

PAIN–FUNCTION RECOVERY PATTERN FOLLOWING FUNCTIONAL VERSUS TRADITIONAL EXERCISE WITH AERION ARTHRON CLASS IV LASER IN GRADE I AND II SUPRASPINATUS TEARS

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KEYWORDS

Supraspinatus tear, pain–function relationship, functional recovery, Class IV laser, VAS, QuickDASH, task-oriented exercise.

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Abstract

Background: Pain and loss of upper-limb function often occur together in people with partial supraspinatus tears. Treatment may reduce pain without fully restoring activity, so it is useful to examine whether improvement in pain is accompanied by meaningful functional recovery. Functional exercise may offer an advantage because it trains the shoulder through coordinated movements that resemble daily tasks.

Aim: To examine the pattern of pain reduction and functional recovery following traditional and functional exercise programmes combined with Aerion Arthron Class IV laser therapy in patients with Grade I and II supraspinatus tears.

Methodology: Sixty adults aged 20–60 years were assigned equally to two treatment groups. Group A received traditional shoulder exercises with Class IV laser therapy, while Group B received functional exercises with the same laser intervention. Pain was measured using the Visual Analogue Scale and upper-limb disability was assessed using QuickDASH before and after treatment. Within-group changes, between-group differences and the relationship between pain improvement and functional gain were analysed.

Results: Both groups improved after treatment. Group A showed a mean VAS reduction of 2.257 ± 0.910 and a mean QuickDASH improvement of 21.937 ± 8.410 . Group B showed larger changes, with a VAS reduction of 4.410 ± 0.779 and a QuickDASH improvement of 41.438 ± 7.629 . Between-group differences favoured Group B for both pain and disability ($p < 0.001$). Pain reduction and functional improvement were positively related ($r = 0.58$), indicating that participants who experienced greater pain relief generally regained more upper-limb function.

Conclusion: Improvement in pain was accompanied by improvement in function in both groups, but the recovery pattern was stronger in participants who performed functional exercises. The findings suggest that task-based and kinetic-chain training may help convert pain relief into better use of the arm during everyday activity.

Introduction

Partial supraspinatus tears are a common source of shoulder pain and difficulty with upper-limb activity. The supraspinatus contributes to arm elevation and helps centre the humeral head during movement. When the tendon is irritated or partly torn, patients may experience pain while reaching, lifting, dressing, sleeping on the affected side or carrying objects.

Pain and disability are closely connected, but they are not identical. A patient may report less pain yet continue to avoid movement, use compensatory patterns or struggle with routine tasks. For this reason, successful rehabilitation should be judged not only by symptom reduction but also by the return of confident and efficient arm use.^{1,2}

Traditional rehabilitation usually begins with mobility exercises and gradually adds isolated strengthening for the rotator cuff and scapular muscles. This approach can restore basic muscle capacity and reduce protective stiffness. It remains an important part of conservative management, particularly during the painful or irritable stage.³

Functional rehabilitation places greater emphasis on coordinated movement. Exercises such as wall-supported loading, reaching, carrying, pushing and kinetic-chain drills train the shoulder together with the scapula and trunk. These activities more closely resemble the demands patients face outside the clinic and may therefore produce stronger transfer to daily function.⁴

Class IV laser therapy is used as an adjunct in many musculoskeletal programmes. Its proposed photobiomodulatory effects may help control pain and support tissue recovery, making active exercise easier to tolerate. Since both groups in the present study received the same laser treatment, the comparison provides an opportunity to consider how the choice of exercise influences the link between pain relief and functional gain.⁵

This paper uses the same clinical dataset but approaches it from a different perspective. Rather than focusing only on which programme produced

lower post-treatment scores, it examines the recovery pattern across pain and disability and considers whether functional exercise helps patients translate symptom improvement into better performance of everyday upper-limb activities.⁶

NEED OF THE STUDY

Clinical improvement after a supraspinatus tear is often reported through separate pain and disability scores. Looking at these outcomes independently may overlook an important question: does pain relief occur alongside real improvement in the patient's ability to use the arm?

A rehabilitation programme that lowers pain but produces limited functional change may not fully meet the needs of patients returning to work, household tasks or recreational activity. Examining the pain–function relationship can therefore provide a more practical picture of recovery.

The present analysis was undertaken to compare the overall response produced by traditional and functional exercise programmes and to understand whether greater pain reduction was associated with greater improvement in QuickDASH disability.^{7,8}

AIM

To compare pain–function recovery patterns following traditional and functional exercise programmes combined with Aerion Arthron Class IV laser therapy in patients with Grade I and II supraspinatus tears.

OBJECTIVES

- To measure the change in shoulder pain following each rehabilitation programme.
- To measure the change in upper-limb disability following each rehabilitation programme.
- To compare the magnitude of combined pain and functional recovery between the two groups.
- To examine the relationship between reduction in VAS pain and improvement in QuickDASH scores.

HYPOTHESIS

Null hypothesis: There will be no significant difference in pain–function recovery between traditional and functional exercise programmes combined with Class IV laser therapy.

Alternative hypothesis: Functional exercise combined with Class IV laser therapy will produce a stronger pain–function recovery pattern than traditional exercise with the same laser intervention.

MATERIALS AND METHOD

Item	Description
Study design	Comparative interventional study.
Study setting	Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan.
Sample size	Sixty participants, with 30 participants in each group.
Sampling method	Purposive sampling.
Age range	20–60 years.
Study groups	Group A: traditional exercises with Class IV laser therapy; Group B: functional exercises with Class IV laser therapy.
Outcome measures	Visual Analogue Scale (VAS) and QuickDASH.
Statistical analysis	Paired t-test for within-group comparisons and independent t-test for between-group change-score comparisons. Statistical significance was set at $p < 0.05$.

INCLUSION CRITERIA

1. Patients diagnosed with conservatively managed Grade I or II supraspinatus tear.
2. Age between 20 and 60 years.
3. Diagnosis confirmed under medical supervision.
4. Willingness to participate and provide informed consent.

EXCLUSION CRITERIA

1. High-grade or full-thickness rotator cuff tear.
2. Previous surgical repair of the supraspinatus tendon.
3. Fracture, spinal trauma or amputation.
4. Systemic inflammatory disease or progressive neurological condition.
5. Pregnancy, open wound, high-degree burns or other contraindications to laser therapy.
6. Use of selected medications or conditions requiring medical exclusion.

INTERVENTION PROTOCOL

ETHICAL CONSIDERATION

The study is done after obtaining ethical committee clearance protocol no. PMU/IEC/MPT/2025/04 in the outpatient physiotherapy department of PACIFIC MEDICAL COLLEGE & HOSPITAL, BHILLO KA, NH27, PRATAP PURA, UDAIPUR (313001)

GROUP A: TRADITIONAL EXERCISES WITH CLASS IV LASER

Weeks 1–2: pendulum exercises, passive shoulder flexion, cryotherapy and pain-free scapular retraction.

Weeks 3–4: active-assisted flexion with a stick, resisted internal and external rotation, prone horizontal abduction and light resistance-band rows.

Week 5: side-lying external rotation, prone shoulder extension, horizontal abduction to neutral and scaption with light resistance.

Week 6: progressed resistance-band rotation, seated shoulder press and lateral raises. Resistance was advanced only when symptoms remained controlled.

GROUP B: FUNCTIONAL EXERCISES WITH CLASS IV LASER

Weeks 1–2: supported wall slides, scapular clocks, ball-assisted reach-outs and quadruped rocking.

Weeks 3–4: wall push-ups, ball stabilization on the wall, diagonal band pull-aparts and light farmer's carries.

Week 5: dynamic wall pushes, medicine-ball wall dribbles, band-resisted reach-outs and progressed carrying tasks.

Week 6: push-up progression, ball throws against a wall, closed-chain stability drills and kinetic-chain integration using a lunge with overhead reach.

Class IV laser therapy was administered to both groups according to the treatment protocol. Exercise progression was based on pain response, movement quality and the absence of a next-day symptom flare.

OUTCOME MEASURES

Visual Analogue Scale (VAS): Pain intensity was recorded on a numerical visual scale, with higher scores indicating greater pain.

QuickDASH: The 11-item QuickDASH questionnaire was used to measure upper-limb symptoms and disability. Higher scores indicate greater functional limitation.

RESULTS

A total of 60 participants completed the study. Thirty participants received traditional exercises with Class IV laser therapy, and 30 received

functional exercises with the same laser intervention. Both groups demonstrated statistically significant improvement, but the magnitude of change was consistently greater in the functional exercise group.

DEMOGRAPHIC PROFILE

Group	Mean age $\pm$ SD	Male	Female
Group A: Traditional + Laser	40.97 $\pm$ 11.01	13	17
Group B: Functional + Laser	37.07 $\pm$ 12.56	19	11

The average age of both groups fell within the adult working-age population. Although the sex distribution differed slightly, both groups included male and female participants and were clinically suitable for comparison.

WITHIN-GROUP COMPARISON

Group	Outcome	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	Mean change $\pm$ SD	t-value	p-value	Effect size dz
A	VAS	7.020 $\pm$ 0.511	4.763 $\pm$ 0.766	2.257 $\pm$ 0.910	13.580	<0.001	2.479
A	Quick DASH	65.741 $\pm$ 6.226	43.804 $\pm$ 6.911	21.937 $\pm$ 8.410	14.288	<0.001	2.609
B	VAS	7.222	2.812	4.410 $\pm$	30.995	<0.001	5.659

		± 0.5 85	± 0.6 51	0.77 9			
B	Quick DASH	69. 267 ± 6.5 36	27. 829 ± 7.7 88	41.4 38 ± 7.62 9	29. 751	<0. 001	5.4 32

Group A showed meaningful reductions in pain and disability after treatment. Group B also improved significantly, but the larger mean changes and effect sizes indicate a stronger response to the functional exercise programme.

Outcome	Change Group A	Change Group B	Mean difference (B-A)	t-value	p-value	Effect size g
VAS	2.25 7 ± 0.91 0	4.41 0 ± 0.77 9	2.154	- 9.8 44	<0.0 01	2.5 09
QuickDASH	21.9 37 ± 8.41 0	41.4 38 ± 7.62 9	19.501	- 9.4 07	<0.0 01	2.3 97

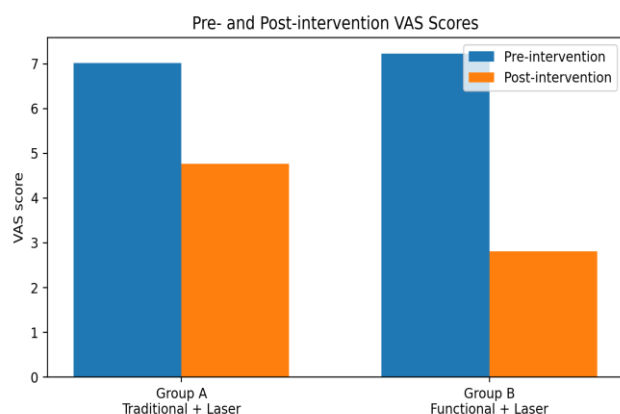


Figure 1. Mean VAS scores before and after intervention in both groups.

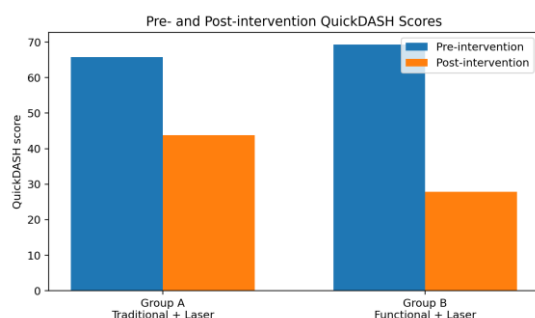


Figure 2. Mean QuickDASH scores before and after intervention in both groups.

BETWEEN-GROUP COMPARISON OF CHANGE SCORES

The between-group analysis showed a clear advantage for functional exercises. Participants in Group B experienced approximately twice the mean reduction in VAS and almost twice the mean improvement in QuickDASH compared with Group A. The very large effect sizes suggest that the differences were clinically important as well as statistically significant.

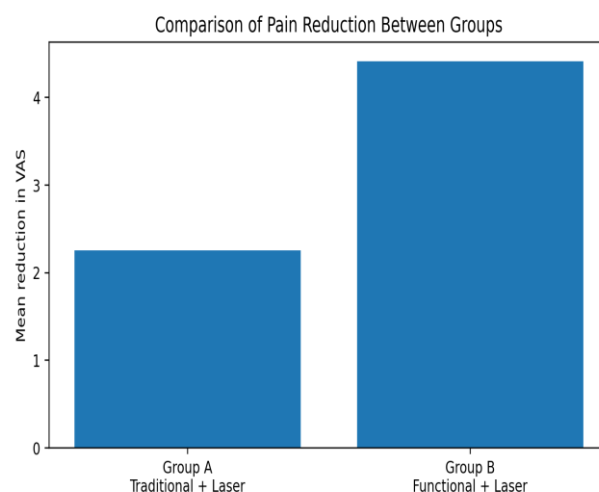


Figure 3. Comparison of mean pain reduction between Group A and Group B.

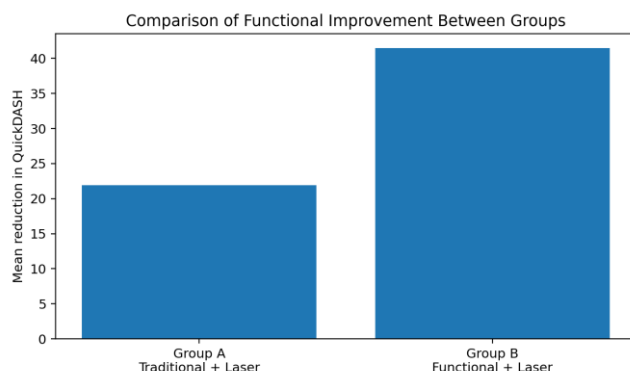


Figure 4. Comparison of mean functional improvement between Group A and Group B.

RELATIONSHIP BETWEEN PAIN AND DISABILITY

The study showed a moderate positive relationship between pain reduction and functional improvement ($r = 0.58$). In practical terms, participants who reported a larger fall in VAS pain generally also showed a larger reduction in QuickDASH disability.

This finding does not mean that pain alone determines function. Shoulder control, confidence, muscle capacity and task practice also influence recovery. However, the association suggests that pain relief and functional restoration developed together during the rehabilitation period.

The stronger changes in Group B indicate that functional training may have supported both sides of recovery: it reduced symptoms while repeatedly exposing participants to coordinated movements that were relevant to daily activity.

SUMMARY OF FINDINGS

- Both groups experienced significant pain relief and functional improvement.
- Group B showed a larger reduction in VAS than Group A.
- Group B showed a larger improvement in QuickDASH than Group A.
- Pain reduction was moderately associated with functional improvement ($r = 0.58$).

- The overall recovery pattern favoured functional exercise combined with Class IV laser therapy.

DISCUSSION

The present paper examined recovery as a linked change in pain and function rather than as two unrelated outcomes. Both rehabilitation programmes were helpful, but participants in the functional exercise group showed a more pronounced fall in pain and a greater return of upper-limb ability. The moderate positive correlation between the two changes supports the view that symptom relief and functional recovery developed together.⁹

The improvement seen in the traditional exercise group is clinically meaningful. Gentle mobility, rotator cuff strengthening and scapular exercises can reduce guarding, improve local muscle capacity and restore basic shoulder control. These changes may explain why Group A showed significant improvement in both VAS and QuickDASH scores.¹⁰

The response in Group B was larger. Functional exercises required participants to control the arm during supported loading, reaching, pushing, carrying and multi-segment movement. Repeated practice of these tasks may have reduced fear of movement and improved confidence alongside physical capacity. This could help explain why the fall in disability was greater than that achieved through isolated exercise.

The QuickDASH result is important because it reflects the patient's experience of using the arm in daily life. A programme may strengthen individual muscles without fully preparing the patient for coordinated activities. Functional exercise narrows this gap by practising movement in a context that is closer to household, occupational and recreational tasks.¹¹

The pain–function correlation of $r = 0.58$ indicates a meaningful, although not perfect, relationship. Pain relief can make movement easier, but function also depends on strength, motor control, endurance, confidence and opportunity to practise tasks. The finding therefore supports a

broad rehabilitation approach rather than treatment directed only at pain.

Class IV laser therapy may have helped participants in both groups tolerate exercise by reducing pain sensitivity and supporting tissue recovery. Because the laser intervention was shared by both groups, it cannot explain the difference between them. The larger response in Group B is more likely related to the nature and progression of the exercise programme.¹²

From a biomechanical perspective, functional tasks encourage cooperation between the rotator cuff, scapular stabilisers and trunk. A stable scapular base and coordinated trunk movement can improve the path of the humeral head and reduce unnecessary stress on the supraspinatus during reaching. Training the whole movement pattern may therefore improve both comfort and efficiency.¹³

The findings should not be interpreted as evidence that traditional exercises are unnecessary. Early isolated work may be appropriate when pain is high or movement control is poor. A practical clinical pathway may begin with mobility and targeted activation, then progress toward closed-chain, task-oriented and kinetic-chain exercises as symptoms settle.

Overall, the results suggest that recovery is most useful when pain relief is translated into better activity. Functional exercise appears to strengthen this translation, making it a valuable progression in conservative care for Grade I and II supraspinatus tears.¹⁴

CLINICAL IMPLICATIONS

- Clinicians should assess pain and function together rather than relying on pain scores alone.
- Early traditional exercises can be used to restore movement and basic muscle activation.
- Functional tasks should be introduced progressively to improve confidence and everyday arm use.
- Treatment progression should consider movement

quality, next-day symptoms and task performance.

- Class IV laser may support exercise tolerance, but active rehabilitation should remain the central component of care.

CONCLUSION

Both rehabilitation programmes produced significant improvement in patients with Grade I and II supraspinatus tears. Reductions in pain were accompanied by reductions in upper-limb disability, showing that symptom relief and functional recovery were related during treatment.

The functional exercise group demonstrated the stronger overall response, with greater changes in both VAS and QuickDASH and a recovery pattern that was more relevant to daily activity. Functional exercise combined with Class IV laser therapy may therefore be preferred when the clinical goal is not only to reduce pain, but also to restore confident and useful arm function.

LIMITATIONS

1. The study involved 60 participants from one clinical setting, which may limit wider application of the findings.
2. There was no exercise-only or laser-only group, so the separate effect of Class IV laser could not be calculated.
3. VAS and QuickDASH were the main outcomes; objective strength, range of motion and imaging measures were not included.
4. Participants and therapists could not be blinded because the exercise programmes were visibly different.
5. The broad age range may have included patients with different recovery capacities, but age-based subgroup analysis was not performed.
6. Long-term follow-up was not available, so it is unclear whether the improvements were maintained.
7. The reported pain–function correlation shows

association and should not be interpreted as proof that pain reduction directly caused functional improvement.

RECOMMENDATIONS

1. Future studies should use larger, multicentre samples with random allocation.
2. Separate laser-only and exercise-only groups would help identify the contribution of each treatment component.
3. Longer follow-up is needed to examine recurrence, sustained activity and later surgical requirements.
4. Future work should include strength testing, shoulder range, scapular movement, tendon imaging and patient confidence.
5. Individual-level analysis should explore whether early pain change predicts later functional recovery.
6. Rehabilitation trials should compare staged programmes that progress from traditional activation to functional task training.
7. Further research should examine whether the pain–function relationship differs according to tear grade, occupation, age or symptom duration.

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