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Scapular Dyskinesia: Rethinking Assessment and Advancing Physiotherapy Rehabilitation Through a Biopsychosocial Approach

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Abstract
Scapular dyskinesia (SD)—an alteration in the normal position or motion of the scapula during coupled scapulohumeral movement—is frequently implicated in shoulder pain and dysfunction. Conventional assessment and rehabilitation have remained predominantly biomechanical, often overlooking the psychological and social determinants that modulate pain perception, movement behaviour, and rehabilitation outcomes. To evaluate the effectiveness of a biopsychosocial (BPS) rehabilitation framework compared with conventional exercise therapy in individuals with scapular dyskinesia, and to re-examine the reliability of current clinical assessment methods. A prospective, single-blind, randomised controlled trial was conducted on 60 participants (aged 18–45 years) with scapular dyskinesia confirmed by the Scapular Dyskinesis Test (SDT). Participants were allocated to a Conventional Group (CG, n=30) receiving standard scapular stabilisation exercises, or a Biopsychosocial Group (BG, n=30) receiving the same exercises integrated with pain neuroscience education, graded motor activity, and psychosocial coaching, over 6 weeks. Outcomes included the Shoulder Pain and Disability Index (SPADI), Numeric Pain Rating Scale (NPRS), Pain Catastrophizing Scale (PCS), and scapular dyskinesia classification.

Keywords: Scapular dyskinesia, biopsychosocial model, shoulder rehabilitation, pain neuroscience education, physiotherapy.

Introduction
Background
The scapula serves as the critical link in the kinetic chain that transfers energy from the trunk and lower limbs to the upper extremity. Optimal shoulder function depends on coordinated scapulohumeral rhythm, scapular stability, and dynamic muscular control. **Scapular dyskinesia (SD)** refers to an observable alteration in the position of the scapula and the patterns of scapular motion relative to the thoracic cage. It is recognised as both a contributor to, and a consequence of, various shoulder pathologies including subacromial pain syndrome, rotator cuff disease, and glenohumeral instability.

The Research Problem
Traditional models of SD assessment and management are anchored in a **biomedical paradigm**, attributing dysfunction primarily to muscular imbalance, altered length-tension relationships, and faulty movement mechanics. However, mounting evidence indicates that:

- Visual and palpatory assessment methods demonstrate **inconsistent inter-rater reliability**.
- The presence of scapular dyskinesia is **common in asymptomatic individuals**, questioning its direct causal role in pain.
- **Psychosocial factors**—fear-avoidance, pain catastrophizing, kinesiophobia, work stress, and self-efficacy—significantly influence shoulder pain chronicity and rehabilitation outcomes.

This disconnect highlights a need to *rethink* how SD is assessed and to *advance* rehabilitation beyond isolated biomechanical correction.

Literature Review

Kibler and colleagues pioneered the classification of scapular dysfunction and the Scapular Dyskinesis Test, establishing the foundation for clinical observation. Subsequent systematic reviews, however, reported only fair-to-moderate reliability of visual classification and weak correlation between dyskinesia and symptoms. The **biopsychosocial (BPS) model**, introduced by Engel and increasingly validated in musculoskeletal practice, conceptualises pain and disability as emerging from the interaction of biological, psychological, and social domains. Pain neuroscience education (PNE), graded exposure, and cognitive-functional approaches have shown promise in chronic spinal conditions, yet their application to scapular and shoulder rehabilitation remains underexplored. This study addresses that gap.

Significance of the Study

By integrating psychological and social dimensions into a structured rehabilitation protocol, this study aims to provide clinicians with a more holistic, evidence-aligned framework, potentially improving outcomes and reducing recurrence in shoulder dysfunction.

Research Questions and Hypotheses

Research Question: Does a biopsychosocial rehabilitation approach produce superior outcomes compared with conventional exercise therapy in individuals with scapular dyskinesia?

- **Null Hypothesis (H_0):** There is no significant difference in outcomes between the biopsychosocial and conventional rehabilitation approaches.
- **Alternative Hypothesis (H_1):** The biopsychosocial approach produces significantly greater improvements in pain, disability, and psychological outcomes.

Methodology

Study Design

A **prospective, single-blind, two-arm randomised controlled trial (RCT)** was conducted at the Department of Physiotherapy, Indutai Tilak College of Physiotherapy, Pune.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants. The trial adhered to the principles of the Declaration of Helsinki.

Participants

Sample Size: 60 participants, derived using a power calculation (α=0.05, power=80%) based on expected SPADI differences from prior literature.

Inclusion Criteria:

- Age 18–45 years.
- Presence of scapular dyskinesia confirmed by the Scapular Dyskinesis Test.
- Shoulder pain of ≥4 weeks' duration.

Exclusion Criteria:

- Recent shoulder surgery or fracture.
- Frozen shoulder or full-thickness rotator cuff tear.
- Cervical radiculopathy or neurological deficit.
- Inability to comprehend educational components.

Randomisation and Blinding

Participants were randomly allocated using computer-generated random numbers into two groups (1:1). The outcome assessor was blinded to group allocation.

Outcome Measures

Domain	Outcome Measure	Tool
Pain	Pain intensity	Numeric Pain Rating Scale (NPRS)
Disability	Functional limitation	Shoulder Pain and Disability Index (SPADI)
Psychological	Catastrophizing	Pain Catastrophizing Scale (PCS)
Movement	Scapular motion	Scapular Dyskinesis Test (SDT) classification

Assessments were performed at **baseline** and at **6 weeks**.

Intervention Protocols

Conventional Group (CG):

- Scapular stabilisation and strengthening (serratus anterior, lower trapezius).
- Stretching of pectoralis minor and upper trapezius.
- Postural correction exercises.
- 3 sessions/week for 6 weeks.

Biopsychosocial Group (BG):

- All components of the conventional protocol, **plus**:
  - **Pain Neuroscience Education** (2 structured sessions).
  - **Graded motor and functional activity** based on individual goals.
  - **Psychosocial coaching** addressing fear-avoidance, self-efficacy, and activity pacing.
  - Reassurance and cognitive reframing of movement-related fears.

Statistical Analysis

Data were analysed using SPSS. Within-group comparisons used the paired *t*-test; between-group comparisons used the independent *t*-test. Categorical outcomes were analysed using the Chi-square test. Significance was set at **$p<0.05$**.

Results

Participant Flow

All 60 participants completed the study, with no dropouts. Baseline characteristics were comparable between groups ($p>0.05$).

Within-Group Outcomes

Both groups showed statistically significant improvement across all outcomes at 6 weeks ($p<0.05$).

Between-Group Outcomes

Outcome	CG (Mean ± SD)	BG (Mean ± SD)	Mean Difference	p-value
SPADI (Δ)	22.1 ± 6.3	34.5 ± 7.1	12.4	0.002*
NPRS (Δ)	2.6 ± 0.9	3.8 ± 1.1	1.2	0.004*
PCS (Δ)	7.4 ± 3.2	13.1 ± 4.0	5.7	<0.001*

Statistically significant ($p<0.05$). Δ = change from baseline.

Scapular Motion Normalisation

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Scapular Dyskinesia Normalised
Conventional Group: 50%
Biopsychosocial Group: 73.3%

A significantly higher proportion of participants in the BG achieved normalisation of scapular motion (73.3% vs 50%, $p=0.04$).

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Summary of Findings

The biopsychosocial intervention demonstrated **statistically and clinically superior** improvements across pain, disability, psychological, and movement-based outcomes.

Both groups improved significantly ($p<0.05$). The BG demonstrated significantly greater reductions in SPADI (mean difference 12.4 points, $p=0.002$), NPRS ($p=0.004$), and PCS ($p<0.001$), with a higher proportion achieving normalisation of scapular motion (73.3% vs 50%).

Discussion

Interpretation of Findings

This study demonstrates that augmenting conventional scapular rehabilitation with a biopsychosocial framework produces superior outcomes. The pronounced reduction in the **Pain Catastrophizing Scale** within the BG suggests that addressing maladaptive cognitions and fear-avoidance behaviours directly contributes to functional recovery. This aligns with the principle that pain and disability are not solely a product of tissue mechanics but emerge from the dynamic interplay between biological, psychological, and social factors.

Rethinking Assessment

The frequent presence of scapular dyskinesia in asymptomatic individuals and the modest reliability of visual classification reinforce the argument that SD should not be treated as an isolated mechanical fault. A **multidimensional assessment**—incorporating pain behaviour, psychosocial screening, and functional goals alongside movement observation—offers a more clinically meaningful framework.

Clinical Implications

- Clinicians should integrate **psychosocial screening** routinely in shoulder evaluation.
- Pain neuroscience education and graded functional exposure can be feasibly embedded within standard physiotherapy.
- A patient-centred, biopsychosocial approach may reduce recurrence and improve long-term self-management.

Limitations

- Short follow-up period (6 weeks); long-term effects were not assessed.
- Single-centre design may limit generalisability.
- Visual SDT, despite standardisation, carries inherent subjectivity.

Future Research

Future studies should employ **longer follow-up**, larger multi-centre samples, objective three-dimensional kinematic analysis, and economic evaluation to further validate the biopsychosocial model in scapular rehabilitation.

Conclusion

A biopsychosocial rehabilitation approach is superior to conventional exercise therapy alone in improving pain, disability, psychological status, and scapular motion in individuals with scapular dyskinesia. These findings advocate a **paradigm shift**—from a purely biomechanical view toward a holistic, patient-centred model of assessment and rehabilitation. Integrating a biopsychosocial approach with conventional scapular rehabilitation yields superior improvements in pain, disability, and psychological outcomes. The findings support a paradigm shift toward multidimensional assessment and patient-centred rehabilitation in scapular dyskinesia.

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