares phonophoresis in contrast to IFT in conjunction with scapular stabilisation exercises (5).

The purpose of this study was to evaluate the efficacy of IFT with scapular stabilisation exercise against phonophoresis with scapular stabilisation exercise in SAIS.

2. Materials and Methods

Study Design and Participants:
Over the course of a year, a comparative randomised study was carried out at Kempegowda Institute of Physiotherapy and KIMS Hospital in Bengaluru. Included were sixty individuals between the ages of 18 and 65 who had been diagnosed with SAIS (positive Neer, Hawkins-Kennedy, and Empty Can tests).

Inclusion Criteria:
- Age 18–65 years.
- Localized shoulder pain >1 month.
- Tendinitis or partial supraspinatus tear.

Exclusion Criteria:
- Complete rotator cuff tear.
- Major trauma or surgery.
- Diabetes.
- Hypothyroidism.
- Cardiac pacemaker.
- Cervical spine pathology.
- Bursitis.
- Adhesive capsulitis.

Intervention:

- Group A (n=30): Phonophoresis with diclofenac gel (1 MHz, 1.5 W/cm², continuous mode, 7 minutes) + scapular stabilisation exercises.
- Group B (n=30): Interferential therapy (80–150 Hz, 20 minutes, 4 electrodes) + scapular stabilisation exercises. Ten supervised sessions (five per week × two weeks) were given to both groups. Exercise regimen included posterior capsule stretching, pectoralis and levator scapulae stretching, resisted internal/external rotation, and scapular strengthening drills .

Outcome Measures:

1) Shoulder Pain and Disability Index (SPADI) – functional outcome (6).
2) Pressure Pain Threshold (PPT) – assessed using algometer.
3) Shoulder Range of Motion (ROM) – measured with universal goniometer (flexion, extension, abduction, IR, ER.

Statistical Analysis:

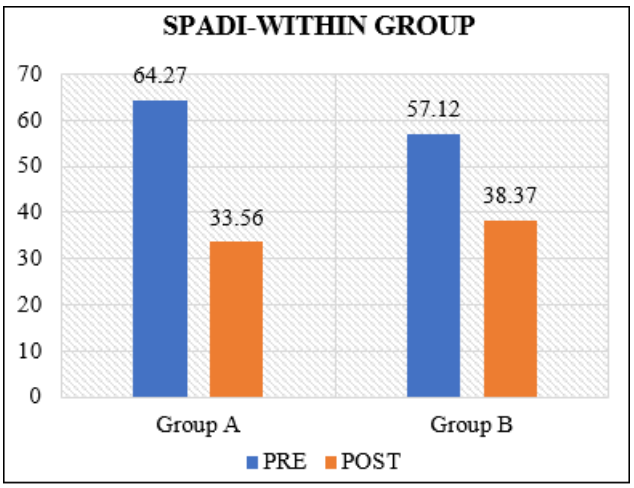
Data were analysed using SPSS 26.0. Paired t-test assessed within-group changes, independent t-test for between-group differences. The significance threshold was set at $p<0.05$.

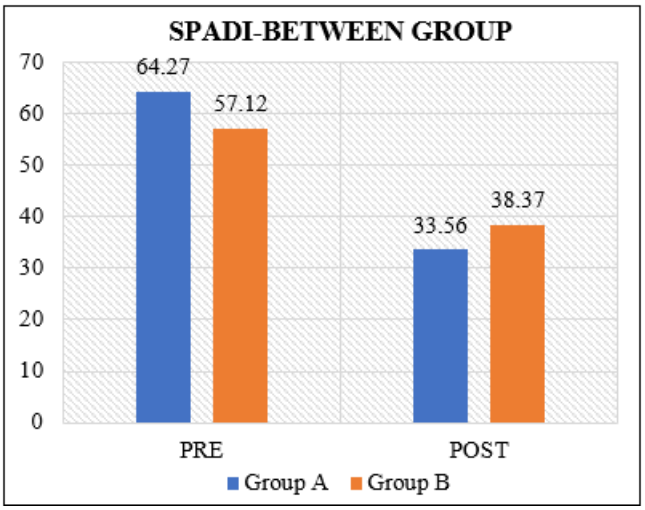
3. Results

- SPADI: There was a significant improvement in both groups ($p<0.0001$). Group A exhibited greater percentage improvement (47.7%) vs Group B (32.8%) (6).

Table 4: Between and within group comparison of 'SPADI'

		Group A	Group B	T Value (T Test)	P Value
SPADI	Pre	64.27±11.12	57.12±9.69	2.65	0.01*
	Post	33.56±6.79	38.37±7.99	2.51	0.01*
Difference		30.71±8.67	18.75±8.23		
T Value		12.91	8.17		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		47.7%	32.82%		

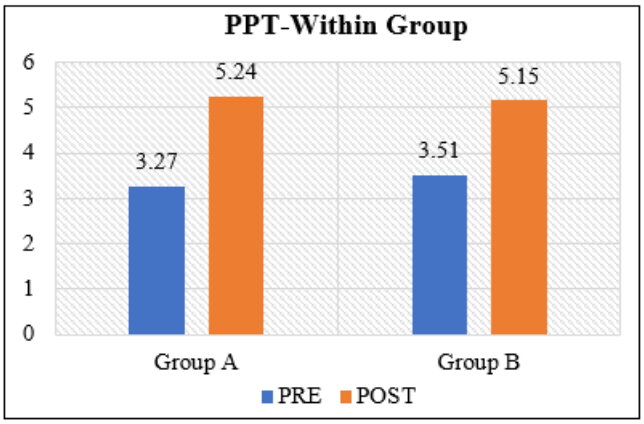


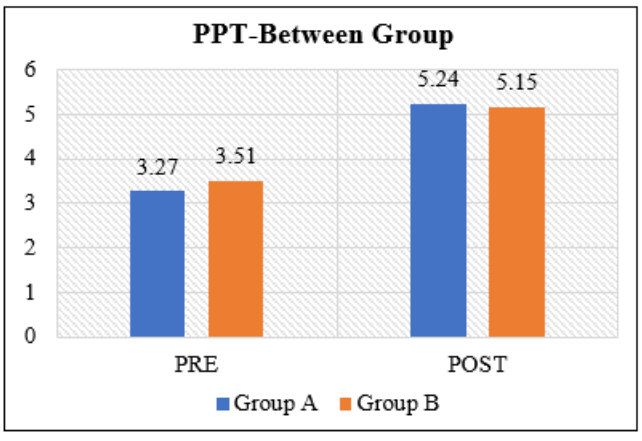


- PPT: Significant increases in both groups; greater gain in Group A ($p<0.05$) (7,8,9).

Table 5: Between and within group comparison of 'PPT'

		Group A	Group B	T Value (T Test)	P Value
PPT	Pre	3.27±1.05	3.51±0.63	1.07	0.28
	Post	5.24±1.02	5.15±0.57	0.42	0.67
Difference		1.97±1.01	1.64±0.60		
T Value		7.37	10.57		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		60.24%	46.7%		

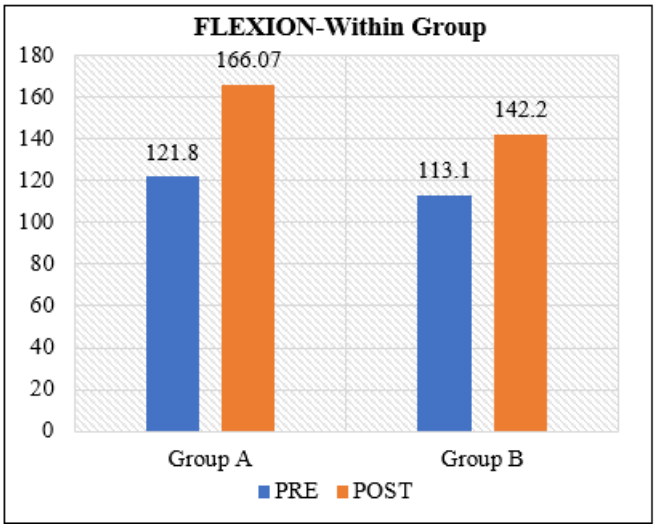




ROM: Flexion, abduction, internal and external rotation improved more in Group A ($p<0.05$) (10,11).

Table 6: Between and within group comparison of 'FLEXION'

		Group A	Group B	T Value (T Test)	P Value
FLEXION	Pre	121.8±22.46	113.1±22.23	1.50	0.13
	Post	166.07±10.57	142.2±19.71	5.84	0.0001*
Difference		38.27±14.56	29.1±20.67		
T Value		9.76	5.36		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		31.4%	25.7%		



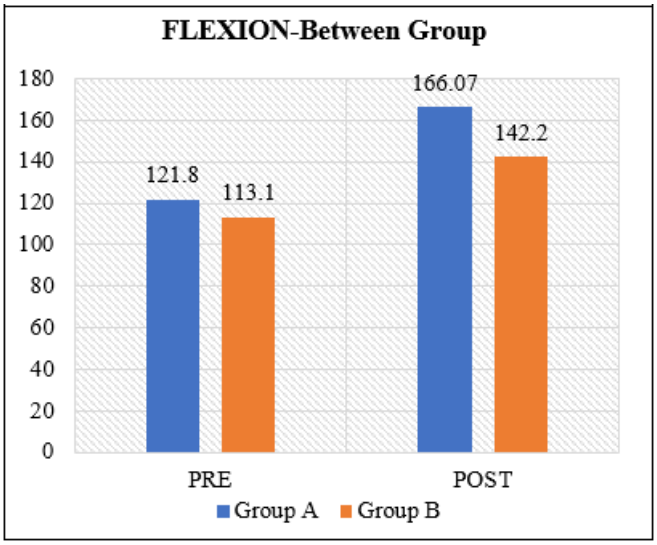
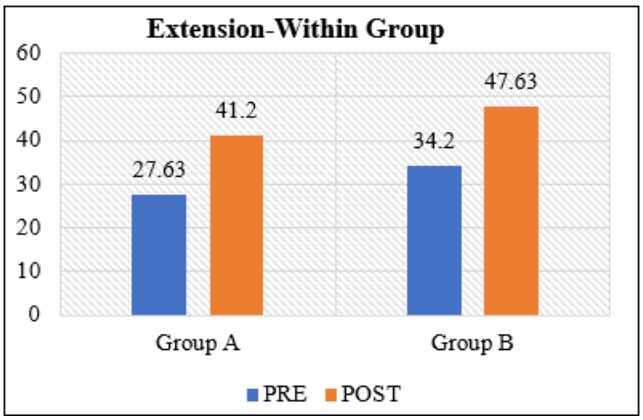


Table 7: Between and within group comparison of 'EXTENSION'

		Group A	Group B	T Value (T Test)	P Value
Extension	Pre	27.63±6.43	34.2±10.52	2.91	0.005*
	Post	41.2±7.75	47.63±6.81	3.41	0.001*
Difference		13.57±6.87	13.43±8.23		
T Value		7.38	5.86		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		49.1%	39.2%		



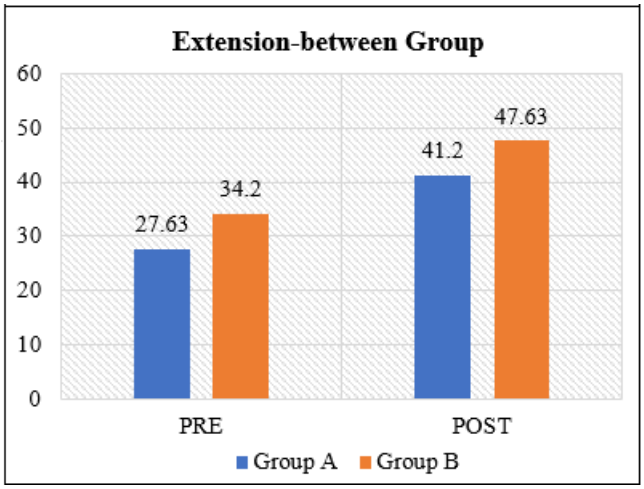
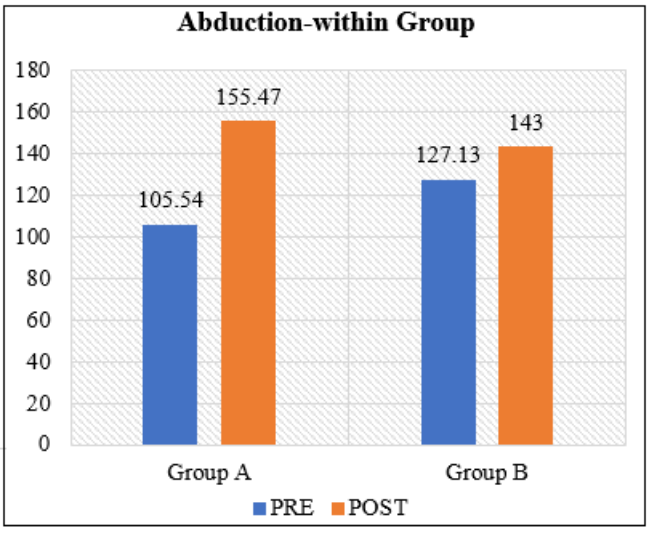


Table 8: Between and within group comparison of 'ABDUCTION'

		Group A	Group B	T Value (T Test)	P Value
Abduction	Pre	105.54±23.68	127.13±17.11	4.04	0.0002*
	Post	155.47±12.08	143±16.62	3.32	0.001*
Difference		49.93±18.87	15.87±16.88		
T Value		10.28	3.64		
P Value (Paired T test)		0.0001*	0.0006*		
Percentage difference		47.3%	12.4%		



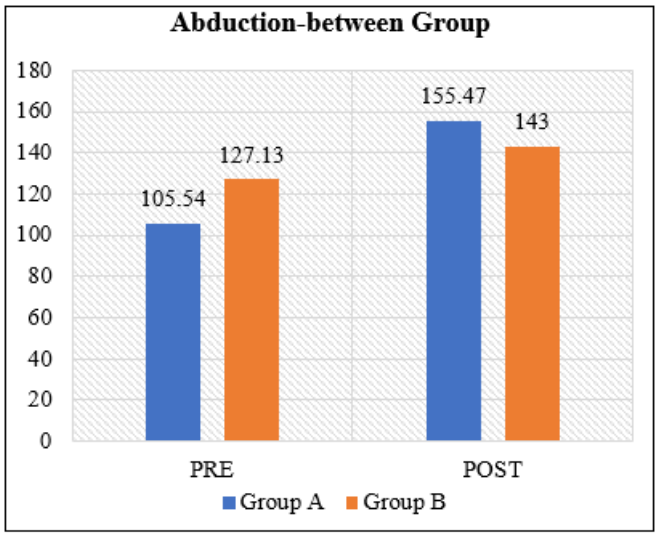
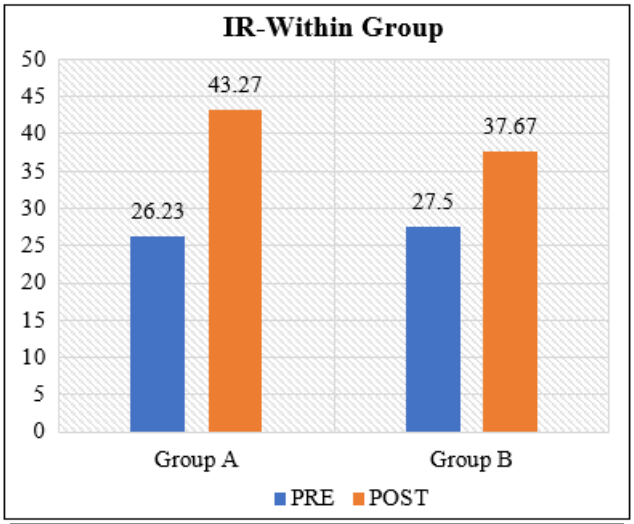


Table 9: Between and within group comparison of 'IR'

		Group A	Group B	T Value (T Test)	P Value
IR	Pre	26.23±7.37	27.5±6.80	0.69	0.49
	Post	43.27±3.99	37.67±6.65	3.95	0.0002*
Difference		17.04±4.76	10.17±6.74		
T Value		11.13	5.85		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		64.9%	36.9%		



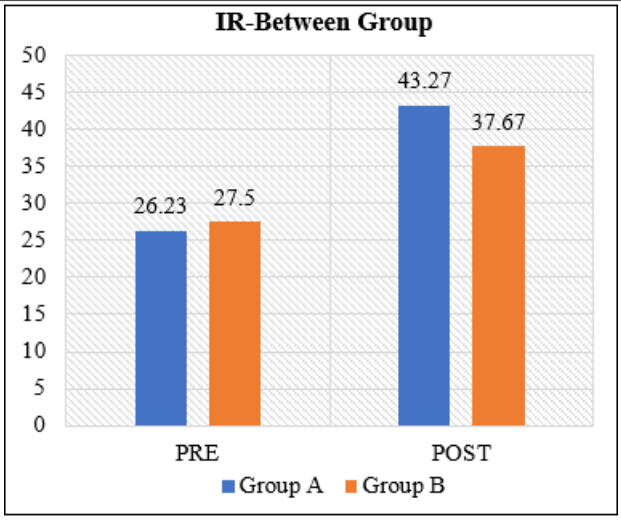
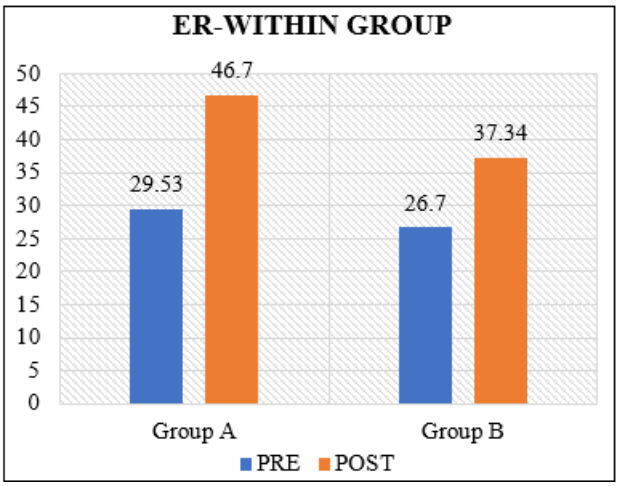
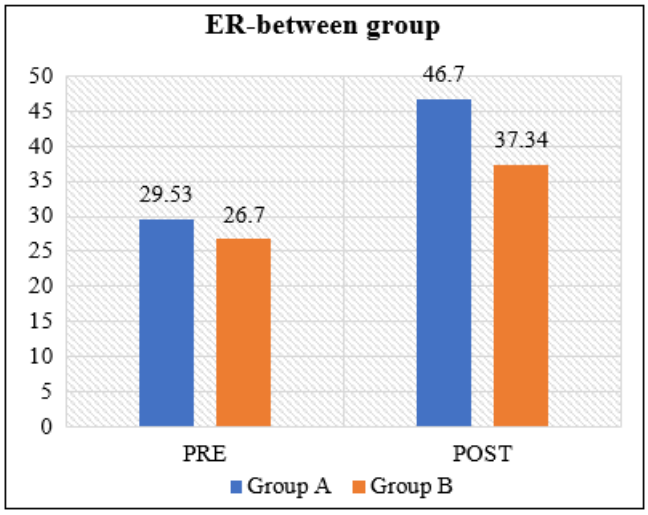


Table 10: Between and within group comparison of 'ER'

		Group A	Group B	T Value (T Test)	P Value
ER	Pre	29.53±7.64	26.7±7.34	1.46	0.14
	Post	46.7±4.45	37.34±7.12	6.10	0.0001*
Difference		17.17±	10.64±		
T Value		10.63	5.69		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		58.1%	39.8%		





These results show that the phonophoresis + exercise group performed better than the IFT + exercise group.

4. Discussion

This study indicated that both phonophoresis and IFT, when paired with scapular stabilization training, significantly reduce discomfort and enhance function in SAIS. However, phonophoresis gave superior outcomes.

Ultrasound-mediated transdermal administration of diclofenac, which offers localised anti-inflammatory effects, is responsible for the improved outcomes with phonophoresis. The effectiveness of phonophoresis in enhancing pain and function in shoulder diseases is supported by earlier research (Bayram Kelle et al., 2023; Walid Ahmed Kamal et al., 2021). Similarly, scapular stabilization

exercises, as revealed by Shiravi et al. (2019) and Hotta et al. (2018), play a crucial role in improving kinematics and lowering pain.

On the other hand, whereas IFT has analgesic benefits (Nazligul et al., 2017), its effects might be less powerful in comparison to drug delivery aided by phonophoresis

Clinical Implications
Phonophoresis, being non-invasive and effective, can be considered a desirable complement to scapular stabilisation exercise in addressing SAIS in clinical practice.

5. Conclusion

Phonophoresis combined with scapular stabilisation exercise was considerably more effective than interferential therapy with exercise in lowering pain, improving ROM, and enhancing functional ability in patients with SAIS. This shows phonophoresis may be a superior adjunct technique in conservative therapy of shoulder impingement.

6. Limitations

1) Short intervention period. (2 weeks)
2) Small sample size (n=60).
3) Lack of long-term follow-up.

7. Future Scope

Further multicentric studies with larger cohorts and long-term follow-up are necessary to confirm findings and examine sustained outcomes.

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