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AN EXPERIMENTAL STUDY ON THE CLINICAL BURDEN OF FROZEN SHOULDER SYNDROME AND THE ROLE OF THORACIC SPINE MANIPULATION IN PHYSIOTHERAPY MANAGEMENT

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Abstract

Background: Frozen shoulder syndrome is a major clinical burden in physiotherapy practice and disproportionately affects the working-age population and can cause prolonged pain, disability and poor quality of life. Physiotherapy management is usually based on exercise, but the extent to which adjunctive thoracic spine physiotherapy manipulation reduces this burden within a standard management pathway is underexplored. **Objective**: To determine the clinical and demographic presentation of frozen shoulder syndrome in a physiotherapy OPD population and to evaluate the role thoracic spine manipulation along with exercise in reducing the burden of frozen shoulder **Methods**: A total of 60 patients with adhesive capsulitis were evaluated by demographic distribution (age, gender, side involved) and randomised into two groups: Group A (thoracic spine manipulation plus exercises, n=30) Group B (exercises only, n=30), with functional burden measured using the DASH questionnaire throughout the treatment period. **Results:** The age range with the highest burden of frozen shoulder in this population was 41–60 years (93.3% Group A, 86.7% Group B), and two-thirds of patients were female and right side involvement. Group A showed a greater and earlier reduction in DASH score (mean difference – 40.50 point) from baseline to 6th week than reported with exercise alone. **Conclusion:** Frozen shoulder syndrome has a significant burden in the working-age population. Physiotherapy management incorporating thoracic spine manipulation reduce this burden much greater extent and more quickly than exercise alone, making it an integral part of standard management.

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INTRODUCTION

Frozen shoulder syndrome (adhesive capsulitis) is one of the more burdensome musculoskeletal conditions seen in outpatient physiotherapy and orthopaedic practice - not because it occurs infrequently or is especially severe on its own, but because it has a long natural history, causes disabling pain, and disproportionately affect the working age population.It is characterized by inflammation of the capsule and progressive fibrosis in the glenohumeral joint, leading to a gradual and insidious loss of both active and passive shoulder movement[1]. Clinically it progresses through three stages: freezing phase, marked by increasing pain, early stiffness ; frozen phase , when and stiffness prodominates; and thawing phase - when mobility gradually returns as inflammation subsides.[2]

Because the cycle can last one to three years, and a significant number of patients continue to experience stiffness and discomfort long after the 'active' treatment period has elapsed, frozen shoulder cannot be treated as self resolving nuisance from a service-planning point of view, but rather as a clinical resource that consumes physiotherapy appointments, restricts working and domestic activities, and occupies clinical resources for an subtantial period of time. The scale of this burden becomes clearer when it is examined against its epidemiology. Adhesive capsulitis occurs in estimated 2–5% of the general population, with the highest incidence rates occurring in the 5th and 6th decades of life – a period when many individuals are at their peak economic productivity, family caregiving demands, and least likely to tolerate a prolonged period with one-sided upper-limb dysfunction.[3]

The condition also occurs slightly more often in women than men, for reasons that remain incompletely understood and its risk is significantly increased by systemic factors such as diabetes mellitus – diabetic patients are not only more likely to develop the condition but also tend to recover less rapidly and less completely once developed.[4] Other condition that increase the risk include thyroid disease, cardiovascular disease, autoimmune disorders and prolonged shoulder immobilization after trauma or surgery, all believed to act through the same underlying mechanism – capsular tightening and decreased synovial turnover.[5] Beyond the biological picture, the consequences are immediate and practical: patient lose the ability reach overhead, dress independently, carry loads and sleep at night without pain. This loss persist for months rather than days, generating demands that consume considerable physiotherapy department's time and resources.[6]

Traditionally, the physiotherapy management of frozen shoulder involves structured, progressive physiotherapy exercise - pendulum work, assisted stretching in flexion, abduction and rotation, and capsular mobility exercises – which have a moderate evidence base for improving pain and mobility over time.[7] However treating the glenohumeral joint in isolation ignores a significant proportion of overall shoulder's movement. Efficient overhead elevation requires coordinated movement at the glenohumeral joint together scapulothoracic articulation and thoracic spine which cooperate to ensure the scapula rotates and tilts in the correct sequence as the arm moves overhead.Thoracic restriction, whether due to posture, age or habitual flexed posiure - has been has been shown to reduced shoulder mobility and strength even in the absence of primary joint disease, suggesting

that a stiff thoracic spine may be a hidden contributor to shoulder disability rather than an independent condition[8,9].

This observation is formalized in the concept of regional interdependence which holds that dysfunction in one body regions can influence and be addressed through treatment of an anatomical distant region [10] . A systematic review of manual therapy combined with exercise in adhesive capsulitis supported the principle that adding manual therapy toexercise in adhesive capsulitis supported the principle that adding manual technique to exercise was more effective than exercise alone[11] and a growing number of trials examining thoracic spine manipulated specifically in adhesive capsulitis and related shoulder conditions have reported greater reduction in pain and disability with manual therapy combined with exercise than exercise only protocols[12-14] .Related work examining cervicothoracic mobility and shoulder pain[15] immediate post-manipulation shoulder function,[16] and short-term effects on shoulder impingement[17] further supports the potential for a thoracic component in shoulder region recovery generally

While this evidence is accumulating few studies have quantified – in burden terms – how much of a typical patients pain and disability trajectory can realistically be offset by adding thoracic assessment and manipulation to a standard exercise-based pathway in routine clinical practice versus reserving it as an optional technique reserved for non-responders. Equally, description about who is actually affected - by age, gender, and laterality - are rarely reported with outcome data from the same population, even though this information is directly relevant to service planning and to identifying who is most likely to benefit from earlier introduction of more intensive service.

The present study was therefore designed with two connected arms, first to characterize the demographic and clinical burden of frozen shoulder syndrome in patients attending a physiotherapy department in a tertiary hospital, and second, to compare the impact of the use of thoracic spine manipulation, in addition to a standard exercise programme, with the impact of the exercise programme alone on reduction in functional disability over the course of the study in the same cohort of patients as the main index of benefit.

MATERIAL AND METHOD

Research design: Experimental study (randomized, two-arm)

Study setting: Department of Physiotherapy, Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan.

Sampling method: Chit method of Simple random sampling

Study population: Clinically diagnosed patients with adhesive capsulitis, aged 40-70 years**.**

Sample size: 60 calculating using $n = Z^2p(1-p)/d^2$ (prevalence 20.7%, 95% CI, 10% precision), giving $n \approx 63$ was rounded up to 60 for feasibility.

Study duration: 8 months after ethical clearance**.**

Treatment of duration: 6 weeks

Groups: Group A (n=30) the thoracic spine manipulation + conventional exercises;

Group B (n=30) conventional exercises only.

Inclusion criteria: Age range 40-70 years; clinical diagnosed adhesive capsulitis (unilateral/bilateral), including post-traumatic/post-operative presentations; able to understand instructions and provide consent

Exclusion criteria: Deformity of the shoulder, wrist, or elbow; systemic inflammatory illness, progressive neurological disorder, or malignancy; fibromyalgia/chronic regional pain syndrome; infection of upper-extremity joints or cervical spine; cervical radiculopathy or long thoracic/ spinal accessory nerve palsy; De Quervain's tenosynovitis; carpal tunnel/ thoracic outlet syndrome; ankylosing spondylitis; osteoporosis; pregnancy;non cooperative patients..

Burden Indicators: Demographic distribution (age, gender, side involved) were recorded on intake of the patient; functional disability burden (DASH questionnaire) recorded at baseline, 3rd week, and 6th week and was the main treatment outcome measured throughout the treatment course.

Procedure: Following ethical clearance and informed consent, 60 eligible participants were randomly divided into Group A and Group B by chit method. Group A received graded prone thoracic spine manipulation (posteroanterior high velocity, low amplitude thrust at the restricted thoracic segment) combined with a 10 exercise structured shoulder programme Over 6 weeks, Group B received the same exercise programme, without manipulation, over the same periods.

Statistical analysis: Descriptive statistics (mean ± SD).The paired t-tests were used for within-group comparison across the three time points, and the independent t-tests were used for between-group comparison at every time point; statistical significance was set at $p<0.05$.

CLINICAL BURDEN AND RESULTS

Table 1: Age-group distribution of patients

Age group	Group A (n/%)	Group B (n/%)
41–50	15 (50.00%)	14 (46.67%)
51–60	13 (43.33%)	12 (40.00%)
61–70	2 (6.67%)	4 (13.33%)
Mean age	51.53 ± 6.13	52.00 ± 6.40

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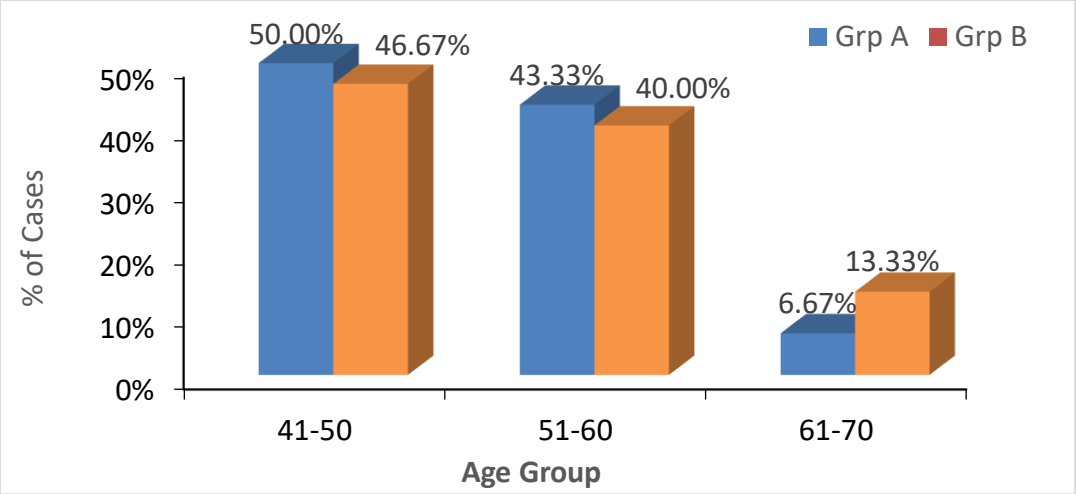


Age group distribution — 93.3% of Group A and 86.7% of Group B fell within the 41–60 year working-age bracket, showing that frozen shoulder syndrome disproportionately burdens the economically active population.

Table 2: Gender distribution of patients

Gender	Group A (n/%)	Group B (n/%)
Male	13 (43.33%)	14 (46.67%)
Female	17 (56.67%)	16 (53.33%)

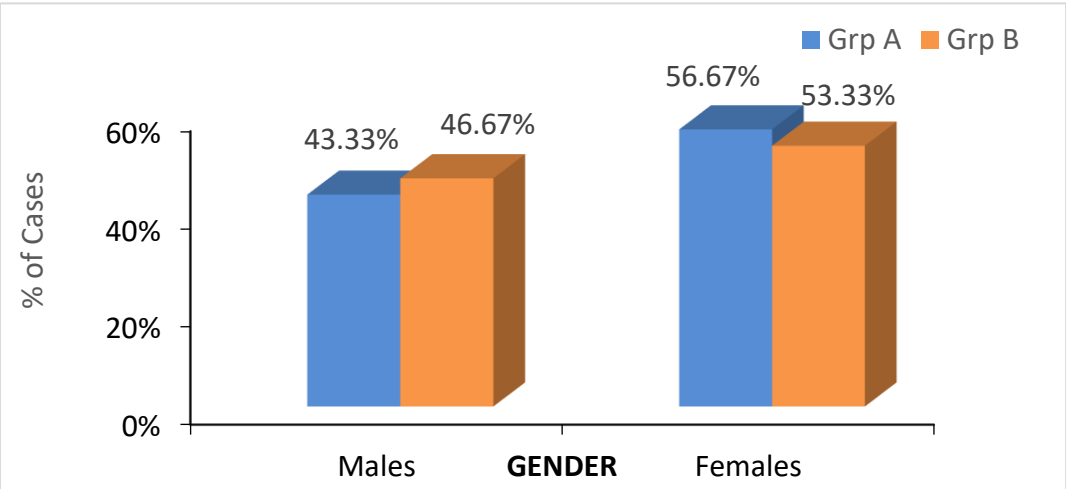
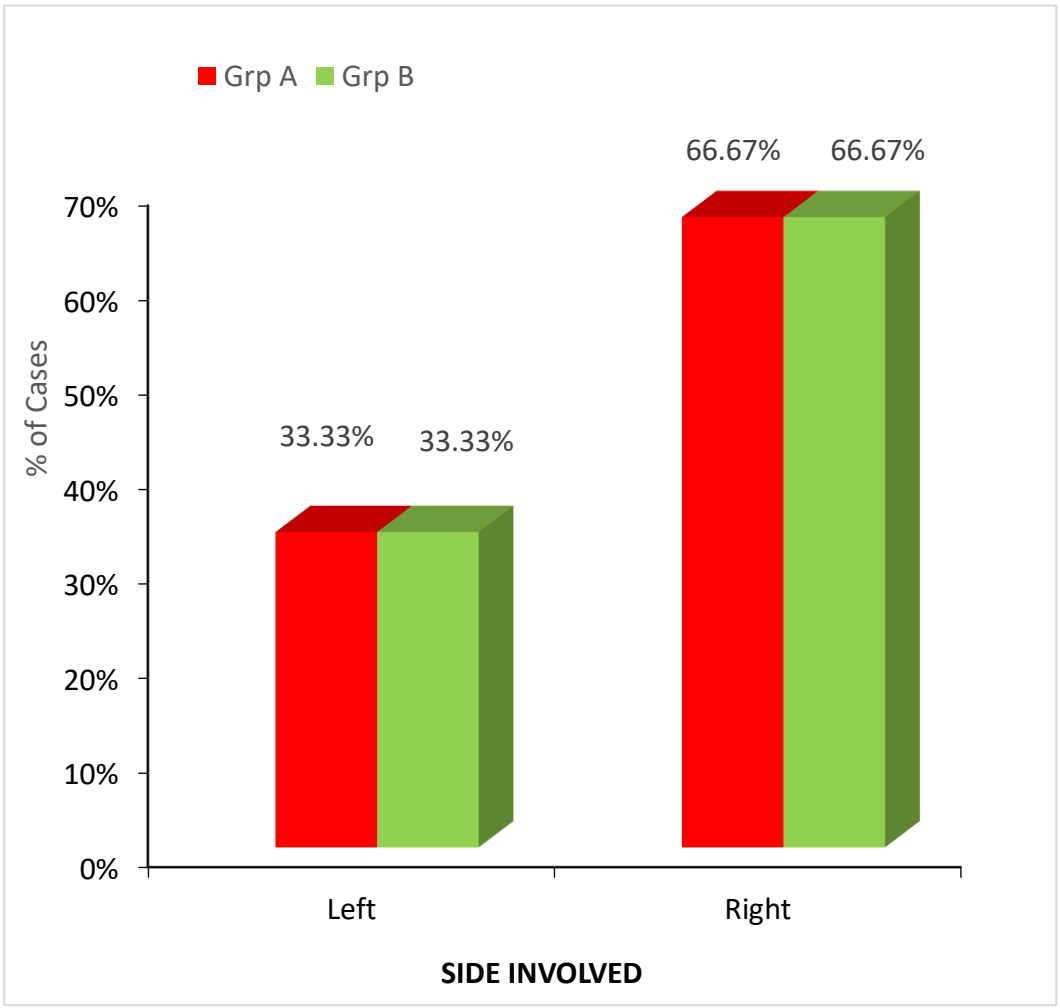


Table 3: Side involved–wise distribution of patients

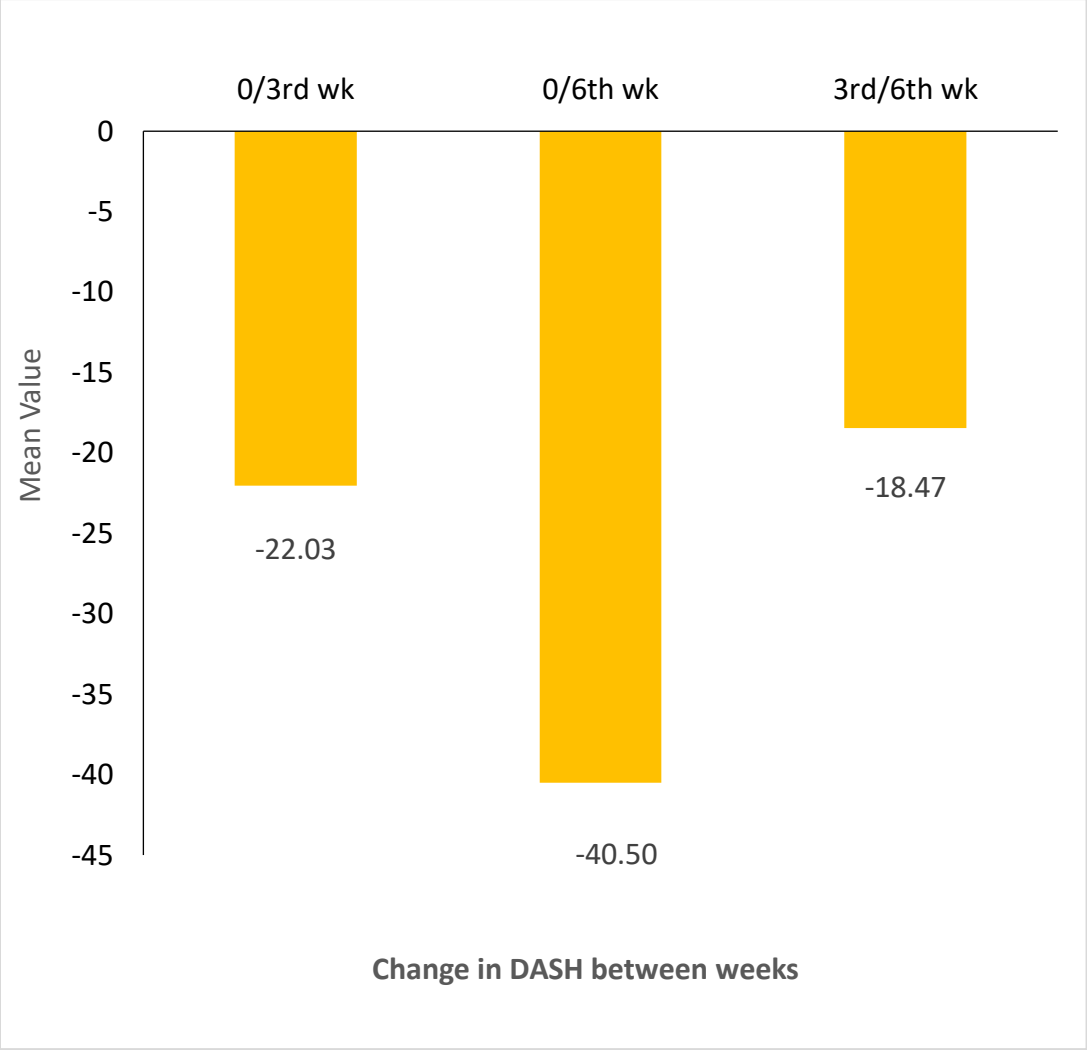
Side involved	Group A (n/%)	Group B (n/%)
Left	10 (33.33%)	10 (33.33%)
Right	20 (66.67%)	20 (66.67%)



Side involved distribution — right-side involvement was roughly twice as frequent as left-side in both groups.

Table 4: Reduction in DASH-measured disability burden, Group A (mean difference between timepoints)

Comparison	Mean difference	p value
0 / 3rd week	−22.03	<0.001
0 / 6th week	−40.50	<0.001
3rd / 6th week	−18.47	<0.001



Mean change in DASH score, Group A --- the largest single interval of improvement within a week in DASH score was from −22.03, representing the manipulation-based

pathway, suggesting that the pathway produces the greatest functional improvements early in management.

However, both groups were homogeneous at baseline on age (p=0.68), gender and side involved, suggesting that differences between the groups are not due to sampling imbalance. There was no significant difference between the two groups for baseline DASH burden (67.40±4.14 vs 67.87±4.47, p>0.05).

DISCUSSION

This study characterized a description of the clinical burden of frozen shoulder syndrome and assessed the impact that thoracic spine manipulation had on reducing this burden as part of the routine physiotherapy management of patients with frozen shoulder. Consistent with Hsu et al. (2010)[3] and Dyer et al. (2023)[4], the burden was seen in the working-age population aged 41-60, highlighting the importance of considering the relevance of the job and effective management of the burden, rather than a wait and monitor strategy.

Group A disability burden, measured by DASH, felt by a mean of 40.50 points from baseline to the 6th week with the majority of that improvement occurring within the first 3 weeks .This is consistent with the regional interdependence framework of Sueki et al. (2013)[10], and with reports that adding thoracic manipulation to exercise produces greater functional improvement than exercise alone in adhesive capsulitis, as described by by El AM et al. (2024)[12] and Bilal et al. (2021)[13], as well as the early gains in pain and range of motion reported by Jahangir et al. (2022)[14]. These findings support a plausible mechanism underlying recovering in adhesive capsulitis, and align with those of Belón-Perez and Cuesta-Vargas (2018)[16] and Haik et al. (2017)[17], who reported improved shoulder region function following thoracic manipulation.

These findings also have implications for management : Physiotherapy pathways that rely on exercise alone for all patients with a frozen shoulder may fail to achieve a significant proportion of the potential benefit since disability reduction is most pronounced in the first few weeks of care, when patients are experiencing pain and disability. Introducing thoracic assessment and manipulation early in the pathway - particualrly for working age population bear the majority of this burden - may do more to make the disabling phase of the condition manageable than simply supplementing an already effective exercise programme.

CONCLUSION

Frozen shoulder syndrome represents a significant disability burden concentrated in the working-age population ,with a marked preponderance in women, and right shoulder involvement. This burden is reduced significantly more, and earlier, by physiotherapy management that incorporates thoracic spine manipulation in addition to exercise, and supporting its adoption as a standard management component, rather than as an optional adjunct.

Limitation: Single centre hospital based study (n=60); 6 week observation period; cost-effectiveness of the added manipulation was not formally evaluated.

Future recommendations: More multi-centre burden-of-disease studies using a productivity loss measurement; longer follow-up; economic evaluation of manipulation as a standard management component.

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