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Original Article

Physiotherapy Section

Development of Comprehensive Movement Screening Tool in Competitive Swimmers: A Modified Delphi Study

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ABSTRACT

Introduction: Competitive swimmers are subjected to repeated, high volume of training loads which predispose them to overuse injuries, primarily involving the shoulder, knee and low-back. Current screening tools are generic and isolated screening tests may not adequately identify swimming specific injury risk; therefore, developing an evidence-based screening tool will help to identify injury risk and guide injury prevention.

Aim: To develop a sports-specific comprehensive movement screening tool for competitive swimmers.

Materials and Methods: A 3-round modified Delphi conducted at School of Physiotherapy, D Y Patil deemed to be University, Navi Mumbai, Maharashtra, India online between January 2024 and September 2024. A total of 13 experts (7 academicians and 6 clinicians) participated In Round-1, 29 pre-identified tests comprising of six domains were rated on a 2-point Likert scale with consensus set at ≥70%. In rounds 2 and 3, experts reappraised their agreement in view of group consensus and threshold was stepped up at ≥80% on 5-point Likert scale.

Results: In Round-1, 13 tests achieved ≥70% threshold and four tests nearing threshold were retained for the next round. In Round-2, a total of 23 tests (including six newly suggested tests) were evaluated, of which 10 achieved ≥80% consensus and were included in the final screening tool. Instead of eliminating 13 tests in Round-2 they were re-evaluated again in Round-3. In Round-3, from 13 tests below 80% consensus were evaluated again, from those seven tests which achieved the required consensus agreement and were included in the final tool. However, all tests in the category of balance domain did not achieve expert consensus were eliminated. A total of 17 tests achieved consensus and included in the final screening tool which comprised of 5 domains- functional movements, mobility, muscle strength and endurance, muscle length and core stability.

Conclusion: The comprehensive movement screening tool for competitive swimmers developed using a modified delphi process achieved consensus on 17 tests comprising of 5 domains. This tool can assist in early identification of injury risk and guide prevention strategies based on the identified risk.

Keywords: Consensus methods, Injury prevention, Risk assessment

INTRODUCTION

Movement screening is popularly used in athletes or clinical settings to identify sports injury risk and guide injury prevention [1]. Early identification and timely intervention of risk factors allow targeted interventions to reduce injury risks, enhance performance and sustain career longevity [2,3]. Due to demanding training schedules and highly repetitive training, predispose swimmers to increased injury risk [3].

Competitive swimmers swim an average of 60-80 km weekly, performing around 40,000 shoulder strokes and 80,000 kicks depending on skill level and training intensity highlighting the need for screening [4-6]. Studies indicate high prevalence of overuse injuries in swimmers, with shoulder being more frequently affected region, followed by knee and low back [6-8].

Existing screening tools such as Functional Movement Screen (FMS), Movement System Screening Tool (MSST), does not address the sports-specific demands of swimming, while individual screening tests fail to capture the multifactorial nature of injury risk [1,7,9,10]. A recent systematic review reported the screening tests used in swimmers have shown limited or conflicting evidence of commonly assessed modifiable and non modifiable risk factors inconsistently associated with shoulder pain or injury [3]. Studies indicate individual risk factors alone may not adequately predict injury risk; however, incorporating assessments across multiple domains may help to identify potential injury risks [11,12].

Therefore, developing a comprehensive movement screening tool that encompass strength, endurance, mobility and flexibility domains is essential that effectively identify injury risks in competitive swimmers. Currently, there is no screening tool which addresses swimming-specific movement patterns for common injury sites, particularly the shoulder, lower back, and knee.

To address this gap, the present study used modified Delphi methodology to systematically develop a comprehensive movement screening tool for competitive swimmers. The modified Delphi method is a structured approach achieving experts consensus via an iterative process with controlled feedback while maintaining anonymity [13,14]. This approach ensures the tool captures clinically relevant and swimming-specific risk factors, making it applicable to real-world environments. This screening tool will assist coaches and clinicians in the early identification of injury risk factors.

Therefore, the present study aimed to develop a comprehensive movement screening tool for competitive swimmers. The objective was to achieve expert consensus on the movement screening tests to be included in this tool.

MATERIALS AND METHODS

A 3-round modified Delphi design was conducted online between January 2024 and September 2024, at School of Physiotherapy, D Y Patil deemed to be University, Navi Mumbai, Maharashtra, India involving experts from different geographical regions. The present study was approved by the Institutional Ethics Committee of Dr. D Y Patil School of Medicine and Hospital, Navi Mumbai (DYP/IECBH/2020/40).

Inclusion and Exclusion criteria: Purposive sampling was used to select eligible participants. Experts were defined as individuals as academic experts or clinical experts with the following criteria.

Academic experts with more than five years' experience in musculoskeletal and sports physiotherapy and research experience in competitive swimmers, assessment and screening tools, injury prevention, and movement skills in athletic populations were identified for inclusion in the present study. Clinical experts with at least three years' experience working with competitive swimmers or managing sports injuries, and routinely using screening tools in their practice. Snowball sampling was used, to identify additional potential experts. Experts who did not have relevant academic or clinical qualifications were excluded from the study.

Sample size: The sample size was determined by the quality and heterogeneity of expertise [15]. However, the panel size for delphi studies range from 8-23 participants which are adequate when they are drawing from well-defined expert group [16]. Therefore, 34 experts were invited to participate in the present study; from which 13 experts consented to participate (7 academicians, 6 clinicians) after two experts declined and 19 did not respond.

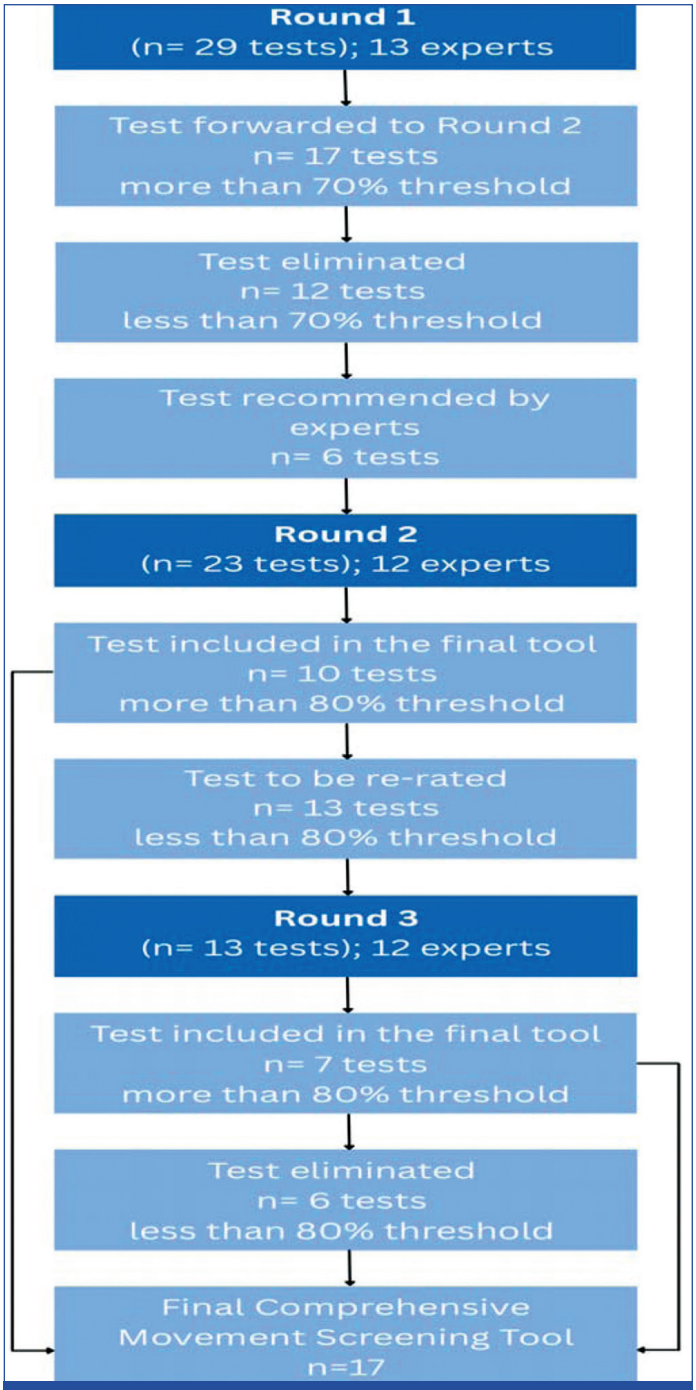
Study Procedure

Modified delphi approach: A modified delphi approach which included 3 rounds, was used to obtain expert consensus on tests for the screening tool [Table/Fig-1]. An online Delphi survey questions were distributed to collect responses from experts, of different geographical regions from India which were from within Maharashtra State (Mumbai, Pune, Ahmednagar), Karnataka state (Belagavi) and Ireland, Europe [17]. Anonymity was maintained to minimise conflicts in expert opinions [15]. Modified Delphi approaches are suitable for exploring new or emerging areas of research areas not yet comprehensively addressed. The present study followed Conducting and Reporting of Delphi Studies (CREDES) recommendations and was reported using Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines [18,19].

Delphi survey questions development: An extensive literature review was conducted to identify and compile a preliminary list of movement screening tests suitable for competitive swimmers. This tool development questionnaire was developed by the authors based on the findings from a recent scoping review and additional supporting literature [3,7,20,21]. A total of 29 tests were identified across six domains and compiled for evaluation in Round-1. A total of 29 pre-selected list of tests were identified and included in Round-1 survey and categorised in six domains as follows: functional tests (n=6), mobility tests (n=7), muscle length tests (n=4), muscle strength and endurance test (n=4), balance tests (n=2) and core stability tests (n=6). This survey used closed-ended questions, for experts to rate their agreement or disagreement for each test that can be included in the final screening tool [ANNEXURE 1].

The survey questions were sent by email using Google Forms. Participants had month per round to complete the survey, with periodic reminders sent by email, SMS or Whatsapp, and follow-up calls for non responders. All participants responded to the survey and no incomplete data was submitted. Duplicate submissions were prevented by limiting one response per email ID. Data were stored in encrypted, de-identified files accessible only to the authors.

A pilot study was conducted with academicians not involved in the Delphi process to evaluate for clarity, usability, language, completion time and technical functionality. Minor revisions like correcting grammar, improving clarity of tests descriptions and replacing unclear images and compression of test description video files to reduce size and enhance easy accessibility by minimising loading time were made based on feedback. The pilot study responses were excluded from the final distribution of survey. The estimated time to complete survey for each round required approximately 40-45 minutes. Validity and reliability assessments of this screening tool were not undertaken at this phase, since this phase focused on developing the tool through expert consensus.



[Table/Fig-1]: Flowchart of the Modified Delphi Methodology for the development of comprehensive movement screening tool.

Delphi Rounds

- **Round-1:** Experts evaluated 29 pre-selected movement screening tests indicating their agreement or disagreement for each test's inclusion. Additionally, experts were allowed to suggest additional tests for consideration in the next round. The consensus threshold agreement was defined as 70% in this round and calculated using percentage agreement, consistent with methodological recommendations for preliminary consensus in delphi studies where thresholds of 70-80% is widely accepted for establishing consensus [16,22]. The responses were recorded as "agree or "disagree" and percentage agreement for each test was calculated by dividing the number of experts selecting "Agree" for each test with the total number of respondents in that round. Tests achieving agreement were advanced for the next round, while those not reaching consensus agreement were eliminated.

- **Round-2:** A stepped process with increasing level of agreement at 80% on a 5-point Likert scale was used to narrow the test selection in this round (5- Strongly Agree, 4- Agree, 3- Fairly agree, 2- Disagree, 1- Strongly Disagree). Consensus in Round-2 and 3 was defined as ≥80% of experts selecting Agree (4) or Strongly Agree (5) on the 5-point Likert scale, widely used in clinical Delphi studies to represent strong consensus [16,23]. The decision to increase the threshold in this round was to enhance stringency and strengthen the robustness of consensus. Tests achieving consensus in Round-1 were included in Round-2. All experts were provided with both individual and group responses from the previous round. Tests achieving ≥80% in Round-2 were included in the final comprehensive movement screening tool while the tests which did not reach this threshold in Round-2 were not eliminated but were re-evaluated in Round-3 to allow experts to reconsider their ratings in view of their previous response and overall group consensus.
- **Round-3:** In this round expert re-evaluated those test items which did not reach 80% consensus in Round-2. They were provided with both group and individual Round-2 responses for reconsideration. This allowed the experts to reconsider their judgements and either revise or retain their previous responses based on group consensus. The same 5-point Likert scale and consensus criteria of ≥80% agreement used in Round-2 were applied in this round. Test items that achieved ≥80% agreement in Round-3 were included in the final comprehensive movement screening tool, in addition to those that had already reached the consensus threshold in the previous round. Test not reaching the consensus of 80% were finally eliminated.

STATISTICAL ANALYSIS

Quantitative data from the Delphi process were analysed using descriptive statistics in Microsoft Excel (Office 2019, Microsoft Corp., Redmond, WA, USA). Consensus was defined a priori as more than 70% of participants agreeing in Round-1 and 80% and above in subsequent rounds. The percentage agreement was calculated to determine the level of consensus achieved in each round. After each round, participant responses were coded (1-5) based on the corresponding Likert scale. Descriptive statistics were used to describe the participants demographic characteristics and group responses to each test in all three rounds.

RESULTS

Participant demographics: A total of 13 experts (seven academicians, six clinical experts) participated in Round-1, with 12 (seven academicians, five clinical experts) continued in Rounds 2 and 3. All experts were based in India, except for one clinical expert who was based in Europe. The demographic characteristics of the expert panel are presented in [Table/Fig-2].

Round-1: In Round-1, 13 experts evaluated 29 pre-selected tests. A total of 13 tests achieved the required ≥70% threshold and were included in Round-2. These included functional tests (n=3), mobility tests (n=5), muscle length tests (n=2), muscle strength and endurance tests (n=2) and balance tests (n=1), as shown in [Table/Fig-3]. The remaining tests that did not reached agreement threshold was eliminated in Round-1. Four tests that achieved consensus between 69% and 70% were also retained and included in Round-2 for re-evaluation. This aligns with the common Delphi methodologies, which allows for flexibility around predefined consensus thresholds [24-26]. To ensure potentially relevant tests are not eliminated too early, tests that demonstrated near threshold were retained for re-evaluation. Overall, this approach supported comprehensive evaluation and allowed participants to reconsider assessments with marginal agreement. The expert panel suggested additional six tests be included in the tool was added in Round-2 under their respective domains.

Characteristics	Round-1		Round-2 and 3	
	Academician n (%)	Clinical experts n (%)	Academician n (%)	Clinical experts n (%)
Experience				
Less than 10 years	1 (14.29%)	4 (66.67%)	1 (14.29%)	3 (60%)
10-15 years	2 (28.57%)	1 (16.67%)	2 (28.57%)	1 (20%)
More than 15 years	4 (57.14%)	1 (16.67%)	4 (57.14%)	1 (20%)
Education				
Master's degree	3 (42.86%)	6 (100%)	3 (42.86%)	5 (100%)
Doctoral degree	4 (57.14%)	0	4 (57.14%)	0
Age (Mean ± SD)	42.71±5.25	34±4.85	42.71±5.25	34.4±5.31
Gender				
Male	6 (85.71%)	1 (16.67%)	6 (85.71%)	1 (20%)
Female	1 (14.29%)	5 (83.33%)	1 (14.29%)	4 (80%)

[Table/Fig-2]: Demographic characteristics of expert panel.

Domain	S. No.	Test constructs of comprehensive movement screening tool	Round-1 (threshold cut-off= 70%) (n=13)
Functional test	1	Deep Squat	46.15
	2	Vertical jump test	30.77
	3	Observational scapular dyskinesis	84.62*
	4	Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)	92.31*
	5	Combined Elevation Test (CET)	84.62*
	6	Dorsiflexion lunge Test	53.85
Mobility test	7	Thoracic wall mobility	69.23#
	8	Locked lumbar rotation test	76.92*
	9	GIRD/GERG ratio	100*
	10	Shoulder external ROM	61.54
	11	Hip extension ROM	76.92*
	12	Hip internal rotation ROM	84.62*
	13	Ankle plantarflexion ROM	84.62*
Muscle length test	14	Shoulder flexibility test	100*
	15	Sit and reach test	61.54
	16	Pectoralis minor test	84.62*
	17	Thomas test	61.54
Muscle strength and endurance test	18	Isokinetic shoulder ER:IR strength ratio	76.92*
	19	Isokinetic shoulder ER:IR endurance ratio	76.92*
	20	Isokinetic shoulder abduction: adduction endurance ratio	38.46
	21	Isokinetic quadriceps: hamstrings strength ratio	38.46
Balance test	22	UE-SEBT	46.15
	23	UE-YBT	76.92*
Core stability	24	Core endurance test	69.23#
	25	Sports specific endurance plank test	61.54
	26	Side bridge with active hip abduction	69.23#
	27	Unilateral hip bridge endurance	69.23#
	28	Seated clinical core control test	46.15
	29	Step down test	30.77

[Table/Fig-3]: Expert agreement for comprehensive movement screening tool in Round-1.
Note: (*) indicates tests achieving consensus in the respective Round-1. # Indicates tests retained for re-evaluation in Round-2. Abbreviations: CKCUEST: Closed kinetic chain upper extremity stability test; GIRD: Glenohumeral internal rotation deficit; GERG: Glenohumeral external rotation gain; ROM: Range of motion; ER: External rotation; IR: Internal rotation; UE: Upper extremity; SEBT: Star excursion balance test; YBT: Y-Balance test

Round-2: In Round-2, 12 of the same 13 panelist who had participated in Round-1 responded, while one clinical expert did not respond despite sending multiple reminders. Ten tests that received

above 80% consensus threshold in Round-2 were included in the final tool.

Additionally, expert suggested tests from Round-1, upper limb rotation test and posterior shoulder endurance test were included in the final tool that achieved the required threshold, particularly due to their relevance in swimming-specific assessments [Table/Fig-4].

Domain	S. no	Test constructs of comprehensive movement screening tool	Round-2 (threshold cutoff= 80%) (n=12)	Round-3 (threshold cutoff= 80%) (n=12)
Functional test	1	Observational scapular dyskinesis	71.67	73.33
	2	Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)	85*	†
	3	Combined Elevation Test (CET)	86.67*	†
	4	Upper limb rotation test ‡	83.33*	†
Mobility test	5	Thoracic wall mobility	69.23	70
	6	Locked lumbar rotation test	71.67	78.33
	7	GIRD/GERG ratio	83.33*	†
	8	Hip extension ROM	71.67	81.67*
	9	Hip internal rotation ROM	71.67	80*
	10	Ankle plantarflexion ROM	73.33	76.67
	11	Cervical rotation ROM ‡	75	85*
	12	Shoulder flexion ROM ‡	78.33	83.33*
	13	Shoulder extension ROM ‡	76.67	81.67*
	14	Shoulder horizontal abduction ROM ‡	78.33	88.33*
Muscle length test	15	Shoulder flexibility test	91.67*	†
	16	Pectoralis minor test	80*	†
Muscle strength and endurance test	17	Isokinetic shoulder ER:IR strength ratio	81.67*	†
	18	Isokinetic shoulder ER:IR endurance ratio	88.33*	†
	19	Posterior shoulder muscle endurance test ‡	81.67*	†
Balance test	20	UE-YBT	76.67	†
Core stability	21	Core endurance test	80*	†
	22	Side bridge with active hip abduction	71.67	73.33
	23	Unilateral hip bridge endurance	75	80*

[Table/Fig-4]: Expert agreement for comprehensive movement screening tool in Round-2 and Round-3.
Note: (*) indicates tests achieving consensus in the respective round. Tests highlighted with (‡) were suggested by experts in Round-1. "†" indicate that the tests were not evaluated in that round.

Round-3: All 12 participants from Round-2 continued into Round-3. Seven additional tests reached the predefined consensus threshold of ≥80% and were included in the final tool. These were hip extension ROM, hip internal rotation ROM, cervical rotation ROM, shoulder flexion ROM, shoulder extension ROM, shoulder horizontal abduction ROM, and unilateral hip bridge endurance. Combined with the 10 tests that achieved ≥80% consensus in Round-2, the final Comprehensive Musculoskeletal Screening Tool (CMST) comprised of 17 tests [ANNEXURE 2]. The present study established expert consensus on the selection of the tests to be included in the screening tool, while validity and reliability will be conducted in further phases of research.

DISCUSSION

The present study developed a comprehensive movement screening tool using a modified Delphi method comprising of five domains incorporating literature-based and panel-suggested additions, aligned with swimming-specific biomechanical demands and injury risk characteristics. Maintaining the same panelist throughout enhanced feedback consistency, but their busy schedules required repeated reminders and extended timelines to obtain responses.

Extensive literature supports CKCUEST for evaluating upper body function and functional performance in overhead athletes and Combined Elevation Test (CET) biomechanically replicates swimming streamline position, assessing shoulder and thoracic flexibility along with upper extremity strength [27] supporting its inclusion.

Deep squat and vertical jump test are widely utilised in athletic screening but did not achieve consensus. Vertical jump test measures lower limb power and start performance in swimmers [28,29]; but was eliminated due to its limited evidence for injury. Similarly, despite evaluating complete body mechanics, the deep squat has weak relevance to swimming injuries explains its low agreement [30,31].

Observational scapular dyskinesis test achieved initial consensus but was eliminated subsequently. Although scapular dyskinesis associates with altered scapular control and serratus anterior weakness, studies show no predictive relationship with shoulder injuries in swimmers [32]. Experts likely recognised this, as studies found no significant differences in scapular dyskinesis between symptomatic and asymptomatic swimmers [33]. Furthermore, scapular dyskinesis occurs in nearly half of asymptomatic athletes, limiting its predictive validity [34]. Consistent with these, a recent systematic review study reported that scapular dyskinesis was not significantly associated with shoulder injury development in athletes [35].

Dorsiflexion lunge test is an excellent measure of ankle mobility, but did not achieve consensus, possibly due to limited evidence linking ankle mobility with swimming injuries, particularly given swimming's non weight bearing movement patterns predominantly involving plantarflexion during kicking, making this assessment less relevant.

The upper limb rotation test, recommended by experts in Round-1, achieved consensus in Round-2. This test requires shoulder motor control and stability in weight-bearing while involving the entire kinetic chain by placing the shoulder in a complex position of 90° abduction and external rotation [36].

Thoracic mobility test and locked lumbar rotation test failed to achieve consensus despite initial interest. This elimination likely reflects limited evidence of swimming-specific risk linking thoracic rotation with shoulder dysfunction in swimmers, even though it is recognised as important for kinetic chain function in overhead athletes [37].

Hip extension ROM achieved the consensus in Round-3. Tight hip flexors contribute to compensatory lumbar hyperextension; assessing hip extension mobility helps identify these risks. Although agreement varied in earlier rounds, achieving consensus highlights the importance of assessing trunk-hip mobility for identifying spinal injury risk [38]. Similarly, hip internal rotation was ultimately included. Experts likely reconsidered ratings after reviewing group response. This shift suggests experts reconsidered these tests importance, supported by studies showing limited hip internal rotation may contribute to knee pain in breaststroke swimmers, emphasising hip internal rotation assessments relevance [7].

Shoulder external rotation did not reach consensus as experts considered it overlapped with GIRD:GERG ratio, a more useful shoulder mobility indicator, resulting in the ratio's inclusion instead [39]. Ankle Plantarflexion progressed to Round-2 but was excluded since no evidence of injury risk has been established. However, previous studies show greater plantarflexion mobility is required for propulsive force generation and moderately associates with leg kick speed [40,41].

Cervical rotation and shoulder flexion, extension, horizontal abduction ROM proposed by the experts in Round-1, achieved

consensus in Round-2 justifying inclusion. Growing literature links restricted shoulder horizontal abduction to increased injury risk in swimmers [42]. Experts suggested cervical rotation is important for breathing mechanics and head positioning. Although no injury association evidence exists, previous study observed cervical spine problems can cause shoulder symptoms and cervical pain is common in swimmers, related to freestyle stroke technical errors [43].

Muscle length tests (Sit and Reach and Thomas Test) were excluded early, suggesting consensus that generic flexibility assessments lack swimming-specific relevance. Only shoulder flexibility test and pectoralis minor test achieved consensus, highlighting shoulder mobility and posture importance in competitive swimmers [32,39].

Isokinetic Shoulder ER:IR strength and endurance ratios were included as they significantly predict shoulder injury risk [7,44,45]. The quadricep: hamstring strength ratio and abduction: adduction endurance ratio did not achieved consensus, consistent with recent evidence indicating weak associations with lower limb injury risk [7]. Posterior shoulder endurance test as recommended by experts achieved consensus threshold, aligning with evidence highlighting the importance of posterior chain endurance for maintaining stroke technique and shoulder stability [39]. Experts identified the importance of core stability tests, emphasising their role in effective force transfer and injury prevention in swimming [32]. In butterfly and breaststroke, the undulating wave-like motion of the dolphin kick requires dynamic engagement of the core to generate repetitive flexion and extension of the spine, a common mechanism for hyperextension injuries [38]. The exclusion of balance domain from the final tool, despite initial agreement, aligns with weak evidence linking balance to injury in swimming [46].

The robustness of this tool was improved gradually by systematically increasing the agreement threshold, ensuring only the most relevant and supported tests were retained. This approach may enhance the tool's clinical usefulness, pending validation studies. The Delphi method, with its iterative process, helped the experts reach an agreement, which is important when evidence is limited or still developing [13,15].

Limitation(s)

A total of 12 participants, from 13, were from India. This expert consensus may reflect consideration specific to local context where trainings methods, coaching and resources differ from other regions. Future validation studies involving experts from diverse geographical regions to provide broader perspectives on this tool. The overall response rate was only 38.2% and some participants did not respond or declined, possibly due to anticipated long survey duration which was communicated in the invitation email. Isokinetic testing may limit feasibility in resource-limited settings.

CONCLUSION(S)

The present study developed a comprehensive movement screening tool for competitive swimmers through expert consensus across three Delphi rounds. The final tool comprises 17 tests across five domains which included functional tests, mobility tests, muscle length tests, muscle strength and endurance and core stability tests, reflecting sports specific demands and injury risks in competitive swimmers.

Further studies are required to determine psychometric properties of tool and develop its scoring framework. In addition, longitudinal studies are needed to establish the predictive validity for identifying injury and determine applicability within routine screening and injury prevention strategies.

Authors' contribution: Both authors contributed significantly (DP and AD) for this research DP: conceptualisation, data curation, formal analysis, visualisation, writing of original draft. AD: writing: review, editing, supervision and validation. Both authors have read and approved the final manuscript.

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[ANNEXURE 1]: Delphi survey for comprehensive movement screening tool for competitive swimmers.

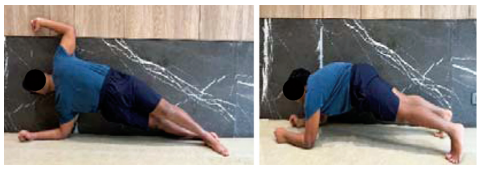
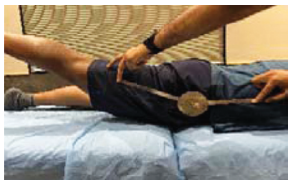
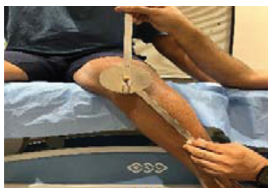
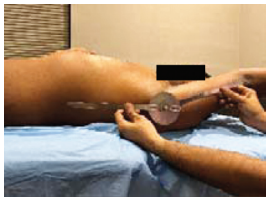
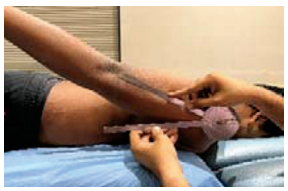
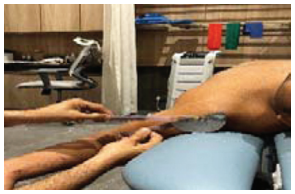
(Round-1)

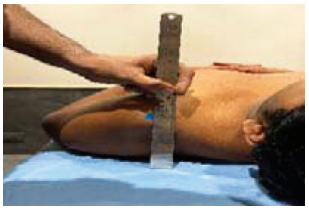
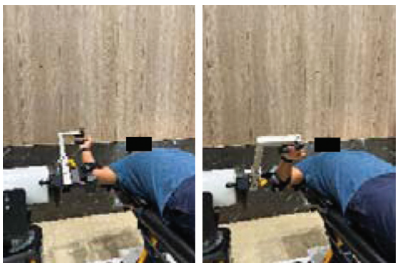
A	According to you, which of the following Functional tests should be included in movement screening that would best assess the injury risk in swimmers?			
S. No	**Tests**	**Agree**	**Disagree**	**Comment**
1	Deep squat			
2	Vertical jump test			
3	Observational scapular dyskinesis			
4	Closed Kinetic chain upper Extremity Stability Test (CKCUEST)			
5	Combined Elevation Test (CET)			
6	Dorsiflexion lunge test			
	Are there any other test(s) you feel which have not been included in the above category of functional test that should be used for comprehensive movement screening tool for swimmers? If yes, please list the names of the tests along with descriptions of the test in the box below			
	Comments:			

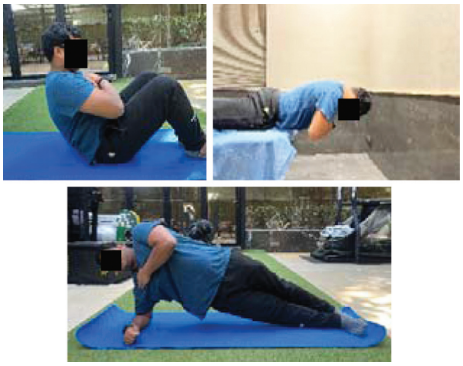
II	According to you, which of the following Mobility test should be included in movement screening that would best assess injury risk in swimmers?			
	Mobility test	**Agree**	**Disagree**	**Comment**
7	Thoracic wall mobility			
8	Locked lumbar rotation test			
9	GIRD/GERG ratio			
10	Shoulder external rotation ROM			
11	Hip extension ROM			
12	Hip internal rotation ROM			
13	Ankle plantar flexion ROM			
	Are there any other test(s) you feel which have not been included in the above category of mobility test that should be used for comprehensive movement screening tool for swimmers? If yes, please list the names of the tests along with descriptions of the test in the box below			
	Comments:			
C	**According to you, which of the following muscle length tests should be included in movement screening that would best assess injury risk in swimmers?**			
	Muscle Length test	**Agree**	**Disagree**	**Comment**
14	Shoulder flexibility test			

15	Sit and reach test			
16	Pectoralis minor test			
17	Thomas test			
	Are there any other test(s) you feel which have not been included in the above category of Muscle length test that should be used for comprehensive movement screening tool for swimmers? If yes, please list the names of the tests along with descriptions of the test in the box below			
	Comments:			
D	**According to you, do you think that following muscle strength and endurance test should be included in movement screening that would best assess the injury risk in swimmers?**			
	Muscle strength and endurance test	**Agree**	**Disagree**	**Comment**
18	Isokinetic shoulder ER:IR strength ratio			
19	Isokinetic shoulder ER:IR endurance ratio			
20	Isokinetic shoulder abduction and adduction endurance strength ratio			
21	Isokinetic quadriceps: hamstrings strength ratio			
	Are there any other test(s) you feel which have not been included in the above category of Muscle strength and Endurance test that should be used for comprehensive movement screening tool for swimmers? If yes, please list the names of the tests along with descriptions of the test in the box below			
	Comments:			
E	**According to you, do you think that following Balance test should be included in movement screening that would best assess the injury risk in swimmers?**			
	Balance Tests	**Agree**	**Disagree**	**Comment**
22	Upper Extremity-Star Excursion Balance Test (UE-SEBT)			
23	Upper Extremity-Y Balance Test (UE-YBT)			
	Are there any other test(s) you feel which have not been included in the above category of Balance test that should be used for comprehensive movement screening tool for swimmers? If yes, please list the names of the tests along with descriptions of the test in the box below			
	Comment:			
F	**According to you, do you think that following Core stability test should be included in movement screening that would best assess the functional pattern in swimmers?**			
	Core Stability	**Agree**	**Disagree**	**Comment**
24	Core endurance test			
25	Sport specific endurance plank test			
26	Side bridge with active hip abduction			
27	Unilateral hip bridge endurance			
28	Seated Clinical core control test (3ct)			
29	Step Down test			
	Are there any other test(s) you feel which have not been included in the above category of Core stability test that should be used for comprehensive movement screening tool for swimmers? If yes, please list the names of the tests along with descriptions of the test in the box below			
	Comments:			
	Would you like to give any other suggestions or comments regarding this questionnaire? Yes/No If yes, then please mention			
	Are there any test(s)/domain which have not been included in this survey that you feel should be included in this tool? If yest, please list the names of the test (with description)/ domain in the suggestion box below			

[ANNEXURE 2]: Final tool with 17 tests.

S. No	Test name	Photo
1	Closed Kinetic chain upper Extremity Stability test (CKCUEST)	
2	Combined Elevation Test (CET)	
3	Upper limb rotation test	
4	GIRD/GERG ratio	
5	Hip extension ROM	
6	Hip internal rotation ROM	
7	Cervical rotation ROM	
8	Shoulder flexion ROM	
9	Shoulder extension ROM	
10	Shoulder horizontal abduction ROM	
11	Shoulder flexibility test	

12	Pectroralis minor length test	
13	Isokinetic shoulder ER: IR strength ratio	
14	Isokinetic shoulder ER: IR endurance ratio	
15	Posterior shoulder endurance test	

16	Core endurance test	
17	Unilateral hip bridge endurance